Understanding the Role of Motivation in the Reading of Children With ADHD-related Characteristics

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Declaration

I, Myrofora Kakoulidou, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I can confirm that this has been indicated in the thesis.

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Abstract

This thesis investigated the potential reading benefits of motivation, and particularly story choice (intrinsic motivator) and reward (extrinsic motivator) in children with ADHD-related characteristics (inattention, hyperactivity/impulsivity, poor interference control), who attended mainstream primary schools. Children with ADHD-related characteristics are at risk of reading underachievement, irrespective of the presence of an ADHD diagnosis. Using a repeated measures design with two conditions (Choice, No Choice), *Study 1* tested choice effects on the reading of a community sample of children (N = 108, aged 8 to 9 years old, 56 boys) with minimal and severe ADHD-related characteristics, with focus on inattention. Using a repeated measures design with three conditions (Choice, Reward, No Motivation), *Study 2* explored choice and reward effects on the reading of children with and without diagnosed ADHD (N = 24, aged 8 to 11 years old, 16 boys). Using the Study 2 sample, *Study 3* sought the perspectives of children with and without ADHD about reading motivation and checked for any group qualitative differences. Drawing on the quantitative findings, story choice increased the reading comprehension, and less consistently the reading enjoyment, of both children with minimal and severe ADHD-related characteristics. Study 2 findings pointed towards the benefits of story choice and reward for the reading comprehension and enjoyment of children with and without ADHD, however, results were relatively inconclusive. Choice and reward effects were not found to be more pronounced for children with severe ADHD-related characteristics and/or ADHD than those with such minimal characteristics. In Study 3, children with and without ADHD acknowledged similarly the contribution of motivators, including choice and reward, to reading. Overall, findings offer empirical support for the positive impact of story choice and reward on children with varying degrees of ADHD-related characteristics, stressing the need to consider further their manipulation during reading instruction in the classroom.

Impact Statement

Children with ADHD-related characteristics are at high risk of reading underachievement, irrespective of the presence of an ADHD diagnosis (Merrell et al., 2017; Miller et al., 2013), as reading involves several attentional mechanisms (Kendeou et al., 2014; Oakhill et al., 2014). Nevertheless, there is sparse research exploring reading practices to support these children in the classroom. Using a mixed-methods approach (reading interventions, interviews) with community and clinical samples, this thesis underlined the contribution of intrinsic (story choice) and extrinsic (reward) motivators to the reading outcomes of children with varying degrees (minimal, severe, diagnosed ADHD) of ADHD-related characteristics.

The thesis findings could generate considerable impact in the field of reading motivation, school, and clinical practice. First, such findings advance the current theoretical understanding of the role of motivation in the reading of children with ADHD and those with ADHD-related characteristics in general. To my knowledge, this study is the first to investigate and offer strong evidence for the positive impact of story choice on the reading comprehension and enjoyment of children with non-diagnosed ADHD-related characteristics. Additionally, this is the only study that has used an experimental paradigm to offer some support for the positive effects of both an intrinsic (story choice) and an extrinsic (reward) motivator on the reading of children with and without diagnosed ADHD. In line with previous limited research (Beike & Zentall, 2012; Zentall & Lee, 2012), this evidence advocates the benefits of reading motivation for children with varying degrees of ADHD-related characteristics and opens the door towards further examining the benefits of easily manipulated motivators, including story choice and reward. Such motivators could serve as useful practical tools that educators and parents can apply during everyday reading activities to support children who struggle with inattention and/or hyperactivity/impulsivity. Considering that medication interventions have minimal or no positive effects on the learning of children with ADHD and given that children with non-diagnosed ADHD-related characteristics are less likely to receive medication (Beery et al., 2017; Molina et al., 2009), practices promoting motivation offer a promising avenue to support readers with different cognitive profiles. Due to the multi-method assessment of ADHD-related characteristics (rating scales, behavioural tasks, and a novel virtual reality task), an additional important finding highlights the weak-to-moderate associations between the different measures (Sims & Lonnigan, 2012) with important implications for the assessment of ADHD.

De-identified data from Study 1 have been made available in the UCL Research Data Repository to ensure greater transparency and facilitate future data use for re-analysis and synthesis of evidence. The remaining data will become available following publications. Finally, the thesis findings have informed a knowledge exchange programme around school wellbeing co-led by Kakoulidou and supported by the UCL Train and Engage fund (https://www.ucl.ac.uk/culture/projects/2020-train-and-engage-funded-projects).

Dissemination

Publication

Data from Chapter 3 were published as a Journal Article in the Research on Child and Adolescent Psychopathology

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Presentations (Talks)

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Data from Chapter 3 were presented at the Monthly Meeting of the Centre for Language, Literacy, and Numeracy, UCL Institute of Education, United Kingdom

Kakoulidou, M., Hurry, J., Knight, F., & Filippi, R. (2019). The Role of Choice in the Reading Comprehension and Enjoyment of Children with ADHD-related Characteristics.

Data from Chapter 3 were presented at the February's meeting of the London ADHD Research Forum (LARF) organised by Professor Edmund Sonuga-Barke, King's College, United Kingdom

Kakoulidou, M., Hurry, J., & Knight, F. (2019). A Multi-Method Assessment of Attentional Difficulties in Year 4 Typically Developing Children: Associations Between Attention Measures, Baseline Reading, and Motivation.

Data from Chapter 3 were presented at the 33rd PsyPAG Conference, University of Huddersfield, United Kingdom

Kakoulidou, M., Hurry, J., & Knight, F. (2018). The Role of Choice Making in the Reading Comprehension of Year 4 Children with Broad Attentional Difficulties: Preliminary Findings.

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List of Main Abbreviations

ADHD: Attention Deficit Hyperactivity Disorder

APA: American Psychiatric Association

AULA: Advanced Virtual Reality Tool for the Assessment of Attention

BPVS-III: British Picture Vocabulary Scale- 3rd Edition

CET: Cognitive Evaluation Theory

CORI: Concept Oriented Reading Instruction

CPT: Continuous Performance Test

DfE: Department for Education

DSM: Diagnostic Statistical Manual

EAL: English as an Additional Language

EF: Executive Functions

EHC: Education, Health and Care plan

EVTAM: Expectancy Value Theory of Achievement Motivation

FA: Factor Analysis

GPA: Grade Point Average

ICD: International Classification of Diseases

IQ: Intelligence Quotient

MRQ: Motivation for Reading Questionnaire

MTA: Multimodal Treatment of Children with ADHD

NGRT: New Group Reading Test

NICE: National Institute for Health and Care Excellence

OFSTED: Office for Standards in Education, Children's Services and Skills

RD: Reading Disability

RT: Reaction Time

RTV: Reaction Time Variability

SATs: Standard Attainment Tests

SDQ: Strengths and Difficulties Questionnaire

SDT: Self-determination theory

SEN: Special Education Needs

TA: Thematic Analysis

WHO: World Health Organisation

Thesis Overview

The present thesis explored the role of intrinsic (choice) and extrinsic (reward) motivation in the reading outcomes of children with ADHD-related characteristics using a mixed-methods approach. The thesis comprises seven chapters. Chapters 1 and 2 are the two literature review chapters that evaluate key motivational theories and research. Chapter 1 discusses the role of motivation and interest in the reading of neurotypical[1] young people. The first part of Chapter 2 investigates the relationship between ADHD-related characteristics such as inattention, hyperactivity/impulsivity, and poor interference control and reading, focusing on the role of inattention. The second part examines the importance of choice and reward as powerful motivators during the learning/reading of children at risk of and/or diagnosed with ADHD.

Chapter 3 first describes the pilot of Study 1 that tested the reliability and appropriateness of a set of reading materials and measures (rating scales, behavioural tasks) assessing ADHD-related characteristics. Results from this pilot study influenced decisions around measure selection in the main Studies 1 and 2. After this, Chapter 3 presents the main Study 1. Addressing the main experimental aims, Study 1 tested empirically choice effects on the reading comprehension and enjoyment of children with minimal and severe ADHD-related characteristics, focusing on inattention, testing the hypotheses that choice improves reading comprehension and enjoyment for all children, but more markedly for children with severe

[1] Drawing on the neurodiversity paradigm, *neurotypical children* present intellectual, cognitive, and developmental abilities within the typical (average) range for child development (Singer, 1999). Children are described as *neurodivergent* when they differ intellectually, cognitively, and developmentally from neurotypicality. Neurodiversity does not serve as a separatist term that distinguishes between 'normal' and neurodivergent people Also, the neurodiversity paradigm does not aim to underestimate the challenges that many people with neurodevelopmental conditions, including people with ADHD, may encounter across the life course. Neurodiversity is a rather powerful concept, which acknowledges and celebrates the fact that people can be 'wired' differently, to minimise the stigma surrounding neurodevelopmental conditions.

ADHD-related characteristics. This also explored the associations between the different measures of ADHD using a factor analysis (FA). Following on from this, Chapter 4 presents the pilot and main Study 2. The pilot study explored the reliability and difficulty level of researcher-designed reading materials with a community sample of children to test for further use in the main Study 2. Drawing on the main experimental aims, Study 2 investigated choice and reward effects on reading comprehension and enjoyment, testing the hypotheses as to whether choice and reward improve the reading comprehension and enjoyment of children with and without diagnosed ADHD, with these effects being more pronounced for those with ADHD. This study also examined the convergent and divergent validity of the ADHD-related measures and explored any differences between the two groups across these measures.

Chapter 5 presents the qualitative Study 3 of the thesis that explored the role of motivation in children with and without ADHD and tested for any qualitative differences in the motivational profiles and reading experiences of the two groups. Finally, Chapter 6 discusses the major thesis findings and theoretical implications drawing on literature. This chapter also addresses key study limitations, implications for school/clinical practice, and future directions.

Chapter 1. Literature Review

The Role of Motivation and Interest in the Reading of Neurotypical Children

Theory and research view reading motivation as a key contributor to successful reading and reading for pleasure (Wigfield et al., 2016). In the context of reading, motivation is a multifaceted construct that comprises both intrinsic and extrinsic motivation. Choice has been regarded as a strong intrinsic motivator that improves cognitive performance, learning and also secures a positive reading experience (Flowerday et al., 2004; Wigfield & Guthrie, 1997). Research with neurotypical children stresses the greater learning/reading benefits of intrinsic motivators, such as choice, compared to extrinsic motivators, including rewards. Nevertheless, evidence around the benefits of choice can be, relatively, inconsistent due to a range of factors that may moderate choice effects on potential reading outcomes.

Chapter 1 explores the role of motivation and interest in the reading of neurotypical children. First, this investigates the role of reading and reading for pleasure in the educational system of England, considering that the thesis studies were conducted in this geographical region. After this, it discusses the role of motivation in skilled reading with a particular focus on intrinsic and extrinsic motivation. It also examines the relationship between intrinsic motivation, rewards, and learning in the light of inconsistent evidence. Chapter 1 then presents the motivational construct of interest and describes the different phases of its development drawing on the influential Four-Phase Model of Interest Development (Hidi & Renninger, 2006). Due to the scope of this thesis, other interest theories will be referenced, but not further discussed. Further to this, the chapter discusses the educational importance of situational interest and, particularly the role of choice as a booster of situational interest for the increase of motivation and learning/reading outcomes. It further investigates choice, as a powerful motivator, within the Engagement Model of Reading Development (Wigfield & Guthrie, 1997) and Self-determination theory ([SDT], Deci & Ryan, 1985). The present chapter evaluates the cognitive and affective benefits of choice drawing on theory and research and addresses those factors that may explain the inconsistency in findings regarding choice effects. The primary focus is given to research related to reading; however, the role of choice in cognitive performance and learning will be explored more broadly due to the limited evidence examining choice effects specific to reading. Finally, Chapter 1 aims to clarify key motivational terms, where possible; however, this task remains a challenge considering that many of these terms have been used interchangeably in motivation literature.

The Role of Reading and Reading for Pleasure in the National Curriculum of England

Reading is a highly valued and vital skill. The link between poor reading/literacy and potential negative outcomes has been reported systematically in research (Department for Business Innovation & Skills, 2016; Her Majesty's [HM] Government, 2014; Sullivan & Brown, 2013). Poor literacy (literacy skills below Level 1[2]) has been associated with increased unemployment and poverty rates, poor mental/physical health, negative health behaviours (e.g. obesity, smoking) and risk factors related with offending behaviour, including low educational attainment, negative school experiences, exclusion, and truancy (Clark & Picton, 2018; Morrisroe, 2014). Poor literacy predicts significantly negative adult outcomes, although this relationship is usually complicated rather than simply linear.

The educational system of England places reading at the heart of the Key Stage 1 and 2[3] national curriculum (DfE, 2013). The national curriculum for reading draws on the Simple

[2] Level 1 is equivalent to GCSE grades D-G. People with literacy skills below Level 1 may have difficulty in reading everyday transport timelines (Morrisroe, 2014).

[3] Key Stage 1 includes children in Year 1 (aged 5 to 6 years old) and Year 2 (aged 6 to 7 years old). Key Stage 2 includes children in Year 3 (aged 7 to 8 years old), Year 4 (aged 8 to 9 years old), Year 5 (aged 9 to 10 years old) and Year 6 (aged 10 to 11 years old). Key Stage 3 includes adolescents in Year 7 (aged 11 to 12 years old), Year 8 (aged 12 to 13 years old) and Year 9 (aged 13 to 14 years old). Key Stage 4 includes adolescents in Year 10 (aged 14 to 15 years old) and Year 11 (aged 15 to 16 years old). UK school years refer to US school grades. Grade 1 refers to Year 2, Grade 2 refers to Year 3, Grade 3 refers to Year 4 and so on. The terms 'Year' and 'Grade' will

View of Reading framework, which stresses the development of children's competence in two dimensions: word reading and listening/reading comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). *Word reading* refers to the child's ability to translate the printed symbols into sounds (decode) to access word meaning. Letter knowledge and phonemic awareness have been considered as important factors of decoding in early childhood and main predictors of successful reading comprehension (Hulme & Snowling, 2015). *Reading comprehension* refers to the child's ability to retrieve the meaning of both familiar and unfamiliar words in print by accessing their lexicon (mental dictionary), link clauses to make simple and complex sentences as well as integrate information over different parts of the text (sentences, paragraphs) for inference making (Oakhill & Cain, 2012). Towards the end of the primary phase, children should be able to apply a set of high-level inference-making, problem-solving and analytical strategies to understand the meanings of a text (Wigfield et al., 2016). Difficulties with any of these skills could place severe obstacles for reading comprehension and overall academic achievement, considering that reading is a central component of most school subjects as children advance into education.

Similar to the development of core reading skills, the national curriculum promotes reading for pleasure (DfE, 2012; 2015). *Reading for pleasure* (also commonly named as reading enjoyment) refers to the type of reading that children do when being involved freely for personal satisfaction and also to the reading that they may initially do upon request, but then continue out of personal interest (Clark & Rumbold, 2006). Reading for pleasure has been associated with increased vocabulary, grammar, general knowledge, reading comprehension (Clark & Rumbold, 2006), and reading attainment (e.g., national curriculum assessments)

be used interchangeably based on the information provided in each study, to describe children's educational level accurately.

(DfE, 2019a; McGrane et al., 2017). The link between reading motivation, reading for pleasure, and reading attainment has been reported systematically (DfE, 2012).

Defining reading motivation is a relatively complex task since this is a multifaceted construct that comprises several factors (Wigfield et al., 2016). Nevertheless, lack of conceptual consensus and clarity in motivation-related terminology can influence significantly how the different motivational factors have been operationalised and measured in research (Conradi et al., 2014). Similarly, it is difficult to interpret findings across different studies around the practical implications of reading motivation in the classroom due to the different ways motivation has been defined. A related issue is that researchers do not clearly define the motivational constructs under investigation, or they use inter-related, but distinct terms interchangeably as further discussed in Section 1.5. To ensure greater clarity in the present thesis, *reading motivation* refers to those factors that drive children to engage in the activity of reading and comprises aspects such as their values and goals for reading, their reading attitudes, children's beliefs about their competence and the sense of autonomy children experience during their reading (Wigfield et al., 2016). Considering the scope of the thesis, intrinsic motivation refers to a child's intrinsic drive to engage with reading out of interest or personal curiosity, whereas extrinsic motivation describes a child's drive to read for external factors such as rewards (Conradi et al., 2014).

In a large-scale survey of over 18,000 young people aged 8 to 17 years old, Clark (2011) found that young people who enjoyed reading were six times more likely to read above their expected age level (standardised reading attainment data) than those who did not enjoy reading. Young people who did not enjoy reading at all were 11 times more likely to read below the expected age level than those who enjoyed reading; however, it is difficult to understand the direction of this relationship due to the lack of a longitudinal design, as previous poor reading could have led to low enjoyment levels and not vice versa. For example, early reading performance may influence the development of later reading motivation; however, reading motivation could further impact on reading performance over time (Toste et al., 2020).

Using a large sample of 3,583 participants from the 1970 British Cohort Study, Sullivan and Brown (2015) found that self-reported reading for pleasure was associated with improved performance in standardised mathematics and vocabulary assessments between 10 and 16 years old, even after controlling for children's verbal, non-verbal, language and reading skills at ages 5 and 10. According to Sullivan and Brown (2015), reading exposes children to a variety of familiar and unfamiliar words, thus contributing to vocabulary development. In this study, reading for pleasure was a greater contributor to children's cognitive performance than parental education (considered as a proxy indicator of socioeconomic status), suggesting that reading for pleasure may provide a possible way to narrow the educational gap between disadvantaged children and others (Organisation for Economic Cooperation and Development [OECD], 2002). These findings did not underestimate the role of other factors including cognitive skills and socioeconomic status in reading, but they rather proposed that reading for pleasure may compensate, to a degree, for children's poor cognitive skills (e.g., reading ability), low family income, and parental education.

The national curriculum emphasises the importance of skilled reading and reading for pleasure in primary education; nevertheless, reading underachievement remains a concern in England. The national curriculum assessments at Key Stage 2[4] (DfE, 2019b) showed that 73% of children reached the expected standard in the reading test in 2019, down by 2 percentage points from 2018. Reading attainment at the expected standard was the lowest of all Key Stage 2 tests and teacher assessments. The Programme for International Student Assessment (PISA) 2018 report[5] showed that adolescents in England performed higher in reading compared with

[4] In the UK, children in Year 6 (aged 10 to 11 years old) take national curriculum assessments usually referred to as Standard Attainment Tests (SATs). Children are tested in reading, maths, grammar, punctuation and spelling, and also receive a statutory teacher assessment in science and writing.

[5] The PISA is a worldwide study that evaluates the educational systems of the OECD countries. The PISA 2018

the OECD average (DfE, 2019); however, there was no significant change in reading scores since 2006. Adolescents in England had more negative reading attitudes and read less than their peers in other OECD countries (DfE, 2019).

Older children and adolescents are less likely to hold positive attitudes towards reading than the younger ones (Clark & Douglas, 2011; Clark, 2016; Topping, 2010). Clark (2016) reported that Key Stage 2 children showed greater reading enjoyment than Key Stage 3 and Key Stage 4 adolescents. Topping (2010) also found that children chose books that were easier to read, rather than challenging ones, once they reached age 11. This decline in reading for pleasure may be attributed to developmental changes, as older children and adolescents begin exploring their identity and valuing social aspects of life more than school subjects, including reading (LaFontana & Cillessen, 2010). Others have suggested that reading becomes more structured and performance-oriented towards the end of the primary phase, as children need to get prepared for the Key Stage 2 assessments (Sainsbury & Schagen, 2004). Thus, the less flexible structure of the curriculum may discourage reading for pleasure and lead older children to view reading as a less preferred activity (Clark & Rumbold, 2006; Sainsbury & Schagen, 2004).

Instructional practices may also undermine reading motivation. For instance, controlling classroom practices (e.g., teacher controlling language, limited child opportunities for free expression) that restrict child autonomy in the classroom may thwart reading motivation (Niemec & Ryan, 2009). A longitudinal study by Gnambs and Hanfstingl (2016) with 600 adolescents showed that self-reported intrinsic motivation (e.g., student likes learning new things), as a central dimension of academic motivation, significantly declined between 11 and 16 years old. This study found that autonomy-supportive (e.g., 'My teachers trust me to

(DfE, 2019) was a national report assessing the knowledge and skills of 15-year-old adolescents in reading, maths and science across the UK.

work on my own') and competence-enhancing (e.g., 'If I have questions about a subject matter, I can ask my teacher') academic environments might buffer this decline of intrinsic motivation, as intrinsic motivation remained relatively stable when controlling for self-reported autonomy and competence. Other studies have suggested that children with high intrinsic motivation in the first place may further maintain this through primary and adolescent years (Guthrie et al., 2006; Otis et al., 2005). Drawing on the link between intrinsic motivation and reading, the following section explores the complex construct of reading motivation and its relevance to reading.

Reading Motivation

In the 1980s and 1990s, reading research focused principally on the role of cognitive skills such as word recognition and decoding (Baker & Wigfield, 1999). As children advance in education, they are expected to apply a good set of cognitive skills during reading (Cutting & Scarborough, 2006; Garcia & Cain, 2014; Hulme & Snowling, 2015; Oakhill & Cain, 2012). In a sample of two cohorts of children aged 4 and 6 years old (N = 113), Kendeou et al. (2009) showed that early oral language (e.g., listening comprehension) and decoding skills (letter/word identification and phonological awareness), measured via standardised assessments, independently contributed to reading comprehension at 6 and 8 years. In a longitudinal study, Oakhill and Cain (2012) found that inference skills, comprehension monitoring, knowledge, and use of story structure (e.g., understanding of characters, setting) in Year 3 (N = 102) predicted comprehension, measured via standardised assessments, in Year 6 (N = 83). To apply these skills efficiently, children need to exercise cognitive effort, practice, and invest time; therefore, children should be driven by strong motivation (Baker & Wigfield, 1999; Deci & Ryan, 1985; Ryan & Deci, 2000; Stanovich, 1986). Reading motivation has been found to improve cognitive skills related to reading including word recognition and inference making (Guthrie et al., 2007a; van den Broek et al., 2001; Wang & Guthrie, 2004). Early and frequent engagement with reading could also enhance vocabulary development and reading comprehension (Guthrie & al., 1999; Schiefele et al., 2016; Stanovich, 1986).

Both cross-sectional and longitudinal studies show that reading motivation could explain reading performance in primary-aged children, even after controlling for cognitive skills such as background knowledge, questioning, searching for information and word/sentence comprehension as well as decoding, verbal ability, and reading-specific executive function skills such as cognitive flexibility[6] (Cartwright et al., 2015; Guthrie et al., 2004; Stutz et al., 2016). Reading motivation could influence students' reading comprehension skills significantly, but indirectly via behavioural and cognitive engagement. Specifically, the relationship between intrinsic motivation and reading comprehension has been found to be mediated by reading amount (e.g., time spent on activities [behavioural engagement]) and/or the effective use of reading strategies (e.g., building connections between text information and background knowledge [cognitive engagement]), even when accounting for other factors such as prior reading achievement (Schaffner et al., 2013; Schiefele et al., 2012).

Miyamoto et al. (2019) found that students who enjoyed reading in Grade 5 (reading enjoyment as an aspect of intrinsic motivation) spent more time on reading (self-reported reading amount) and had greater knowledge of applying reading strategies (assessed through a test) in Grade 6, which led subsequently to an increase in their reading comprehension scores (measured through a reading assessment) in Grade 7. In a cross-sectional study with children aged 7 to 9 years old ($N = 1053$), Stutz et al. (2015) found that self-reported reading motivation (reading involvement) increased performance on a standardised reading assessment. This relationship was mediated by self-reported reading amount, even after controlling for word/sentence comprehension (standardised assessment). In a longitudinal

[6] Cognitive flexibility refers to one's ability to switch attention between different parts of the text.

study, Cartwright et al. (2015) found that self-reported reading motivation in Grades 1 and 2 (*N* = 68) predicted standardised reading comprehension concurrently and longitudinally (31 children received a posttest two years later), even when controlling for decoding, verbal ability and reading-specific executive functions such as cognitive flexibility (measured via standardised tests). Further empirical research contributes to existing work showing that reading-related cognitive skills, such as word recognition, and reading motivation are synergistic and make independent contributions to reading comprehension (Cox & Guthrie, 2001; Taboada et al., 2009). Reading skills alone cannot automatically turn someone into a good reader and, similarly, motivation alone cannot guarantee skilled reading. Regarding reading motivation, this has been viewed consistently as an important factor that contributes to proficient reading and reading for pleasure (Baker & Wigfield, 1999; Deci & Ryan, 1985; Ryan & Deci, 2000; Wigfield et al., 2016).

Reading motivation is a multifaceted construct that comprises variables such as competence beliefs and goal orientations, self-efficacy, perceived autonomy, intrinsic and extrinsic motivation, and social motivation (Guthrie & Wigfield, 2000; Wigfield & Guthrie, 1997; Wigfield et al., 2016). Children's goals and values of reading could be important factors when they choose to read (Durik et al., 2006). Children who maintain high self-efficacy beliefs[7] and feel that they can accomplish a reading task are more likely to do better in reading (Bandura, 1997; Schunk & DiBenedetto, 2016). Children who feel a sense of personal agency and control over their reading have a greater likelihood to engage in reading and read for pleasure (Guthrie et al., 2007a). When children participate in reading activities with their peers (exchange and discuss books with friends), they are more likely to develop positive reading

[7] *Self-efficacy* refers to one's beliefs about their own abilities. Children are more likely to engage in tasks, when the feel that they are competent enough to accomplish them, irrespective of the expected outcomes (Bandura, 1997). The construct of self-efficacy differs from that of perceived competence introduced by SDT and discussed later (Deci & Ryan, 1985). *Perceived competence* refers to one's intrinsic need to master personally relevant and challenging tasks. This does not refer only to an ability to complete these tasks, but also to the considerations one has about the meaningfulness of the task (Rodgers et al., 2014).

attitudes and improve as readers (Wigfield et al., 2016).

Intrinsic motivation refers to one's intrinsic need to engage in a task for its own sake out of personal interest (Ryan & Deci, 2000). Intrinsic motivation includes aspects such as *importance*, which refers to one's beliefs that reading is valuable, *curiosity* that describes one's desire to learn about a certain task, *involvement*, which refers to one's enjoyment of reading different text types and genres, and *preference for challenging,* which describes one's satisfaction to engage in complex reading material (Wigfield & Guthrie, 1997). *Extrinsic motivation* relates to academic behaviours driven by extrinsic factors including work/social recognition for success, competition (desire to outperform others), and attainment of higher grades (Deci & Ryan, 1985; Wigfield & Guthrie, 1997; Wigfield et al., 2016). Intrinsic and extrinsic motivation have received high interest in reading research. These two dimensions will now be further unpacked drawing on theory and research, which propose frequently that the two dimensions may be differentially related to reading outcomes.

The Role of Intrinsic and Extrinsic Motivation in Reading

Intrinsic motivation has been related strongly to positive reading outcomes such as increased reading frequency, breadth of reading, and reading for pleasure compared to extrinsic motivation (Schaffner et al., 2013; Wang & Guthrie, 2004; Wigfield & Guthrie, 2001). Wigfield and Guthrie (1997) explored whether reading motivation is related to increased amount and breadth of reading in children aged 9 to 11 years old (Grade 4, Grade 5). Children completed the Motivation for Reading Questionnaire (MRQ) twice during the school year. This widely used questionnaire includes different dimensions of reading motivation including self-efficacy, intrinsic/extrinsic motivation, work avoidance, and social reasons for reading (Guthrie et al., 1996). Children's amount and breadth of reading were measured via diaries and questionnaires. Children with greater intrinsic motivation read three times more than children with lower intrinsic motivation, and more broadly, after controlling for prior reading amount and breadth

(Cox & Guthrie, 2001). Intrinsic motivation accounted more for the variance in reading amount and breadth than extrinsic motivation. Reading motivation may thus contribute to early and frequent engagement with reading, which increases vocabulary development and reading comprehension (Schiefele et al., 2016; Stanovich, 1986). However, extrinsic motivation in the Wigfield and Guthrie (1997) study predicted reading more in the spring term than intrinsic motivation, probably due to the school's greater emphasis on recognising those children who engage in frequent reading during that school term. Intrinsic motivation has been associated more highly with positive reading outcomes, although contextual factors (time of school year, school schedule) may moderate, to an extent, the relationship between extrinsic motivation and reading.

In a study with 740 children, Becker et al. (2010) examined the longitudinal relationship between intrinsic/extrinsic motivation and reading literacy development from 8 and 9 years old (Grade 3) to 11 and 12 years old (Grade 6). Self-reported intrinsic motivation in Grade 4 related positively to reading literacy (reading comprehension and vocabulary tests) in Grade 6 and this relationship was mediated by self-reported reading amount. Children who read for pleasure read more frequently and developed better comprehension, vocabulary, and decoding skills than those who did not. However, when previous reading comprehension was considered, the effect of reading motivation, as mediated by reading amount, was overshadowed by the direct effect of reading literacy in Grade 3 on the reading literacy in Grade 6. The researchers proposed that reading achievement remained relatively stable across the year groups, and thus little variance could be explained by reading motivation. Extrinsic motivation correlated negatively with reading literacy and this relationship was not mediated by reading amount. Children who were more extrinsically motivated showed poorer reading skills than children with lower extrinsic motivation (Schaffner et al., 2013). These findings offer evidence for the greater benefits of intrinsic over extrinsic reading motivation.

It has also been argued that intrinsic motivation serves as a booster of reading comprehension, especially for weak readers (Lau & Chan, 2003; Logan et al., 2011). In a study with 111 children aged between 9 and 11 years old, Logan et al. (2011) found that self-reported intrinsic motivation resulted in children's greater reading growth, assessed via reading tests, over the school year. Verbal skills, assessed through a verbal similarities and word definitions test, explained better the reading skills of skilled readers, while intrinsic motivation explained more significantly the reading comprehension of weak readers. The researchers found that some young readers who struggled with word decoding may have become more disengaged and apathetic, while those weak readers who sustained high intrinsic motivation were more likely to keep themselves engaged in reading. Those readers who showed both poor reading skills and poor intrinsic motivation were more likely to struggle with reading comprehension.

The relationship between intrinsic motivation and reading has been well established, however, there is conflicting evidence around the role of extrinsic motivation in reading and the relationship between extrinsic motivation and intrinsic motivation (Cameron & Pierce, 1994; Cameron et al. 2001; Deci et al., 1999; Ryan & Deci, 1996) Several studies have suggested that extrinsic motivation is associated negatively with reading (Becker et al., 2010; Schaffner et al., 2013; Wigfield & Guthrie, 1997). Other studies have proposed that extrinsic motivation could benefit some readers (McGeown et al., 2012). Park (2011) used United States (US) data from the Progress in International Reading Literacy Study (PIRLS) 2016 to examine the relationship between self-reported intrinsic/extrinsic motivation and performance on a standardised reading assessment in a sample of 4.826 children aged 9 to 10 years old. Secondary analyses showed that reading motivation predicted reading performance, even after controlling for gender and socioeconomic status. Interestingly, moderate extrinsic motivation improved reading performance, only when children had at least a moderate level of intrinsic motivation. Extrinsic motivation decreased reading performance when children had low intrinsic motivation (Lin et al., 2003). Therefore, extrinsic motivation may have a deleterious effect on reading, especially when little or no intrinsic motivation is already present.

McGeown et al. (2012) further examined the relationship between reading comprehension (measured via a standardised assessment), intrinsic motivation (e.g., challenge, curiosity), extrinsic motivation (e.g., competition, grades), and reading efficacy in good (top 10% of the sample based on a reading ability test) and poor readers (bottom 10% of the sample). Children rated their motivation using the MRQ. In total, the sample included 1811 young people aged 7 to 13 years old. In the total sample, intrinsic motivation and reading efficacy were significantly positively associated with reading comprehension, whereas extrinsic motivation was not. Extrinsic motivation (preference for grades and competition) among good readers was significantly, but weakly, associated with greater reading performance, whereas intrinsic motivation was not, except for involvement. Reading efficacy was positively associated with reading comprehension for good readers. Among poor readers, reading comprehension was not associated with any aspects of motivation (intrinsic and extrinsic) and reading efficacy. In line with the findings of Park (2011), McGeown et al. (2012) suggested that children may be more motivated by external factors, such as achieving higher grades and outperforming others, when performing at a high reading level and extrinsic motivation may not necessarily have a detrimental effect among children who already maintain high intrinsic motivation as the good readers of this study.

Overall, intrinsic motivation has been regarded as more beneficial for skilled reading than extrinsic motivation. Nevertheless, factors such as baseline reading ability, baseline intrinsic/extrinsic motivation, and issues related to the measurement of intrinsic/ extrinsic motivation may explain partially the inconsistency in findings regarding the role of extrinsic motivation. Some of these factors should be further considered when examining the relationship between intrinsic, extrinsic motivation, and reading.

The Relationship Between Intrinsic Motivation, Rewards, and Learning

The relationship between intrinsic motivation and rewards has received remarkable interest in the motivation literature (Cameron & Pierce, 1994; Cameron et al., 2005; Deci et al., 1999; Hidi, 2016; Murayama et al., 2010; Murayama, 2018; Ryan & Deci, 2009). *Rewards* are external stimuli, which are typically assumed to be positive events and may or may not strengthen behaviour (Cameron & Pierce, 1994). Theory and research have proposed and offered evidence for the undermining effect of rewards on intrinsic motivation and learning (Deci & Ryan, 1985; Kohn, 1993; Murayama et al., 2010; Ryan & Deci, 2009). Other studies have suggested that, although rewards may have detrimental effects on intrinsic motivation and learning, these effects are relatively complex and, thus, rewards do not necessarily influence learning negatively (Cameron & Pierce, 1994; McGeown et al., 2012; Murayama & Kitagami, 2014).

The proposition about the undermining effect of rewards draws on the *overjustification hypothesis*, according to which one's perceptions and ideas about the factors that cause behaviour, could highly influence one's motivation and academic performance (Lepper et al., 1973). Based on the overjustification hypothesis, when children receive a reward to engage in a task, they are more likely to attribute their behaviour to external factors (rewards) rather than intrinsic factors (personal interest). Deci and Ryan (1980; 1985) explored the effects of rewards on intrinsic motivation in the well-cited *Cognitive Evaluation Theory* (CET). According to this theory, it is necessary to explore the interpretations that people attribute to rewards to understand their effects. CET proposes that the needs for autonomy and competence are highly important for the development of intrinsic motivation and reward effects should be considered in relation to how they affect perceived autonomy and competence. Conditions that promote the satisfaction of these needs increase intrinsic motivation and subsequently learning, whereas conditions that undermine need satisfaction thwart learning outcomes. When rewards are given upon the completion of the task irrespective of the quality of performance, they may be perceived as controllers of behaviour, and as the only reason for participating in an activity (*controlling*). Such controlling rewards facilitate an external perceived locus of causality (one's perceptions of success and failure), undermine need satisfaction, and thus decrease intrinsic motivation. Contrariwise, when rewards are perceived as indicators of competence (*informational*), they could facilitate an internal perceived locus of causality and enhance intrinsic motivation and learning. According to CET, there are contextual factors that enhance or thwart intrinsic motivation by promoting or undermining need satisfaction as discussed later (Rigby et al., 1992). Rewards have been perceived primarily as controlling and manipulating events, however, these may also serve as demonstrations of appreciation for one's effort and hard work, and thus contribute, positively, to a sense of competence (Hidi, 2000). In other words, rewards could represent autonomy-supportive or controlling events based on how they are administered (e.g., style, language).

Meta-analyses have examined reward effects on intrinsic motivation providing a way to understand this relationship (Cameron & Pierce, 1994; Deci et al., 1999). The typical design of the studies in these meta-analyses includes a performance-based reward (experimental) group and a no-reward (control) group that both receive an interesting task. Participants in the former group receive or expect a reward based on their performance, while participants in the no-reward group do not receive a reward. On task completion, participants could engage in similar tasks including the target task, if they wish, having the belief that they are not being observed (free-choice period). Intrinsic motivation is typically measured through one's willingness to voluntarily engage in tasks, similar to the experimental task, during a free-choice period.

In a well-cited meta-analysis of 96 studies, Cameron and Pierce (1994) explored the effects of reinforcement/reward on intrinsic motivation. The studies used between-subjects designs to compare rewarded and no rewarded groups across four measures of intrinsic motivation that included free time on task once the reward is withdrawn, performance during the free time measure, self-reports of attitudes towards tasks, and willingness to volunteer for future similar studies in the absence of a reward. The studies of this meta-analysis investigated particularly whether factors such as the type of reward (tangible or verbal), reward expectancy (whether reward is expected or offered unexpectedly), and reward contingency (whether reward is offered simply for completing the task or for achieving a certain level of performance) could moderate the impact of rewards on motivation. Results showed that when all the types of rewards were aggregated, rewards did not produce decrements in intrinsic motivation. Rewards had a deleterious effect on intrinsic motivation (e.g., less time spent on the task once the reward is removed, less positive attitudes towards the task), only when these were offered simply for completing the task, irrespective of successful performance.

Fryer (2011) investigated how financial incentives influenced the academic performance (e.g., to read books, to turn in homework, or attendance and behaviour) of students from 250 urban primary and secondary schools in the US. In terms of reading, large and significant gains were observed for rewards during reading comprehension. In a between-subjects design with 106 children aged 10 to 11 years old, Filsecker and Hickey (2014) found that self-reported motivation was not undermined by external game-related rewards during an educational game. Interestingly, students in the reward condition showed greater gains in conceptual understanding and non-significantly larger gains in achievement, both measured through integrated game assessment tests, compared with those in the non-reward condition. These findings show that rewards may not necessarily have a detrimental impact on intrinsic motivation and learning.

Contrariwise, another widely cited meta-analysis of 128 studies produced by Deci et al. (1999) found that rewards have an undermining effect on children's intrinsic motivation (Deci et al., 2001). These results were in line with three previous meta-analyses, which reported similarly the undermining effect of rewards on intrinsic motivation (Rummer & Feinberg, 1988; Tang & Hall, 1995; Wiersma, 1992). The meta-analysis of Deci et al. (1999) showed that completion-contingent, engagement-contingent, and performance-contingent rewards decreased intrinsic motivation during the free-choice period, similar to the aggregate categories of all rewards except for tangible rewards. Rewards undermined self-reported motivation, except for the performance-contingent rewards and the aggregate categories of all rewards. These findings challenged behavioural/reinforcement theories (Skinner, 1938), which proposed that rewards would increase monotonically intrinsic motivation and that the withdrawal of rewards would not lead to a decrease in intrinsic motivation, as behaviour tends to revert to its original state when extrinsic rewards are no longer offered.

According to Deci et al. (1999), this inconsistency in the results of the meta-analyses may be partially because Cameron and Pierce (1994) also included studies that used boring tasks and they collapsed the effects of rewards on interesting and boring tasks. Failure to measure the potential moderating effects of initial task interest may have obscured the undermining effects of rewards on intrinsic motivation. In a classroom setting, whether a task is interesting or boring is considered to be an important factor for educators, particularly in the case of children who do not hold a genuine intrinsic interest in the task (Hidi & Harackiewicz, 2000). Drawing further on the critique of Deci et al. (1999), the studies in the meta-analysis of Cameron and Pierce (1994) did not always have an appropriate control group (no-reward group), or control groups were not matched appropriately with experimental groups (reward plus positive feedback experimental group, but absence of a no-reward plus positive feedback group). Moreover, there were differences across the meta-analyses in terms of how rewards[8]

[8] Cameron and Pierce (1994) defined reward contingency either as the reward offered simply for completing the task or for achieving a good level of performance. Deci et al. (1999) classified rewards into task-noncontingent rewards (rewards offered irrespective of task completion), engagement-contingent rewards (rewards offered based on engagement with the task), completion-contingent rewards (rewards offered upon task completion) and

were classified in studies, based on factors such as reward contingency. Deci et al. (1999) concluded that tangible rewards could undermine intrinsic motivation when perceived as controlling, whereas unexpected rewards are not perceived as controlling, and thus are less likely to diminish intrinsic motivation. Deci et al. (1999) did not fully reject the positive effects of rewards on intrinsic motivation, and rather suggested that CET offers a useful theoretical framework for educators to consider carefully the potential educational importance of rewards in the classroom. In addition to this, they suggested that rewards may enhance particularly intrinsic motivation and learning, when tasks are not considered as interesting and in this case performance-based rewards may convey positive information about one's competence, thus off-setting the deleterious effects of rewards (Renninger & Hidi, 2016).

The studies discussed above offer critical insight into the relationship between rewards and intrinsic motivation, and the role that potential factors (type of reward, reward contingency, initial interest/intrinsic motivation) and contexts (autonomy-supportive versus controlling) could play when exploring this relationship. However, the majority of studies to date have neglected the role of interest and have not considered how rewards may affect different types of interest (e.g., situational, individual) during learning. The studies in the previous meta-analyses (Cameron & Pierce, 1994; Deci et al., 1999) also did not focus on academic tasks, but rather tested primarily the role of rewards during simple activities, such as solving puzzles, in laboratory-like settings. Further research would elucidate whether rewards and their relationship to interest are of importance during more complex academic tasks, such as reading, particularly for the less motivated and distracted children in the classroom (Hidi & Harackiewicz, 2000; Hidi, 2000). Finally, existing research has explored primarily reward effects on the motivation and learning of neurotypical populations. Nevertheless, rewards likely

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performance-contingent rewards (rewards offered upon successful completion). Completion and performance-contingent rewards may convey occasionally positive information about one's competence, and therefore offset the potentially controlling negative effects of rewards.

have differential effects on the motivation and reading of those with ADHD-related characteristics (Marx et al., 2018; Sonuga-Barke, 2005). By acknowledging the multidimensional nature of motivational constructs and leveraging both intrinsic and extrinsic factors, researchers may be in place to support educators with the reading of children with various cognitive profiles.

The Relationship Between Interest and Motivation

Motivation and interest share long-standing links in educational psychology and the two terms have been frequently used interchangeably (Schiefele, 2009). However, it is important to distinguish between these two to avoid any misinterpretation. *Motivation* refers to the state of desiring to engage in a task. *Interest* serves as an antecedent of motivation that relates to a specific activity and may range from a fleeting person-object relationship (one's interest due to a stimulating text) to a more lasting relationship between the activity and the person (one's continuing interest in reading) (Schiefele, 2009).

Theories of motivation have focused particularly on cognitive processes such as thoughts and beliefs. In Self-efficacy theory (Bandura, 1997), one's beliefs about their ability to accomplish a task highly influence one's motivation and learning. In Expectancy-value theory (Eccles & Wigfield, 2002), one's beliefs about the value of the task are important for motivation. Interest differs from other motivational variables, as it includes both affective and cognitive components that interact with each other (Hidi & Renninger, 2006; Renninger & Hidi, 2016). Interest has an affective component that is usually positive, although negative affective reactions including fear and disgust could also trigger this (Hidi & Harackiewicz, 2000). The cognitive component of interest refers to the perceptual processes involved during the experience of interest (Hidi & Renninger, 2006). Motivation requires a level of focused attention, cognitive effort, perseverance, and determination to engage in a task, whereas interest involves an automatic and effortless person-object interaction, which elicits unconsciously a change in these behaviours. The automatic changes in attention and perseverance, as an outcome of the interest experience, could boost cognitive performance and learning. Interest, when supported by educators and parents, could lead to focused attention and enhanced task engagement (Renninger & Hidi, 2016). During this continued and deep engagement with a task, children are more likely to experience positive feelings, develop positive beliefs about the task value, and as a result re-engage in similar tasks in the future (Hidi & Renninger, 2006).

Considering that reading is an activity that involves both cognitive and motivational mechanisms, promoting interest in the classroom could be a good practice to support motivation, reading for pleasure, and overall reading. The following section explores the different conceptualisations of interest and introduces the Four-Phase Model of Interest Development.

The Four-Phase Model of Interest Development

Several theoretical frameworks have explored interest development. According to the *Model of domain learning* (Alexander, 2004), interest develops in relation to one's developing expertise in academic domains. In *Person-object theory*, interest is the outcome of the dynamic interplay between the person and environment, is content specific rather than general, and is primarily defined by affective (e.g., liking) rather than cognitive factors (e.g., stored knowledge). This section focuses on the Four-Phase Model of Interest Development introduced by Hidi and Renninger (2006), which allows for a more thorough understanding of whether, how, and why interest develops. Contrary to motivational theories and models such as SDT (Deci & Ryan, 1985) and the Engagement Model of Reading Development (Wigfield & Guthrie, 1997) that overlooked the role of interest and interest development, this model addresses how interest develops, even when this is not present in the first place. This knowledge is important for educators who struggle to work with less motivated readers (Hidi & Harackiewicz, 2000). Some educators may hold the belief that children either have or do not have an interest in a reading task and are not always aware of the contribution they can make to child interest development (Lipstein & Renninger, 2006).

The Four-Phase Model of Interest Development (Hidi & Renninger, 2006) classifies interest into situational and individual interest. *Situational interest* describes the first phase of personal interest development, which can be generated by contextual features, and may or may not last (Hidi & Renninger, 2006). *Individual interest* refers to one's relatively stable predisposition to re-engage in specific content over time, and the spontaneous psychological state once this predisposition has been triggered. Situational interest precedes individual interest and is supported by instructional practices including choice, group work, and computer-aided learning (Harackiewicz et al., 2016; Linnenbrink-Garcia et al., 2013; Renninger & Hidi, 2016). Text features such as novelty[9], vividness, surprisingness, coherence, emotiveness, and ease of comprehension could also facilitate the development of situational interest (Cordova & Lepper, 1996; Hidi & Renninger, 2006; Renninger & Hidi, 2016; Schraw et al., 2001). Individual and situational interest refer to different phases of interest development, however, they should not be viewed in strictly dichotomising terms, as they both affect each other's development (Renninger & Hidi, 2016).

This model describes four phases of interest development, two phases for each type of interest (Hidi & Renninger, 2006). Situational interest comprises the triggered and maintained types of interest, while individual interest consists of the emerging and well-developed types of interest. *Triggered interest* is the first phase and refers to a psychological state that stems from short-term changes in cognitive and affective processing of stimuli. Triggered interest develops into *maintained situational interest,* which refers to a psychological state of interest that involves focused attention, cognitive effort, and persistence. This interest is followed by

[9] Novelty and curiosity have commonly been used interchangeably in motivation research; however, they represent two different constructs. They both elicit a state of desire to fill in the gap in previous knowledge, however, unlike curiosity that pauses once fulfilled, novelty, as a trigger of situational interest, is more likely to result in continuous engagement and learning (Renninger & Hidi, 2016; Schraw & Lehman, 2001).

the *emerging individual interest* that describes both a psychological state and the beginning of a relatively enduring predisposition to re-engage with certain content over time. The final phase refers to both a psychological state of interest and a more enduring predisposition to re-engage with content over time, the *well-developed individual interest*. The four phases are sequential, develop progressively, while each phase of interest is characterised by different amounts of knowledge, value, and affect. Throughout the phases of development, support by others such as teachers is necessary for both less and more developed types of interest. This model has received some empirical support (Harackiewicz et al., 2008), however, research testing the different phases of interest development is at a preliminary stage. The following section discusses issues around interest measurement.

Challenges With the Measurement of Interest

Literature proposes different conceptualisations of interest. In educational research, interest has been defined as a motivational predisposition to engage in a task that exists in one's self, or as the outcome of the interplay between the environment (e,g, interesting and stimulating tasks) and one's characteristics (Krapp, 2007; Renninger & Hidi, 2011; Schiefele, 1991). Interest may also have a dual meaning referring to the psychological state of a person when engaging with the content, and also the affective and cognitive motivational predisposition to re-engage with content over time (Renninger & Hidi, 2016).

Similar to motivation research, differences in the conceptualisations of interest have led to differences in the ways this has been measured. Traditionally, researchers assess interest using self-reports that explore liking, positive feelings and perceived feelings about task value, or behavioural indicators such as voluntary engagement, independent engagement (e.g., assessed during a free-choice period), frequency of engagement, comprehension, accuracy, and depth of knowledge (Renninger & Hidi, 2016). Collecting data on different aspects of interest is important, as certain indicators used alone, may not provide reliable measures of interest

(Renninger & Hidi, 2016). For example, liking may indicate that a child holds a certain level of interest in the task, however, the same child might also experience negative feelings, especially during the early phases of interest development.

Situational interest that is triggered by instructional practices including choice, has been measured primarily through self-reports, which poses certain challenges. Situational interest has been described as an unconscious fleeting response towards environmental stimuli (Hidi & Renninger, 2006). Therefore, young readers may have not fully developed the cognitive awareness to reflect on their interest during this initial phase of its development. In contrast, as interest progresses into more emerging forms of individual interest children may gradually become more aware of their interest levels (Renninger & Hidi, 2016). Self-reports can also be subjective, reliant on self-awareness of affective states, and susceptible to social desirability bias. These features of situational interest place extra challenges when exploring the effects of potential triggers of situational interest, including choice, on child learning, stressing the need to design studies that manipulate such triggers empirically.

Lack of consensus regarding the conceptualisation of interest and its measurement underlines the complexities of the field and the need to explore this area further. To address some of these challenges, to a degree, researchers should define the theoretical framework that influences their research aims and the aspects of interest being measured each time. Despite the complexity of this area, the idea that interest can be nurtured and develop and that classroom practices can play an important role in its development has important educational implications (Fridkin, 2018). Taking this into account, the following section investigates the educational benefits of situational interest and choice, as one of its potential triggers.

The Educational Importance of Situational Interest and the Role of Choice

Situational interest, which is the scope of this thesis, is a motivational construct of practical significance in reading research. Educators, who support and maintain continuously its environmental elements could help children develop a more enduring predisposition, and, subsequently, intrinsic motivation during reading. Highly motivated children are more likely to invest in reading and become lifelong readers (Hidi & Renninger, 2006; Schraw et al., 2001; Wigfield et al., 2016).

Promoting situational interest in the classroom has been regarded as an instructional practice that optimises intrinsic motivation and reading. In a sample of 120 children aged 8 to 9 years old, Guthrie et al. (2006) explored whether situational interest in a specific book leads to long-term intrinsic reading motivation. Children completed a reading log that assessed interest in a variety of books (informative and narrative) being read previously in the classroom and their reasons (intrinsic and extrinsic) for reading these books at two different time points (September, December). Children then indicated, which book they found more interesting and the reasons for this choice. Reasons for choosing books were classified into two groups to reflect either intrinsic (e.g., interest in the book) or extrinsic motivation (e.g., need to get a reward). Changes in situated motivations (e.g., reasons for choosing books) were related to changes in general self-reported reading motivation. In the case of children who selected information books, they reported more situational intrinsic motivation first and then increased general intrinsic motivation. In the case of children who selected narrative books, they reported being less extrinsic in their situational motivation first and showed a decrease in their general extrinsic motivation later. Therefore, changes in children's situational motivation (reasons for choosing a specific book) contributed gradually to the development of a more intrinsically (or less extrinsically) oriented motivation.

The Guthrie et al. (2006) findings offer empirical evidence for the role of situational interest in the development of intrinsic motivation (Guthrie et al., 2005). Nevertheless, the researchers did not control for prior book interest, and thus it is difficult to disentangle whether it is situational interest or individual interest that led to an increase in reading motivation.

Children were already familiar with the books in the classroom, and, therefore, it is likely that they had already developed some intrinsic interest in their selected book. Controlling for prior reading interest is important to examine the effects of situational interest on learning and future intrinsic motivation. Considering the important role of intrinsic motivation in reading comprehension and reading achievement, instructional practices that promote situational interest may provide a first step for the development of child intrinsic motivation (Renninger & Hidi, 2016).

In Hidi and Renninger's interest model (2006), choice represents a powerful trigger of situational interest that facilitates an autonomous learning experience. Educators support situational interest in the classroom, when they encourage children to exercise some control over their learning such as co-defining academic goals, choosing the content of learning activities, and selecting strategies for assessment (Schiefele, 2009). Situational interest, as promoted by choice, may contribute to an effortless and automatic allocation of attention and increase learners' engagement and perseverance, regardless of whether or not they have an already-established genuine task interest (Hidi & Harackiewicz, 2000).

During a qualitative study with 224 adolescents aged 14 to 15 years old, Palmer (2009) found that choice, novelty, hands-on activities, and social involvement were important sources of situational interest during a science lesson. In a sample of 126 adolescents (*M* age = 14.6 years old), Linnenbrink-Garcia et al. (2013) explored whether classroom practices such as perceived choice, instructor approachability, the connection of course material to real life, and student's opportunities for involvement, as measured via self-reports, would predict situational interest, as assessed via a survey, across a 2-week science course. They also explored whether situational interest would mediate the relationship between classroom practices and self-reported academic-related outcomes including involvement, individual interest, perceived competence, and cognitive/behavioural engagement subsequently. Situational interest was defined as that type of interest that is triggered by practices such as choice. Three components of situational interest were assessed through a survey including triggered situational interest (characterised as a short-term affective state generated by context), maintained situational interest-feeling (characterised by positive affect), and maintained situational interest- value (characterised by feelings of perceived task relevance). Choice was found to be the most important predictor of situational interest. Situational interest also mediated the relationship between perceived choice and academic outcomes. In line with other studies, these findings stress the central role of choice for the support of situational interest (Palmer, 2009; Renninger & Hidi, 2002). Experience of choice may therefore increase one's interest in a certain task, and such increased interest could contribute to heightened levels of task engagement, motivation, and learning. The following section further explores the role of choice as a motivational construct within the Engagement Model of Reading Development and SDT.

Choice as a Central Motivational Construct

Choice has long been regarded as a central motivational construct in literature (Clark & Phythian-Sence, 2008; de Charms, 1983; Hidi & Renninger, 2006; Renninger & Hidi, 2016; Ryan & Deci, 2000). The role of choice in reading and general learning has been explored in three major theoretical perspectives. In the context of reading, the Four-Phase Model of Interest Development (Hidi & Renninger, 2006) posits that choice serves as a trigger of situational interest. Educators who support situational interest continuously are more likely to enhance motivation and reading. The Engagement Model of Reading Development (Wigfield & Guthrie, 1997) regards choice as one of the five aspects of reading motivation that improves reading comprehension and learning. SDT views choice as a useful motivational instructional practice that promotes autonomy in the classroom (Deci & Ryan, 1985; 2000).

Wigfield and Guthrie (1997) introduced the Engagement Model of Reading Development to address both the cognitive and non-cognitive elements of reading. According to this, successful readers are both cognitively able and motivated to engage in reading. A proficient reader engages in interactions with the text, which are both motivating and strategic. This model embraces motivational constructs such as children's self-efficacy beliefs, attitudes, and values of achievement, personal goals, intrinsic and extrinsic motivation, child autonomy, and social motivation. Choice is a key construct that enhances child autonomy, facilitates the development of reading motivation, promotes reading for pleasure, and increases reading comprehension (Guthrie & Cox, 2001; Guthrie et al., 2007a; Wigfield et al., 2016).

To investigate the practical importance of motivation in the reading comprehension of science-related topics, Guthrie and colleagues designed a series of quasi-experimental intervention studies with children aged 7 to 8 years old and 9 to 10 years old, known as Concept Oriented Reading Instruction (CORI). During the CORI studies, researchers explored the role of a set of motivational variables as potential boosters of reading engagement and subsequent reading comprehension (Guthrie & Wigfield, 2000; Guthrie et al., 2007a; Guthrie et al., 2007b; Taboada et al., 2009; Wigfield & Guthrie, 1997). *Reading engagement* describes the motivational and cognitive processes co-occurring during reading (Guthrie et al., 2007b). In a meta-analysis of 11 studies (Guthrie et al., 2007b), the researchers compared CORI with one or more control groups, in which participants received strategy instruction in reading but no motivational support. The motivational instructional practices applied included relevance, choice, success, collaboration, and thematic unit. The cognitive strategies consisted of questioning, searching, summarising, use of background knowledge, use of text knowledge, and inference making. These cognitive strategies have been associated with high reading outcomes (Guthrie et al., 2006; Taboada et al., 2009).

Findings from the Guthrie et al. (2007b) meta-analysis showed that CORI contributed to high cognitive outcomes with mean effect sizes ranging from .59 to .93 for comprehension measures, such as comprehension of text information, narrative text comprehension, and basic skills including word recognition skills. When motivational support was removed, there was a decrease in reading comprehension. In CORI studies, choice served as an instructional autonomy-supportive practice that motivates children to make choices about texts, topics, and learning partners (Guthrie et al., 2007b; Taboada et al., 2009; Wigfield & Guthrie, 1997). CORI studies offered support for the theoretical hypothesis that reading motivation increases task engagement and comprehension (Guthrie et al., 2007b). However, they constitute a composite analysis of different motivational and cognitive factors contributing to reading and do not enable the exploration of the independent effects of choice on reading outcomes. Further research that manipulates choice experimentally, while controlling for prior interest, could shed further light on the reading benefits of choice.

Choice has also been investigated extensively within the influential SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). Drawing on this theory, people have the innate propensity to satisfy their psychological needs for competence, relatedness, and autonomy. Intrinsic motivation is secured, when these needs are being fulfilled. In educational settings, *competence* refers to a child's feelings that they can accomplish a meaningful task. *Relatedness* describes a child's need to experience a sense of connectedness with their teacher and classmates. *Autonomy*, which is the focus of this thesis, refers to the child's organismic need for personal causation and a sense of control (de Charms, 1983; Ryan & Deci, 2000). Choice has been regarded as an autonomy-supportive practice that reflects an internal perceived locus of causality, promotes the experience of personal agency, increases intrinsic motivation and, thus optimises one's potential for personal development and positive well-being (de Charms, 1983; Deci & Ryan, 1985; Ryan & Deci, 2000). In SDT, social contexts affect the extent to which children fulfill this intrinsic need for personal autonomy and experience intrinsic motivation. SDT has important practical implications in education, as it explores those classroom-related factors (autonomy-supportive versus controlling teaching practices) that could support or thwart children's intrinsic need for learning.

Several classroom-related factors may affect child learning, such as the teaching style for engaging children. In SDT, teaching styles have been explored in terms of the extent to which they support or undermine child autonomy. Teachers apply autonomy-supportive practices when they explain the importance and value of a task, provide children with opportunities to take initiatives and make choices over their learning, give children enough time to process the academic tasks and encourage them to express freely their opinions about different school topics (Guthrie et al., 2007b; Reeve et al., 2004; Reeve, 2006). Offering opportunities for children to make choices over what to read, how to read, or when to read facilitates the experience of autonomy. As in the Four-Phase Model of Interest Development, in SDT a strong relationship is proposed between teacher autonomy support, student interest, and intrinsic motivation. Both theories posit that interest and intrinsic motivation should not be considered as variables within the person, but rather as variables that depend highly on the social aspects of the learning environment, such as teaching style. In line with Hidi and Renninger's interest model (2006), SDT proposes that intrinsically motivated learners display greater effort, attention, and perseverance during a task than the less motivated learners. The following section reviews empirical evidence around choice effects and, in the process, addresses the complexities that emerge when exploring these effects on affective and cognitive engagement.

1.10 An Empirical Exploration of Choice Effects on Learning and Reading

Substantial theory and research support the benefits of choice for motivation and learning (Cordova & Lepper, 1996; Patall, 2013; Renninger & Hidi, 2016; Ryan & Deci, 2000). A report published by the DfE (2012) highlighted that choice is an important strategy that promotes independent reading and reading for pleasure.

Cordova and Lepper (1996) explored the role of choice as a booster of intrinsic motivation and engagement with maths and problem-solving activities in a well-cited study with 72 children aged 9 to 11 years old. Children were randomly assigned to one of five different conditions, a control condition, and four experimental conditions. They participated either in computerised maths games presented in an unembellished form (control condition), or computerised activities embedded in a fantasy context (experimental conditions). In the four experimental conditions, half the children made choices over irrelevant instructional aspects of their learning, such as choosing the name of the computer characters. The rest of the children were not given such a choice. Task involvement was assessed based on children's preference for challenging tasks, amount of time spent on complex operations, such as division, and evidence of strategic skills application during activities. Intrinsic motivation was explored through direct enjoyment measures that tested children's liking and enjoyment of the different computer game versions, and through relative measures during which children expressed whether they enjoyed the game relative to their favourite board games. Learning was measured through a maths test that was administered during the posttest session, with pretest scores being used as a covariate. Choice increased affective engagement, offering support to previous theories (Deci & Ryan, 1985; Deci et al., 1991). Children displayed greater intrinsic motivation in the choice condition and showed greater willingness to continue the game after school than in the control condition. No significant differences were found in task involvement between the choice and no-choice condition; however, children in the choice condition scored higher in the maths test one week later.

The findings of Cordova and Lepper (1996) underline the positive effects of choice on learning outcomes. Nevertheless, it is difficult to conclude whether these differences in affective engagement and learning were due to choice or due to the novelty of motivational embellishments. Situational interest, as triggered by either of these learning practices, contributed to an increase in intrinsic motivation and performance. The researchers of this study provided an illusory or trivial choice, however, they still reported positive choice effects on motivation and learning. A possible explanation for these results may be that choice, even when illusory, provides children with greater control over what they are doing, and therefore this sense of self-agency may help them perceive the task as more engaging (Katz & Assor, 2007; Pattall, 2013). The effects of choice, however, were not as strong as the effects of other conditions (e.g., personalisation manipulation - personalisation of features of the computer activities based on participants' background information), probably because the offered choices were of superficial relevance to the children (Hidi et al., 2015). Due to the choice manipulation (not meaningful), the small sample size, and the between-subjects design of the Cordova and Lepper (1996) study, it is necessary to further explore choice effects on affective and cognitive engagement using more robust controlled experiments.

Assor et al. (2002) investigated the role of personal relevance in the experience of autonomy with a sample of children aged 8 to 11 years old ($N = 498$) and adolescents aged 11 to 14 years old ($N = 364$). Choice increased self-reported cognitive and behavioural engagement with schoolwork; however, choice was motivating when this was meaningful and provided an opportunity for the self-realisation of interests and values. Therefore, meaningful choice does not simply equate with an expression of personal preference, or random choosing between different options, but rather involves some degree of considered thinking and critical evaluation of the available options (Fridkin, 2018). Recent neuroscientific evidence also reports that when people are expected to exercise choice without any relevant information about the available options, the brain may be alerted that this ambiguous choice has potentially negative outcomes (Hidi et al., 2015). Therefore, this level of uncertainty surrounding choice may undermine its benefits. To optimise choice effects in the context of reading, researchers and educators may need to provide young readers with meaningful choices, which somehow involve some critical evaluation of the options.

Flowerday, Schraw, and colleagues conducted a series of studies to investigate the role of choice during learning (Flowerday & Schraw, 2000; 2003; Flowerday et al., 2004). In a series of interviews with 36 university teachers, Flowerday and Schraw (2000) found that teachers perceived choice as a useful motivational practice that increases students' sense of personal agency and interest. Teachers also suggested that choice could be beneficial particularly for cognitive outcomes such as engagement, problem-solving, application of high-level learning strategies, and general learning (Patall et al., 2008, Patall et al., 2010; Patall et al., 2018; Schraw et al., 1998). Teachers claimed that choice could benefit particularly students with low interest and motivation in a task. In the context of primary-school learning, these findings suggest that choice may provide an opportunity for learners to exercise their self-determination and decision-making skills. According to the researchers, choice may enable students to choose their learning material based on background knowledge and personal interests, which contributes to a more positive motivational and cognitive experience. Nevertheless, by suggesting that choice reflects prior interest or knowledge, the researchers did not acknowledge that factors including individual interest and background knowledge could confound our understanding of the effects of choice on learning outcomes. This is a common methodological limitation that needs to be addressed in motivation research to disentangle the effects of choice, as a trigger of situational interest, on learning outcomes, independently of the existing individual interest and story knowledge. In addition to this, teachers' accounts around the learning benefits of choice are valuable; nevertheless, future research should further explore the role of motivation, including choice, from the perspective of young people as their voices have been consistently neglected, especially in the area of reading.

Flowerday and Schraw (2003) explored similarly the effects of choice on the affective and cognitive engagement of 84 college students[10]. Half the students chose whether they would prefer to work on a crossword puzzle or write an essay. Choice increased self-reported affective engagement (e.g., enjoyment, motivation, effort); however, choice did not improve performance in either the essay or crossword puzzle. In a second experiment, choice, in the form of self-pacing (participants processed the material at their own pace) decreased inference-making and deep-level learning, as measured during an essay task, compared with the researcher-paced condition (participants processed the material in the order and time set by the researcher). Contrary to expectations, these findings did not support the *cognitive engagement hypothesis,* which posits that choice improves cognitive processing because students are highly motivated to engage in learning and proposed that choice may have negative or no effects on cognitive performance. A possible explanation for these effects is that the offered choice did not represent a meaningful act of choosing. Choice was too controlled and did not facilitate participants to reflect on their options (Fridkin, 2018).

In a similar experimental design with 98 college students[11], Flowerday et al. (2004) found that self-reported situational interest improved cognitive engagement in an essay and self-reported attitudes during reading. Nevertheless, choice between two essay packets whose content was unknown to students negatively affected engagement and attitudes, with students being more likely to perform poorly on the two essays when asked to select their essay packet compared with no choice. Similar to the Cordova and Lepper study (1996), situational interest increased reading attitudes and learning, however, choice, as a potential trigger of situational interest, did not increase cognitive engagement. As previously discussed, the lack of the Flowerday's et al. study (2004) to report the positive effects of choice on potential outcomes

[10] Mean age of participants is not included in the study.
[11] Mean age of participants is not provided in the study.

may be because the act of picking between two identical packets did not reflect a genuine act of choosing. It is also difficult to generalise these findings to other activities such as reading and different age groups, as it is likely that choice effects on cognitive and affective outcomes may differ based on the age and learning context.

Fridkin (2018) investigated the effects of story choice on the reading comprehension and enjoyment of 110 children aged 8 to 9 years old. A repeated measures design was applied with all children experiencing a choice (experimental) condition, in which they chose between two stories, and a no choice (control) condition, in which a story was pre-assigned by the researcher. In the choice condition, children received two envelopes, each including a story and a set of reading comprehension questions. Stapled on each envelope, children found a set of reading materials (titles, prologues, generic summary reviews), different for each story. These extra reading materials were added to offer opportunities for more meaningful and informed choice. Choice was perceived and the two stories inside the envelope were identical (two versions for the story), except for the titles and prologues, to control for individual interest and story knowledge. Following the completion of the reading tasks, children completed an enjoyment scale for the story they had just read. After counterbalancing for story and condition order, children achieved greater reading comprehension and enjoyment scores in the choice than the no choice condition. These findings indicate that story choice itself is motivating, as shown by improvements in children’s reading comprehension and enjoyment, independently of a child’s prior story interest and background knowledge.

Fridkin (2018) employed a robust repeated-measures design that controlled for children’s reading interests and previous story knowledge. Therefore, her findings are of high pedagogical value as they propose that choice could serve as a powerful practical tool for educators and parents to motivate even those children, who do not hold a genuine interest in a specific reading task or struggle with their motivation in general (Hidi & Harackiewicz, 2000).

Considering that choice has been regularly described as a booster of situational interest, which represents the first phase of interest development (Hidi & Renninger, 2006), educators who continuously offer choices during reading in the classroom, could support them to gradually develop a stronger interest and motivation in reading. Most importantly, Fridkin's promising findings (2018) open the way towards further manipulating the effects of choice during experimental designs, especially with children who may be at risk of poor reading motivation and reading difficulties such as inattentive and hyperactive/impulsive children (Smith & Langberg, 2018), as explored in Chapter 2.

Overall, the studies discussed above support the positive effects of choosing, particularly in terms of learning, underlining that choice could lead to an increase in interest, effort, persistence, and performance (Cordova & Lepper, 1996; Flowerday & Schraw, 2000). Within the model of Hidi and Renninger (2006), choice may trigger a subconscious experience of situational interest that results in an automatic and effortless allocation of attention, and thereby positively influences cognitive performance. However, not all studies have reported that choice is ubiquitously beneficial for cognitive and affective engagement. Several studies point to factors that moderate the relationship between choice and academic outcomes. For example, some researchers argue that when people are exposed to a great number of options, they may find it difficult to choose the best option and, thus, experience a choice overload that could, eventually, be frustrating, burdensome, and demotivating (Iyengar & Lepper, 2000; Ryan & Deci, 2006). Iyengar and Lepper (2000) found that college students produced better essays when presented with 6 topics rather than 30 topics. In a meta-analysis including 41 studies with children and adults, Patall et al. (2008) reported that choice had a minimum positive impact on intrinsic motivation when participants were expected to make more than five choices. It seems unwise to set a precise optimal number of choices to secure positive learning outcomes. A general principle supported by the research is that choice should not represent a complex process, and children should be able to select at least one option that is personally relevant (Renninger & Hidi, 2016).

Patall and colleagues (Patall, 2012; 2013; Patall et al., 2014) explored whether factors within the person, including prior interest, moderate the relationship between choice, motivation, and cognitive performance in children, adolescents, and adults. Across three studies, Patall (2013) examined whether interest, expressed both as one's motivational characteristic and a characteristic of the task, could influence preferences for choosing and choice effects on the motivation and performance of college students, aged 18 to 26 years old, and adults, aged 18 to 65 years old. Choosing the topic of questions during a trivia game or an article and the difficulty level of questions increased interest, only for participants who had already developed an interest in trivia games in general. Thus, for choice to be motivating, a certain level of initial interest needed to be experienced. Patall stressed that people with a high individual interest benefit more from choice, as they can maximise their potential to engage in tasks that fulfil their preferences and goals. In contrast, people with low individual interest may find choice relatively frustrating, and potentially demotivating. These findings are not in line with the theoretical proposition that choice benefits especially those learners who have little or no interest in a task (Hidi & Harackiewicz, 2000; Schraw et al., 2001). Age effects may explain this inconsistency. With the development of one's sense of identity from childhood to adolescence and adulthood (LaFontana & Cillessen, 2010), the effects of different types of choice likely vary. Further research with children would help elucidate whether choice as an instructional practice could help teachers address particularly the academic challenges of the less interested and engaged children.

In a further study, Patall (2013) explored whether choice effects on reading comprehension would vary based on task interestingness. One-hundred seventy-two college students were randomly assigned into two task conditions, namely, the boring task condition, during which students were informed that they would read a text generally perceived as boring, and the interesting task condition, in which the given texts were mostly perceived as interesting. Choice increased perceived interest for college students who were asked to engage in a boring reading activity. Interest did not differ between boring and interesting tasks when choices were provided. Not surprisingly, when choices were not offered students showed greater motivation and performance in the interesting rather than the boring reading task. Choosing may thus provide an opportunity to build interest and, subsequently, intrinsic motivation in tasks, which are not genuinely interesting for a learner, and in this case, boring and interesting activities could be experienced similarly. When a task is already interesting in its nature, it might be difficult for choice to further increase motivation and performance.

Patall (2013) suggests that prior interest in a task may moderate the effects of choice on motivation and performance, a proposition that is not fully in line with Hidi and Renninger's (2006) model of interest development. According to this model, choice is a motivational practice that triggers a fleeting cognitive and affective response (situational interest) that occurs independently of any task characteristics. Choice increases one's interest in a task and stimulates a series of motivational and cognitive outcomes. In Patall’s study (2013), it is not clear whether there is a distinction between prior interest, background knowledge, and situational interest as triggered by choice, which makes it difficult to conclude whether it is choice or task interestingness that improves motivation and performance. Finally, the majority of studies have explored choice effects on reading motivation and performance with middle school, college students, and adults (Flowerday & Schraw, 2003; Flowerday et al., 2004; Patall et al., 2010; Patall, 2013). It is possible, however, that choice may benefit similarly the motivation and cognitive performance of primary-aged children. For example, older children (Key Stage 2 children) may benefit more from autonomy-supportive learning environments than younger children (Nursery, Key Stage 1), as the school curriculum, typically, becomes more structured towards the end of the primary phase providing limited opportunities for autonomous learning (Flowerday & Schraw, 2000; Sainsbury & Schagen, 2004). After controlling for individual interest and story knowledge, Fridkin's research (2018) offers some preliminary evidence for the positive contribution of choice over reading materials to increased reading outcomes in neurotypical children aged 8 to 9 years old. Further research could help further elucidate the positive impact of choice on the reading of primary-aged children.

1.11 Conclusion

Theory and research with neurotypical children underline the positive effects of choice on motivation, cognitive performance, and overall learning. Interpreting the evidence, however, is complex as there are certain conditions under which choice could support or undermine potential academic outcomes. Factors such as the type and nature of choice (e.g. meaningful choice or not), the number of choices, and task characteristics (e.g. interesting task or not) should be considered when examining choice effects. Person-related variables including one's prior interest, background knowledge, and age may also moderate the effects of choice on potential outcomes. Whether choice is a feature of situational interest that leads to an increase in intrinsic motivation and learning/reading, is a research question that needs to be further tested. For instance, it would be of research interest to replicate and extend Fridkin's work (2018) to test for the potential benefits of choice in a community sample of children with different degrees (minimal, severe) of ADHD-related characteristics. Similarly, evidence around the benefits of rewards is relatively inconsistent because factors such as the type (tangible or verbal) and presentation of reward (informational versus controlling) could moderate reward effects on learning outcomes. The Studies 1 and 2 of the present thesis will manipulate experimentally the effects of more meaningful choice and reward on children's reading, while controlling for confounding factors including prior individual interest and story knowledge.

Chapter 2 explores the role of choice and rewards in the reading and overall learning of children with inattention and/or hyperactivity/impulsivity, a population whose motivation and learning have been neglected consistently in school research. A thorough evidence base of how motivation works in children with ADHD-related characteristics could offer educators opportunities to manipulate more effectively the motivational and cognitive benefits of choice and reward with diverse readers in the classroom.

Chapter 2. Literature Review

The Relationship of ADHD-related Characteristics to Reading and the Role of Motivation

Children who present severe inattention and/or hyperactivity/impulsivity are usually qualified for a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD; Diagnostic Statistical Manual, 5th Edition, [DSM-5], American Psychiatric Association [APA], 2013). These children are more likely to experience challenges particularly in reading than their non-ADHD peers, as reading requires several attentional resources (Oakhill et al., 2014; Polderman et al., 2010). Inattention has been found to be a greater precursor of reading underachievement than hyperactivity/impulsivity (Lahey & Willcutt, 2010; Rabiner & Coie, 2000; Sims & Lonigan, 2012). Inattentive children, who do not necessarily hold an ADHD diagnosis, could also struggle with reading (Sims & Lonigan, 2012). Due to the lack of an ADHD diagnosis, the reading difficulties of these children may easily go unnoticed in the classroom, as their inattentive behaviour is less likely to overtly interfere with teacher instruction (Merrell et al., 2017). Thus, although at risk of reading underachievement, these children may not receive sufficient reading support. Reading practices that enhance motivation could provide an alternative way for educators to support the reading of children with ADHD-related characteristics[12], especially those with inattentive behaviours.

This chapter first describes the current picture of ADHD in the United Kingdom (UK) and discusses the debate around categorical versus dimensional approaches to understanding/diagnosing/observing ADHD and associated attentional difficulties. It then explores the relationship between reading and ADHD-related characteristics with a particular

[12] ADHD-related characteristics refer to inattention, hyperactivity/impulsivity and weak interference control.

interest in inattention. The chapter also examines the role of executive functions (EF) in ADHD, focusing on inhibition, and discusses why Executive Dysfunction theory, although useful, may not always provide a comprehensive theory for ADHD. It also explores the role of motivation drawing on key theories and research. After this, it evaluates ADHD interventions with an emphasis on academic interventions. The motivational constructs of choice (intrinsic motivator) and reward (extrinsic motivator) are explored as useful practices to motivate the behaviour and learning of children with ADHD. Due to the limited literature exploring the relationship between reading and motivation in young people with ADHD, this chapter discusses theoretically and empirically the effects of motivation on behaviour and learning more broadly with a focus on reading, where possible.

2.1 Definition of ADHD

ADHD is one of the most common childhood neurodevelopmental conditions characterised by severe degrees of inattention, hyperactivity, and impulsivity that are inconsistent with the child's developmental level (APA, 2013). ADHD is a lifelong condition that continues in adulthood; however, hyperactivity and impulsivity are more likely to decrease with age (Martel et al., 2012). Brain structural and functional differences (Cortese et al., 2012; Hoogman et al., 2017; Norman et al., 2016), as well as biological and genetic factors (Faraone & Larsson, 2019; Nikolas & Burt, 2010), may explain ADHD. Environmental modifications could also contribute to the effective management of ADHD (National Institute for Health and Care Excellence [NICE] guidelines, 2018).

ADHD affects approximately 5-7% of young people worldwide (Willcutt, 2012). Based on parent reports, the estimated prevalence of children diagnosed with ADHD in the UK is at 1.5% (Russell et al., 2014). ADHD is more often diagnosed in boys than girls, with the male to female ratio ranging from 2:1 to 3:1 in community samples (Bauermeister et al., 2007; Willcutt, 2012). The real prevalence of ADHD in girls, however, might be masked as ADHD has been traditionally associated with difficulties in hyperactivity/impulsivity, observed typically in boys (Biederman et al., 2002). Girls most commonly present attentional difficulties (Quinn, 2005). ADHD is usually underdiagnosed in the UK and waiting times to receive a formal diagnosis are longer compared with other European countries, which makes it difficult to estimate securely the number of children who are eligible for a diagnosis (Tettenborn et al., 2008). Such delays in diagnosis, and therefore accommodation plans, could have a long-lasting negative impact on children's emotional, psychological, behavioural, and educational outcomes (Harpin, 2005; Parker et al., 2019; Peasgood et al., 2016).

ADHD could negatively affect child learning without effective classroom management. Children with ADHD have an increased likelihood to experience frustration in the classroom than those without ADHD (68% versus 25% respectively, Caci et al., 2015). In a population-based sample of 5718 children, Yoshimasu et al. (2010) demonstrated that by the age of 19 years, children with ADHD (51% boys and 46.7% girls) are at greater risk of reading disability (RD) than their non-ADHD peers (14.5% boys and 7.7% girls). The researchers reached this conclusion by including children with potential RD and ADHD as identified through history records (school and medical), and results on intelligence quotient (IQ) and reading tasks. RD was higher in ADHD-identified children than non-ADHD children. Children with ADHD are also more likely to be excluded from school than their non-ADHD peers, or children with other conditions (Paget et al., 2018; Parker et al., 2019). As discussed later, children with either minimal or severe ADHD-related characteristics, who do not necessarily hold an ADHD diagnosis, could also struggle at school, stressing the need to address these academic barriers.

2.2 Categorical and Dimensional Approaches in ADHD

The International Classification of Diseases, 10th Edition (ICD-10, World Health Organisation [WHO], 1992) and the DSM-5 (APA, 2013) are the two classification systems that provide a set of criteria for an ADHD diagnosis. The ICD-10 describes ADHD as a hyperkinetic disorder characterised by a combination of severe inattention, hyperactivity, and impulsivity, where extreme hyperactivity is the main criterion for a diagnosis (WHO, 1992). In the DSM-5, ADHD comprises three subtypes: The Predominantly Inattentive type (PI), in which only inattention is present; the Predominantly Hyperactive-Impulsive type (PH), in which hyperactivity/ impulsivity, but not inattention, are present and the Combined type (CT), in which both inattention and hyperactivity/impulsivity are present (APA, 2013). Both classification systems argue that a child is eligible for a diagnosis when these behaviours persist for at least 6 months in multiple settings (e.g., home and school).

The ICD-10 requires that all behaviours are present, whereas the DSM-5 suggests that an ADHD diagnosis can be achieved even if the child is only inattentive or hyperactive/impulsive. The presence of other developmental conditions are indicators of co-occurrence in DSM-5, while in the ICD-10 the presence of co-existing conditions is an exclusion criterion for ADHD. Differences between the two classification systems may explain differences in worldwide ADHD prevalence rates with these rates expected to be higher when using the DSM-5 criteria than the criteria of the ICD-10, where the presence of hyperactivity is the main criterion (Polanczyk et al., 2007). The ICD-10 has been recently replaced by the ICD-11 (WHO, 2018), which fully recognises ADHD (previously termed as a hyperkinetic disorder) as a neurodevelopmental condition characterised by inattention, hyperactivity, or both similar to DSM-5[13], and also acknowledges that ADHD could co-occur with other conditions. The ICD-11 and DSM-5 offer useful guides for identifying children at risk of ADHD. However, they have received regular criticism for supporting a top-down categorical approach that cannot capture the heterogeneity of this population (Bell, 2011; Swanson et al., 2012). According to these criticisms, people with ADHD are being expected to meet one of the suggested subtypes

[13] The DSM-5 and ICD-11 are mostly similar, except for the fact that the DSM-5 requires that young people display at least five or more inattentive and/or hyperactive/impulsive behaviours, whereas the ICD-11 does not provide such specific thresholds.

(British Psychological Society, 2011).

Recently, it has been argued that ADHD could be explored within a dimensional framework, in which people with ADHD are treated as displaying positive markers of a spectrum condition characterised by inattention and/or hyperactivity/impulsivity (Heidbreder, 2015; Zhao & Castellanos, 2016). This proposition finds support in research (Gathercole et al., 2018). Using a whole-sample analysis, Gathercole et al. (2018) explored the associations between learning (vocabulary, reading, spelling, and maths), cognition (phonological processing, speed, and working memory), and behaviour (ADHD-related characteristics and EF) with 108 children aged 5-16 years old. Children had either learning difficulties or both learning difficulties and ADHD. On the surface, children with ADHD are expected to be more inattentive and hyperactive and presented a lower performance in phonological (linked to literacy) and visuospatial executive tasks (linked to maths) than children with learning difficulties alone. However, children with ADHD experienced difficulties in phonological and visuospatial skills similar to those of children with learning difficulties alone. The cognitive and behavioural characteristics of children with learning difficulties alone or combined with ADHD were better explained by impairments in learning-cognitive dimensions and the control of emotional and impulsive behaviour, rather than specific diagnostic criteria.

Dimensional approaches may provide evidence for the design of more effective interventions that address the educational needs of children with different cognitive profiles. Contrary to categorical approaches, dimensional approaches may better capture the variability in the severity of ADHD-related characteristics allowing for exploration of their relationship with learning (Holmes et al., 2020). As discussed later, the dimensional latent structure of ADHD is further supported by evidence showing that mildly inattentive children are also at risk of reading underachievement, despite the absence of an ADHD diagnosis (Merrell et al., 2017).

2.3 The Relationship Between Attention and Reading

Attentional difficulties have been associated with reading underachievement (Arnold et al., 2015; Miller et al., 2013; Oakhill et al., 2014; Polderman et al., 2010; Savage et al., 2006). Reading comprehension involves a number of attentional mechanisms, which require one's ability to focus on relevant textual information (selective attention) irrespective of any distractors (behavioural inhibition), to sustain attention over time (sustained attention), and to shift focus over different parts of the text (attention shift) (Commodari & Guarnera, 2005; Kendeou et al., 2014). According to theoretical models that support the 'cognitive view' of reading comprehension, proficient readers make connections between textual information and world knowledge to build coherent text representations and achieve better understanding (Kieffer et al., 2013; Oakhill et al., 2014).

In the study of Kieffer et al. (2013) with a community sample of 120 children aged 9 to 10 years old, attention shifting (ability to shift attention between cognitive sets or rules) had a direct positive association with text-level reading comprehension, and an indirect association with reading comprehension via oral language comprehension. In a study with 110 children, Miller et al. (2014) found that teacher-rated attention predicted word reading growth in children at risk for reading difficulties aged 6 to 7 years old, even when other reading-related predictors (e.g., phonological awareness, vocabulary) were considered. Teacher-rated attention showed an indirect effect on later reading comprehension (at the ages of 8 and 9) via word reading. Thus, attention could have both direct effects on reading and indirect effects via other reading-related factors, including language comprehension and word reading.

Miller et al. (2013) explored the reading comprehension of children with ($N = 27$) and without ADHD ($N = 76$) aged 9 to 11 years old by assessing their ability to develop coherent mental representations to recall both central and peripheral text information. The researchers assessed the comprehension of a short reading passage. They also checked the centrality of text information through ratings of the importance of text ideas. IQ, working memory, processing speed, and inhibition were also measured through standardised tests. Children read aloud the passages and recalled as many text ideas as they could immediately after reading comprehension. Following this free-recall period, they answered six open-response text questions. All children recalled more central (important ideas for passage's message) than peripheral (less important ideas for passage's message) ideas; however, children with ADHD experienced greater difficulty in the recall of central ideas than those without ADHD. Recall of central information is important for reading comprehension and difficulties with this, due to attentional difficulties, may explain to some extent the reading underachievement of many children with ADHD.

The relationship between ADHD and RD offers another insight into those factors that contribute to skilled reading. RD and ADHD co-occur highly in community and clinical samples (Sexton et al., 2012; Willcutt & Pennington, 2000). Readers with co-occurring ADHD and RD struggle primarily with slow processing speed (Willcutt et al., 2010). Readers with RD display particular difficulties with phonological processing (Purvis & Tannock, 2000), although factors such as verbal reasoning, naming speed, processing speed, and working memory could cause additional challenges (Willcutt et al., 2010). Readers with ADHD, without co-occurring RD, do not commonly experience phonological difficulties (Purvis & Tannock, 2000). They rather struggle more when they read long texts (Cherkes-Julkowski et al., 1995), achieve lower, within the average, scores on measures of passage reading rate, accuracy, and silent reading comprehension (Ghelani et al., 2004). Children with ADHD may also experience greater difficulty in the recall of central ideas than their non-ADHD peers (Miller et al., 2013). Young readers with ADHD may invest more cognitive effort in sustaining attention, and thus they are left with restricted resources for high-level reading comprehension processes. This could also be the case with children with non-diagnosed ADHD-related characteristics, given that high community (children at risk of ADHD) and clinical samples are relatively similar in the manifestations of ADHD-related characteristics and response to interventions (Beike & Zentall, 2012; Loe & Feldman, 2007).

Merrell et al. (2017) conducted a longitudinal study with 46,369 children to explore the relationship between inattention and hyperactivity/ impulsivity at age 5 and academic achievement at age 11. This is one of the few studies that examined the academic attainment of mildly inattentive who did not qualify for an ADHD diagnosis. Early reading attainment was measured at age 4 through a baseline assessment that included individual computerised assessments of vocabulary, concepts about print, phonological awareness, letter and word recognition, and reading comprehension. At the end of Year 1, all teachers rated children's inattention and hyperactivity/impulsivity. Reading attainment was measured at age 11 through standardised assessments. Teacher-rated inattention at age 5 predicted significantly reading underachievement at age 11, after adjusting for baseline reading ability. This evidence suggests that mildly inattentive children, with no ADHD diagnosis, may also be at risk of severe reading difficulties, especially if these are not targeted at an early stage (Merrell & Tymms, 2005).

In a US five-year longitudinal study with a community sample of 387 children, Rabiner et al. (2000) examined whether early inattention at the ages of 5 and 6 (kindergarten) predicts reading difficulties at the ages of 10 and 11 (Grade 5). Standardised reading assessments were used with reading achievement being measured in kindergarten and Grade 5 through a letter-word identification test that assessed single-word reading skills. In Grade 5, reading ability was assessed during a passage comprehension test. In kindergarten, inattention was measured via a teacher scale. In Grades 1 and 2, separate inattention and hyperactivity/impulsivity scores were computed for each child based on teacher reports. Inattention, and not hyperactivity, predicted significantly poor reading after controlling for IQ, prior reading achievement, and parental involvement. This is in line with further research showing that inattention serves as a stronger predictor of reading than hyperactivity (Lahey & Willcutt, 2010; Sims & Lonigan, 2012). Reading difficulties were not evident when reading was first measured in kindergarten. They only became apparent following the emergence of attentional difficulties, suggesting that inattention may be primary to reading difficulties. Children who achieved normal rates of reading in kindergarten but were rated as highly inattentive in Grade 1 faced greater reading difficulties in Grade 5 than less inattentive children. These findings suggest that inattention could affect negatively the reading of inattentive children without a diagnosis. Hurry et al. (2018) found that literacy difficulties, as assessed through a set of standardised reading and writing tasks, did not cause emotional and behavioural difficulties identified by the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). However, behavioural difficulties, including hyperactivity, exacerbated literacy difficulties.

Early inattention and/or hyperactivity are more likely to hamper one's ability to read and trigger a snowballing of reading failures and not vice versa (Hurry et al., 2018; Merrell et al., 2017; Rabiner et al., 2000; 2016a; 2016b). Nevertheless, the direction of this relationship is not always consistent in research. Pennington et al. (1993) compared the performance of 70 boys aged 7 to 10 years old with reading disability (RD) and ADHD in reading (assessed through a parent reading questionnaire, oral reading test, and spelling test), phonological processes (PP) and executive functioning (EF). Pennington et al. (1993) found that the two RD groups (RD-only and RD plus ADHD) performed significantly lower in phonological processing compared with the ADHD-only and control groups. Contrariwise, the ADHD-only group performed significantly lower in EF tasks than the RD groups. These findings suggest that ADHD and RD may have distinct psychopathologies with the former being associated with poor EF, while the latter one with poor phonological processing (Gathercole et al., 2018; Pulvis et al., 2000; Sonuga-Barke, 2002). Given the resemblance of the RD-only and the RD plus ADHD groups, the researchers suggested that reading disability leads to ADHD.

Methodological differences may explain the inconsistency in findings as to whether inattention leads to reading difficulties or vice versa. Pennington et al. (1993) tested only boys and did not distinguish between inattention and hyperactivity/impulsivity, making it difficult to disentangle the independent effects of inattention on reading. Also, the Penninton et al. (1993) study tested children with diagnosed ADHD during a cross-sectional design, whereas Rabiner et al. (2000) tested a community-based sample using longitudinal designs. Measurement issues may also explain partially the inconsistent findings. Teachers are expected to be better raters of inattention in the classroom than parents, and therefore teacher accounts may be more informative when exploring the relationship between inattention and reading underachievement. Controlling for word reading ability (Brock & Knapp, 1996), age (Brock & Knapp, 1996), and IQ (Ghelani et al., 2004) could also explain this conflicting evidence. For example, controlling for baseline reading ability is important to ensure that it is inattention rather than prior reading ability that explains later reading underachievement. Differences in the assessment of reading comprehension may also add different attentional demands for children (Keenan & Meenan, 2014), and therefore influence the relationship between inattention and reading. Research underlines that inattention is a strong predictor of later reading underachievement, however, it is difficult to preclude a reciprocal effect of early poor reading on later inattention, as weak readers may also struggle to sustain attention in the classroom due to reading challenges.

Overall, children with ADHD-related characteristics, and particularly inattention, are equally at risk of reading difficulties, irrespective of the presence of a diagnosis. Considering that children with ADHD usually experience difficulties with EF, the following section examines the relationship between ADHD and EF, focusing on inhibition.

2.4 Executive Functions and Inhibition

Executive functions (EFs; also described as cognitive control or executive control) describe a set of top-down neuropsychological processes involved in information processing (Barkley, 2012). EFs facilitate engagement in self-directed actions including goal setting, planning, organising, attention focusing, and exercising self-control to accomplish a goal (Barkley, 1997; 2012). The use of EFs is effortful and requires controlled attentional resources (Diamond, 2013). The deliberate allocation of these attentional resources can be distinguished from automatic processing (Norman & Shallice, 2000), which does not necessarily involve conscious and voluntary control.

Inhibitory control comprises a series of inhibitory processes (Friedman & Miyake, 2004) and has a behavioural or cognitive component. *Inhibitory control* refers to one's ability to control attention, thoughts, emotions and behaviours, while tuning out distractions and impulses to engage in what is needed (Diamond, 2013). *Cognitive inhibition* refers to one's ability to suppress or slow down mental representations such as thoughts or memories (Noreen & MacLeod, 2015). *Self-control* (known as behavioural inhibition) is another aspect of inhibitory control that describes the ability to control behaviour or monitor emotions to manage this behaviour. Self-control involves resistance to act impulsively to focus on what is appropriate. *Interference control* is another inhibition-related process that describes one's ability to inhibit cognitive interference that occurs when the processing of a certain aspect of a stimulus influences the simultaneous processing of another aspect of this stimulus (Scarpina & Tagini, 2017). Another aspect of self-control refers to one's ability to focus selectively on a relevant task and suppress attention to other distractions, despite an internal desire to engage in a different task (Diamond, 2013). This aspect is usually known as *delaying gratification* and occurs when one resists an immediate small reward to receive a more salient reward in the future (Mischel & Ebbesen, 1970). Children with ADHD are more likely to experience difficulties with self-control and engage in impulsive behaviours, such as interrupting others, constantly moving in the classroom as well as fidgeting or squirming in a seat. They usually show a greater preference towards small immediate rather than large, delayed rewards compared to their non-ADHD peers (Luman et al., 2010; Marx et al., 2018). Inhibitory control has been associated with reading comprehension, after controlling for word reading, phonological awareness, working memory, processing speed, and language comprehension (Kieffer et al., 2013). Skilled readers can exercise interference and inhibit irrelevant information, while the weak ones tend to recall more irrelevant text information (Cain & Oakhill, 2006; De Beni & Palladino, 2000).

There is an ongoing debate regarding the unity and diversity of EFs (Miyake & Friedman, 2012). Using a variety of EF tasks and a series of confirmatory factor analyses (CFA), Miyake et al. (2000) explored the relationships between different components of EF. Inhibition (the ability to suppress or slow down mental representations such as thoughts or memories), updating and monitoring of working memory (the ability to store and manipulate information) and set shifting (the ability to switch between mental sets) were distinct processes (Harnishfeger, 1995; Nigg, 2000), but shared underlying commonalities (Miyake et al., 2000). Using Nigg's taxonomy (2000) and similar statistical analyses, Friedman and Miyake (2004) explored whether the three inhibition-related processes of Prepotent Response Inhibition (behavioural inhibition), Resistance to Distractor Interference (interference control) and Resistance to Proactive Interference (cognition inhibition) are distinct. Resistance to Proactive Interference was unrelated to Prepotent Response Inhibition and Resistance to Distractor Interference. Contrariwise, Prepotent Response Inhibition and Resistance to Distractor Interference were highly associated and fell within a single factor. The strong association between these two inhibition-related processes may be because both processes require resistance to interference from extrinsic stimuli to accomplish a task. Some inhibition-related processes may share underlying commonalities; however, viewing inhibition as a broad unifying mechanism poses several challenges, considering that other processes may be less strongly related. These findings advocate both the unity and diversity of EFs such as inhibition (Friedman & Miyake, 2017).

An alternative approach proposes a distinction between 'hot' and 'cool' EFs (Damasio, 1995). Cool EFs refer to cognitive processes elicited in relatively decontextualised and abstract contexts and are tested during tasks such as the Stroop Test and the Go/No-Go tasks, whereas hot EFs involve cognitive processes elicited in contexts that require a degree of affective and emotional involvement, such as one's ability to delay gratification (Poon, 2018; Zelazo et al, 2005; Zelazo & Müller, 2010). Inattention and hyperactivity/impulsivity may stem primarily from differences in hot EFs (Gathercole et al., 2018). The relationship between inattention, hyperactivity/impulsivity and inhibition has received interest in the literature. Nevertheless, findings are not consistent, raising the question as to whether difficulties with executive functions, including inhibition, are universal in people with ADHD.

2.5 Influential Theories in ADHD

2.5.1 Executive Dysfunction Theory and Empirical Research

The theoretical proposition that ADHD reflects a condition characterised mainly by difficulties with EF, including inhibitory control, has led to a series of substantial studies (Barkley, 1997; Lambek et al., 2011; Nigg, 2001; Schreiber et al., 2014; Wodka et al., 2007). Nevertheless, findings are conflicting as to whether EF difficulties are characteristic of children with ADHD.

Different causal models have been proposed to explain the role of EFs in ADHD. According to Barkley's well-cited unified theoretical model of behavioural inhibition and EF (1997), people with combined, and not inattentive, ADHD have a primary difficulty in exercising behavioural inhibition (also referred to as response inhibition). Barkley proposes that difficulties with behavioural inhibition contribute to secondary impairments in four EFs, namely a) *working memory*, which refers to holding and manipulating information in mind b) *self-regulation* of affect-motivation-arousal that refers to emotional self-control c) *internalisation speech*, which describes self-directed speech; and d) *reconstitution* that refers to one's ability to analyse and synthesise behaviours to attain goals (Barkley, 1997; 2012). Difficulties with inhibition and the four EFs lead to problems with motor control, timing, and goal-directed actions.

Zelazo and Mueller (2010) stressed the importance of EFs in ADHD, suggested a distinction between cool and hot EFs, and proposed that people with ADHD struggle, particularly with cool EFs. Castellanos et al. (2006) argued that inattention might be associated with difficulty in cool EFs, whereas hyperactivity/impulsivity might reflect difficulties in hot EFs (Gathercole et al., 2018). In his dual pathway model, Sonuga-Barke suggested that both inhibitory control and motivation should be considered equally when constructing a coherent and comprehensive theory of ADHD (see Sonuga-Barke, 2005 for a detailed description of the model).

Executive dysfunction theory of ADHD finds support in research (Castellanos & Tannock, 2002; Nigg, 2000; 2001; Pennington & Ozonoff, 1996; Senderecka et al., 2012). Biederman et al. (2004) found that children with ADHD ($N = 222$) aged 6-17 years old display greater EF difficulties (e.g., planning and organisation, response inhibition, selective attention) than children without ADHD ($N = 259$), after controlling for gender, age, intelligence, socio-economic status, and learning difficulties. The presence of EF difficulties also increased children's risk for academic underachievement (reading and maths) and grade retention compared with the controls. Children with ADHD who had EF difficulties were at greater risk of academic underachievement than those with ADHD without EF difficulties (Roberts et al., 2017). Despite the association between ADHD and EF, children with ADHD did not show problems with EFs, which challenges the proposition that EF deficits are universal in the ADHD population. Lambek et al. (2011) reported that children with ADHD are more likely to present difficulties with EFs, including response inhibition and working memory, compared with their non-ADHD peers, although only 50% of children with ADHD (N = 49) met the criteria for executive dysfunction in their study. Contrary to previous studies showing that deficits in EF (e.g., response inhibition) are prevalent in the combined rather than inattentive ADHD subtype (Lockwood et al., 2001; Nigg et al., 2002) providing support for the Barkley's model (1997) and the distinction between the two ADHD subtypes, Geurts et al. (2005) found that boys aged 6 to 13 years old with combined ADHD did not display impairments in all EF tasks. Children with combined ADHD experienced greater difficulties in inhibition than the non-ADHD children but did not encounter secondary impairments in other EF domains (e.g., working memory, planning). EF impairments were also present in both subtypes (combined, inattentive), failing to support Barkley's hypothesis that combined ADHD and inattentive ADHD may represent separate disorders. These findings underline that EF difficulties are important, but not necessarily central to ADHD.

In a meta-analytic review of 83 studies, Willcut et al. (2005) showed that young people with ADHD are more likely to demonstrate EF difficulties than children without ADHD. Nevertheless, medium effect sizes were reported for all EF measures, with the strongest effects reported for the measures of response inhibition, spatial working memory, vigilance, and measures of planning. Young people with ADHD display weaknesses with EFs; however, these weaknesses are neither necessary nor sufficient to explain all ADHD profiles. Such difficulties may rather serve as an important aspect of a more complex neurodevelopmental condition. Considering that there are different forms of inhibition, it is likely that people with ADHD do not struggle with all inhibition-related processes. For instance, Nigg et al. (2002) found that college students with ADHD (N = 22) struggled to exercise prepotent response inhibition (antisaccade task), but these difficulties were not reported in terms of cognitive inhibition (negative priming)[14].

There are several explanations for the inconsistency of findings regarding the role of EF in ADHD. A debatable issue in EF theory is related to the different terminologies proposed for EF (Chan et al., 2008; Diamond, 2013). As discussed earlier, EFs, including inhibition, are not a single construct and comprise a set of inter-related, but distinct inhibition-related processes. A useful approach to avoid any misinterpretation is to define clearly which processes are measured each time, rather than using terms such as behavioural inhibition and interference control interchangeably. The task impurity problem offers a further explanation for why it is difficult to draw safe conclusions about one's performance in EF tasks (Friedman & Miyake, 2017; Miyake & Friedman, 2012). Measurement of EFs can be challenging, as EF tasks include systematic variance related to non-EF processes such as language ability, intellectual ability, and RT, and thus may not be necessarily valid (Willcutt et al., 2005). One approach to address this impurity problem is to employ a variety of tasks expected to measure a similar construct and use statistical analyses such as factor analysis to create a latent variable to reflect this construct (Friedman & Miyake, 2017). Regarding inhibitory control, the use of a variety of tasks could prove particularly useful. The fractionation of inhibitory control and EF, in general, might prove problematic as performance on a certain inhibition-related task does not necessarily guarantee similar performance on a task measuring a different component of inhibitory control (Chan et al., 2008; Nigg et al., 2002). These issues should be considered when researchers interpret different findings.

Differences in the type of EF assessment may also explain the contradictory findings.

[14] In *antisaccade tasks*, a visual cue appears on one side of the computer screen, followed by an arrow (target stimulus) on the opposite side. Participants are advised to ignore the visual cue and respond to the target stimulus by pressing a button to indicate the direction of the arrow (left, up or right). *Negative priming* refers to a slow-down in response speed and decrease in accuracy rate when responding to a stimulus (target) that had to be initially ignored (distractor) (Frings et al., 2015).

Barkley and Fischer (2011) explored the relationship between EF (measured through rating scales and tests) and outcomes in 10 major areas (educational activities, social interactions, and work) including neurotypical children (N = 75) and children diagnosed as hyperactive (N = 135) aged 4 to 12 years old. EF rating scales did not correlate or weakly correlated with EF tests, suggesting that these types of assessment may not evaluate the same EF constructs. Interestingly, EF rating scales explained greater variance in self-reported difficulties in potential outcomes compared to EF tests. Thus, EF rating scales or EF tests alone may not provide the sole source of information as to how people use EF during daily activities. Further methodological challenges related to the measurement of EF through 'real-life' and ecologically valid tasks versus laboratory tasks may also account for the conflicting findings regarding the role of EF in children with and without ADHD (Chan et al., 2008).

Overall, inhibition is a central executive function, and difficulties with EF are relatively common in people with ADHD. Nevertheless, the lack of universality of EF difficulties shows that these may not be present across the entire population. Theory and research exploring the role of motivational, incentive, and reward-related mechanisms indicate that ADHD has also a motivational component, and thus multiple-pathway, rather than EF-deficit models alone, could better capture the heterogeneity of this population.

2.5.2 Motivational Theories/Models in ADHD and Empirical Research

Motivational theories in ADHD propose that ADHD has a motivational component, apart from inhibition-related processes, with young people with ADHD being at greater risk of poor motivation than their non-ADHD peers (Smith et al., 2019). Poor motivation in ADHD is likely due to a lower-than-average activity in the brain's reward circuitry mechanisms, specifically in the dopaminergic pathway (Stevens et al., 2019; Volkow et al., 2011).

Sagvolden and colleagues (Sagvolden & Sergeant, 1998; Sagvolden et al., 2005) proposed a simple motivational model for ADHD. Based on this, disturbances in the motivational processes of reward circuits result in the diminution of the value of reinforcers, such as rewards, and lead to ADHD. Reinforcers are events that occur following a certain behaviour. Due to reinforcers, this behaviour is likely to occur in the future. Positive reinforcers (rewards) motivate a person to engage in similar behaviours in the future, whereas negative reinforcers (punishment) decrease the likelihood of reoccurrence (Sonuga-Barke, 2011). Sagvolden et al. (1998) postulated that the altered reinforcement mechanisms in ADHD are linked with a steeper delay-of-reinforcement gradient. The delay-of-reinforcement gradient refers to the phenomenon that reinforcers have a greater effect when there is a short delay between the response and the reinforcer than when there is a longer delay. People with ADHD are more likely to discount the perceived value of a reinforcer if this is delayed (Mies et al., 2018; Yu & Sonuga-Barke, 2020). In a classroom context, this theory is useful as it suggests that reinforcers such as rewards may motivate behaviour and learning in children with ADHD when these are provided immediately after a certain behaviour/task is performed rather than at a later stage.

Sonuga-Barke and colleagues (Sonuga-Barke et al., 1992; Sonuga-Barke et al. 1994) expanded the theoretical model of Sagvolden (1991) and proposed the well-established and empirically validated *Delay aversion theory*. This theory was later revised to include aspects of Executive dysfunction theory (Sonuga-Barke, 2005). Delay aversion theory extended the simple motivational theory (Sonuga-Barke t al., 1994). According to this, people with ADHD usually have negative emotional reactions to delay, a phenomenon named *delay aversion*. At a behavioural level, these negative emotions are expressed as attempts to escape delay through choosing immediate over delayed rewards, when possible. Delay aversion is expressed as inattention, hyperactivity, and impulsivity. Engaging in inattentive, hyperactive, and impulsive behaviours would serve as the non-temporal stimulation that helps people with ADHD reduce the perception of delay. In contexts in which avoiding or escaping delay is not possible, they tend to seek interesting aspects of their environment to gain more immediate gratification. Thus, delay aversion motivates people to seek stimulation in their environment to reduce time perception. Stimulation seeking could be achieved either through paying attention to the interesting aspects of the environment or through adapting the environment to make it interesting (Sonuga-Barke, 2005). Placing this theory into the classroom context, educational practices that support intrinsic motivation through promoting interest may motivate the behaviour and learning of children with ADHD, particularly in situations where extrinsic reinforcers are delayed or cannot be offered.

In line with Delay aversion theory, *Optimal stimulation* theory emphasises the stimulation-seeking aspect of ADHD suggesting that children tend to seek interesting aspects of the environment to motivate their behaviour (Zentall, 1975; Zentall & Zentall, 1983; Zentall & Meyer, 1987). Children with ADHD are in higher need of stimulation to reach an optimal level of arousal to sustain attention during an activity than non-ADHD children. When stimulation is not provided, they tend to engage in inattentive, hyperactive and risk-taking behaviours to meet this stimulation threshold (Antrop et al., 2000; Beike & Zentall, 2012; Zentall, 2005). Decreased dopamine activity (Banaschewski et al, 2003; Volkow et al., 2011) motivates people with ADHD to seek high arousal/stimulation, as they are less sensitive to low levels of arousal. In the classroom, difficulties of children in maintaining attention during a task may stem, to a degree, from difficulty in securing sufficient levels of arousal/stimulation (Antrop et al., 2000; Beike & Zentall, 2012; Zentall, 2005). Providing greater stimulation in the classroom for children with ADHD may serve as a useful practice for educators to enhance motivation and help these children remain more involved during learning. Delay aversion and Optimal stimulation theories are similar, with the difference that the former one posits that inattention and/or hyperactivity/impulsivity would vary based on the temporal quality of the stimulation, whereas the latter one does not make any propositions regarding the effects of different types of temporal stimulation (Antrop et al., 2000).

Delay aversion theory finds consistent support in research showing that children with ADHD prefer immediate over salient-delayed rewards (Luman et al., 2005; Marx et al., 2018; Wilson et al., 2011; Yu & Sonuga-Barke, 2020). Impulsive choice is commonly measured during delay discounting tasks, in which participants choose between small immediate (1 pound) and large delayed rewards (5 pounds). Choice options are often hypothetical as participants do not practically receive the rewards and the large rewards are usually delayed between days and weeks (Marx et al., 2018).

Yu and Sonuga-Barke (2020) compared the performance of 7 to 12-year-old children with ADHD (N = 23) and matched controls (N = 23) during the real-time delay (R-TD) and hypothetical delay (HD) computerised tasks. During the R-TD task, children chose between a small monetary reward delivered immediately and a large reward delivered after various delays (5, 10, 20, 30, and 60 s). Children experienced each delay. They did not receive any rewards, but they made choices as if they were to receive these. In HD tasks, children chose between a small reward delivered immediately and a large reward delivered after delays (tomorrow, day after tomorrow, 1 week, 2 weeks). Children did not experience any delays and did not receive any rewards, but they imagined that they would receive the chosen rewards after a certain delay. Children with ADHD showed exaggerated temporal discounting only during the R-TD task, and also devalued delayed rewards more steeply than their non-ADHD peers when delays were relatively long. A possible explanation for these findings is that children with ADHD choose immediate over delayed rewards to minimise possible negative emotions related to delays experienced in the R-TD tasks; however, different paradigms of delay (real-time versus hypothetical) may likely tap into different neuropsychological processes. In a meta-analysis of 37 studies, Marx et al. (2018) showed that participants with ADHD were less likely to choose large, delayed rewards than control groups and no effects of rewards were reported for children without ADHD. These findings offer further support for Delay aversion theory.

Antrop et al. (2000) compared 30 hyperactive and 30 non-hyperactive children aged 6 to 12 years old during a waiting situation of 15 min, either with or without extra stimulation, offered via the presentation of a videotape during the delay. Children with ADHD engaged in significantly more hyperactive behaviours when waiting in the absence of the stimulation (watching of the videotape) than non-hyperactive children. When watching the videotape, they showed less disruptive behaviours (e.g., motor activity, running) similar to their non-hyperactive peers. These findings are in line with a later study by Antrop et al. (2006), which found that children with ADHD aged 6 to 14 years old showed a greater preference for the small immediate rewards in the no-stimulation condition than control children. However, children with ADHD did not differ in their preferences between small immediate and large delayed rewards, when stimulation was provided (visual stimulation during the waiting period). Children's difficulty in waiting for rewards might appear as a difficulty in exercising inhibitory control; however, such experiments also show that this difficulty could often be the behavioural outcome of delay aversion. Although the Antrop et al. study (2000) focused on the hyperactive element of ADHD, it suggests that stimulating environments could reduce ADHD-related behaviour during a delay. In the classroom, considering the important role that reinforcement plays towards motivating behaviour in children with ADHD, non-rewarding tasks which lack interest may account, partially, for the poor cognitive performance of some children. It is important to acknowledge though that it may not be always feasible for teachers to provide interesting content in the classroom, and that children are expected to learn curriculum material that is not always of personal interest to them. Therefore, testing easily applicable and practical ways to support interest in the classroom could be of significant educational value.

Within the framework of Optimal stimulation theory, Beike and Zentall (2012) assessed whether content novelty added into narratives (stimulation) would increase the reading comprehension of children at risk of reading disabilities (RD, $N = 16$), at risk of ADHD ($N = 16$) and non-ADHD children ($N = 16$). Forty-eight children aged 7 to 11 years old, of equivalent IQ and with no diagnosis of learning disabilities (LD) were recruited. In the ADHD group, children either had ADHD or were referred by teachers as being at risk of ADHD. In the RD group, children either had a diagnosis or scored well below the classroom average in reading. Novelty elicits a state of desire to fill in the gap between known and unknown information (Chen et al., 2001). Similar to choice, novelty has been theorised to trigger situational interest, which has been associated with increased attention, intrinsic motivation, and learning (Hidi & Renninger, 2006; Renninger et al., 2019). In the Beike and Zentall (2012) study, two high-novelty and two low-novelty versions of fables were produced and reading comprehension was assessed on both versions via five multiple-choice comprehension questions.

Drawing on the findings of Beike and Zentall (2012), the ADHD group scored lower on average than the control group in the low novelty condition, after controlling for intellectual ability and prior reading achievement. The RD group performed worse than both groups in the low novelty condition. When presented with the high-novelty fables, both at-risk groups and particularly boys at risk of ADHD performed significantly higher in reading comprehension and showed additional gains in inference making and the development of causal links between the story events. Contrariwise, children without ADHD did not show any significant differences across the two conditions. This could be because these children showed greater sustained attention during the low-novelty condition compared with the at-risk groups and they would probably benefit from novelty if they were presented with more difficult and lengthy reading materials. Overall, stimulating educational resources and situational interest, as promoted through content novelty, motivated the reading comprehension of children with ADHD, as reflected on their reading scores (Antrop et al., 2000; Zentall, 2005). The 'catch' element of situational interest may raise attention and persistence in children with ADHD, contributing to increased engagement and reading comprehension. Due to the limited research, however, it needs to be further tested whether practices that support situational interest could improve the learning/reading of children with and without ADHD, with greater emphasis on the former group. The following section explores two major motivational theories and their implications for the learning of young people with ADHD.

2.6 Theories of Academic Motivation and Implications for Learners With ADHD-related Characteristics

2.6.1 Self-determination Theory

Self-determination theory (SDT) has been tested widely with neurotypical children. According to this influential theory, people have the innate propensity to satisfy their need for competence, relatedness, and autonomy (Ryan et al., 2019). Regarding autonomy, which is the focus of this thesis, autonomy-supportive instructional practices include provision of meaningful choice, avoidance of controlling language, validation of children's perspectives (Niemec & Ryan, 2009; Sierens et al., 2009), and have been associated with increased academic outcomes in neurotypical children as noted in Section 1.9 (see Sue & Reeve, 2011 for a meta-analysis).

Research with inattentive and/or hyperactive young people provides further evidence for the educational importance of autonomy-supportive practices (e.g., teacher avoids controlling language and the child is free to express ideas). Using a community sample of 117 children aged 6 to 11 years old, Rogers and Tannock (2018) found that children with severe non-diagnosed inattention and hyperactivity/impulsivity, as rated by teachers, perceived their classrooms as providing limited opportunities for autonomy compared with peers with mild characteristics, after controlling for age, co-occurring conduct problems, and reading ability. A possible explanation for the negative classroom experiences of children with severe ADHD-related characteristics is that parents and educators may be more reluctant to apply autonomy-supportive practices when expected to address the behaviour and learning of these children. Due to the excessive workload, stress, and high responsibility for children's behaviour, teachers may apply more controlling practices (e.g., apply pressure, provide limited opportunities to students for self-expression) to address behaviour and learning (Greene et al., 2002; Ofsted[15], 2019; Ohan et al., 2011; Reeve, 2009). Controlling practices, however, may be experienced as autonomy and competence thwarting by children, creating a vicious circle of negative learning experiences and school failures.

Given the multiple benefits of teacher-autonomy support for the motivation and learning of neurotypical children (Ryan et al., 2019), autonomy-supportive teaching practices, including choice, may increase the academic motivation and learning of children with ADHD-related characteristics, irrespective of the presence of an ADHD diagnosis.

2.6.2 Expectancy Value Theory of Achievement Motivation and the Role of Poor Motivation in Learning

The role of motivation in the learning of inattentive and/or hyperactive children, with and without an ADHD diagnosis, could be further examined within the influential framework of Expectancy Value Theory of Achievement Motivation (EVTAM) introduced and researched by Eccles, Wigfield, and colleagues (Wigfield & Eccles, 2000; Wigfield & Gabria, 2010). This theory posits that children develop varied expectancies of success, which depend on their previous experiences, and these expectancies as well as the value[16] they attribute to succeeding in a task would affect motivation and success in this task (Wigfield, 1994). Children who value an activity as highly important and expect that they will succeed in this, are more likely to

[15] Ofsted stands for the Office for Standards in Education, Children's Services and Skills that inspects services and educational standards being achieved in state primary schools.

[16] *Value* has both an intrinsic and extrinsic motivation component. Task values include intrinsic/interest values that refer to the enjoyment experienced during a task, but also include utility values referring to whether and how a certain activity is useful for one's goals and plans (Eccles, 1983; Wigfield & DCambria, 2010).

invest deeply themselves (Wigfield & Eccles, 2000; Wigfield & Gabria, 2010). According to the EVTAM, it is important to explore children's beliefs about whether they feel competent to accomplish a task or not as well as their personal beliefs about the value of the specific task to understand their choices, persistence, and performance. Wigfield and Eccles' expectancy construct embraces the motivational self-efficacy construct proposed by Bandura (1997), which refers to the beliefs that one holds about accomplishing a task based on personal skills. Goal setting[17] serves as an important predictor of academic-related outcomes (Ames, 1992; Elliot & McGregor, 2001). Goals refer to certain purposes that children hold for engaging in a task and are highly related to self-efficacy. Children with high self-efficacy beliefs are more likely to set high goals and perform better, compared with the low goals of children with poor self-efficacy beliefs (Liem et al., 2008; Pintrich, 2000).

Gut et al. (2012) explored the role of externalising problems in the association between achievement motivation and performance on language skills and mathematical thinking in children aged 6 to 10 years old. Sixty-nine children were assigned to one of the three groups; a clinical group of children with disruptive behaviour (e.g., conduct disorder) disorders (N = 23), a clinical group of children with combined ADHD (N = 23), and a non-clinical control group (N = 23). The three groups were matched on chronological age and gender. Achievement

[17] Based on the Achievement goal theory, achievement goals are classified into mastery and performance goals, which constitute distinct motivational variables related with differentiated academic outcomes (Ames, 1992; Elliot & McGregor, 2001; Wolters, 2004). *Mastery goals* orient learners to develop competence in an academic task acquiring knowledge and skills. Success and failure are attributed to personal effort and learners improve their competence by increasing effort, applying different strategies and seeking help to support learning. *Performance goals* orient learners to define competence relative to others. Success and failure are attributed to personal ability and learners make an effort to avoid exposing inadequate competence (Elliot & Church, 1997; Elliot, 2005). Recent research distinguishes between performance-approach goals, where the learner is driven to approach or try to be the best in the class relative to others and avoidance-performance goals, where the learner tries not to demonstrate inadequate ability relative to others (Harackiewicz et al., 2002; Pintrich, 2000). Mastery and performance approach goals have been related with deep learning, preference towards challenging tasks and persistence in the face of difficulty. Performance-avoidance goals have been associated with surface learning, task disengagement, preference towards easy tasks and maladaptive behaviours in the face of academic failure (Ames, 1992; Elliot & Church, 1997; Elliot & McGregor, 2001; Liem et al., 2008). Self-efficacy is positively related with mastery and performance-approach goals and negatively related with performance-avoidance goals (Diseth, 2012; Harackiewicz et al., 2002; Pintrich, 2000).

motivation was conceptualised as one's intrinsic need to succeed in a task and avoid failure (Covington, 2000). Parents and trained psychologists reported on children's academic motivation related to success approach and avoidance of failure. Two tests assessed expressive (language production) and receptive language (language understanding). Expressive and receptive vocabulary have been associated positively with pre-reading skills, including phonological skills (Wise et al., 2007). Mathematical thinking was assessed through mathematical problem-solving. Children with ADHD had significantly lower achievement motivation than the other two groups. Interestingly, children with ADHD with high academic motivation performed equally well as compared to controls on the receptive language and mathematical tasks. In the context of the EVTAM, children with ADHD are more likely to experience frequent exposure to negative school experiences and academic failures (e.g., forget homework, achieve poor school grades) (DuPaul & Langberg, 2015). Therefore, the findings of Gut et al. (2012) propose that children with ADHD who develop achievement motivation, including a desire for success (e.g., confidence in completing a task, even in the face of arising difficulties) and reduced fear towards failure (e.g., not giving up easily) could show increased academic outcomes (e.g., receptive language).

Using a sample of 285 adolescents (*M* age = 11.97) diagnosed with ADHD, Langberg et al. (2018) tested the factor structure of the expectancy-value measure of homework motivation and explored the association between adolescent-rated motivation and homework difficulties. The Expectancy-Value Theory of Motivation Measure (EVTM), designed by Wigfield and Eccles (2000), was modified to include items on ability, expectancy, and value related to homework completion motivation. Parents and teachers completed two questionnaires and rated adolescents' homework difficulties. The best-fitting factor structure for the homework motivation questionnaire included ability-expectancy and values as two distinct factors. Using this model in further analyses, low ability-expectancy beliefs were associated with increased parent-rated homework problems and a low teacher-rated number of assignments. Both adolescents' subjective task values and ability-expectancy beliefs predicted teacher-rated homework difficulties. These findings provide support for the EVTAM; however, it is not clear whether adolescents with ADHD displayed significantly lower motivation than their non-ADHD peers, due to the lack of a control group.

The relationship between motivation and learning has been documented in ADHD research. In a recent systematic review of 20 studies with young people with ADHD aged 5 to 18 years old, Smith and Langberg (2018) explored the relationship between motivation and ADHD as well as the relationship between motivation and potential outcomes, including reading achievement. Motivation was conceptualised in different ways (e.g., intrinsic/extrinsic, achievement motivation) and measured through various methods (e.g., questionnaires, observations, interviews). Young people with ADHD displayed lower motivation than their non-ADHD peers. Six studies of the review reported a significant positive association between motivation and reading (e.g., reading comprehension) indicating that motivation plays an important role in the reading achievement of children with ADHD-related characteristics (Lee & Zentall, 2017; Ogg et al., 2016).

In a correlational study with 302 adolescents (*M* age = 13.20) with (N = 162) and without ADHD (N = 140), Smith et al. (2019) found that adolescents with ADHD showed significantly poorer intrinsic and extrinsic academic motivation than their non-ADHD peers, even after controlling for gender, intelligence, and medication status. High self-reported intrinsic motivation for knowledge in children with ADHD was significantly associated with high standardised reading accuracy, an important factor for successful reading comprehension (Oakhill et al., 2014). For adolescents without ADHD, lower self-reported intrinsic motivation for accomplishment was associated with lower reading accuracy. In both groups, lack of motivation (amotivation) was associated with low parent-reported homework performance.

Interestingly, extrinsic motivation was positively associated with grade point average (GPA), only for adolescents with ADHD. Despite the fact that this study was correlational and not experimental, it underlines that motivation could benefit the learning of children with and without ADHD. The effects of extrinsic motivators, such as rewards, are less clear though. Considering that children with ADHD-related characteristics have an increased risk of poor motivation and school failure, a series of interventions have been proposed to address academic challenges and barriers.

2.7 ADHD Interventions

This section reviews evidence-based approaches to ADHD including stimulant medication, behavioural and academic interventions that aim to address ADHD behaviour and learning. With the central aim of this thesis being on educational outcomes, school-based strategies that target directly the academic outcomes of children with ADHD will be explored predominantly.

2.7.1 Medication and Behavioural Interventions

Stimulant medication and behavioural interventions that usually involve school-based interventions, parent training, positive reinforcement, and response cost contingencies are the most common interventions for young people with ADHD (Barkley, 2006; Loe & Feldman, 2007; Raggi & Chronis, 2006; Sibley et al., 2014). It has been argued that medication interventions (e.g., methylphenidate) improve children's academic outcomes by reducing the occurrence of inattention and/or hyperactivity/impulsivity.

The Multimodal Treatment of Children with ADHD (MTA) study evaluated the leading interventions in ADHD including 579 children with combined ADHD aged 7 to 9.9 years old (The M.T.A. Cooperative Group, 1999; 2004). The interventions included medication, behavioural (parent training, child-focused training, school-based intervention), combined (medication and behavioural) interventions, and community care. All interventions led to a decrease in the presentation of parent and teacher-rated inattention and teacher-rated hyperactivity/impulsivity. Medication alone, or combined with behavioural interventions, was significantly more effective than behavioural intervention alone and community care in reducing combined ADHD and improving standardised reading performance. Medication and combined interventions at 14 months and 24 months following the treatment had non-significant or small effects on the reading and mathematics scores of children (The M.T.A. Cooperative Group, 1999; 2004). During an 8-year follow-up of the MTA, Molina et al. (2009) found that the number of days children were on medication was not associated with spelling and reading achievement scores. Medication was found to have relatively small effects on inattention, hyperactivity/impulsivity, and academic-related measures including comprehension, task persistence, test scores, and grades particularly in children with combined ADHD (Molina et al., 2009; Rapport et al., 1994). Minimum or no medication effects were found for children with only attentional difficulties (e.g., attention during activities, classwork completion) showing that these children may not necessarily benefit from medication (Barkley et al., 1991; Beery et al., 2017).

Advokat et al. (2011) found that stimulant medication status (taking medication or not) did not explain the differences in self-reported academic achievement and average GPA results in young people (*M* age = 21) with ADHD (*N* = 92). Developing good study habits, however, provided a better explanation for these differences with these adolescents performing better, when they had already developed good academic habits (e.g., studying ahead before the GPA exam). Medication was found to have little effect on reading outcomes, such as colour-naming speed, or no effect on other reading outcomes such as naming speed for alphanumeric stimuli, skills which have been associated with successful word identification (Forness et al., 1991; Forness et al., 1992; Tannock et al., 2000). Medication is expected to enhance attention and EF to a degree; however, skilled life-long reading also requires motivation, dedication, and effort

(Taboada et al., 2009; Wigfield et al., 2016). Medication might improve, to some extent, the magnitude of inattention and/or hyperactivity/impulsivity, but less inattentive and hyperactive/impulsive behaviour does not necessarily mean that a young learner comprehends and enjoys reading.

Behavioural interventions have also been classified as empirically validated interventions in ADHD and have been reported to improve moderately or largely inattention and hyperactivity/impulsivity (DuPaul et al., 2012; Fabiano et al., 2009; Gaastra et al., 2016; Miranda et al., 2002; Moore et al., 2019; Raggi & Chronis, 2006). These involve the manipulation of antecedent-based and consequence-based strategies to improve children's behaviour. *Antecedent-based strategies* refer to the manipulation of aspects of the classroom environment that precede target behaviour to reduce the occurrence of self-injurious, aggressive, and non-directed behaviours such as stealing and property damage. The most common antecedent strategies involve choice, reduction of the length of tasks, and teaching of classroom rules (DuPaul & Weyandt, 2006). *Consequence-based strategies* refer to the manipulation of events that occur following a specific behaviour to increase the likelihood that an adaptive behaviour will re-occur in the future and reduce the repetition of 'challenging behaviour' [18], as has been commonly described in the literature. Consequence-based strategies can be positive such as rewards, parent and teacher praise, and daily report cards, or negative including time out and response cost (Raggi & Chronis, 2006).

Miranda et al. (2013) explored the effects of a behavioural intervention on the EF of children with ADHD over 10 weeks. Forty-two children aged 7 to 10 years old with combined

[18] *Challenging behaviour*, as traditionally referred to in the ADHD literature, causes harm to the person presenting this behaviour or to those people around them (ADHD Foundation, 2018). It has been argued that challenging behaviours include self-injurious, aggressive, and non-directed behaviours such as stealing and property damage. Behaviour is challenging when this has an impact on people's ability to function and accomplish everyday tasks. This thesis proposes that motivational practices, such as choice, may help children with ADHD communicate their need for self-expression in more positive, for them, ways with significant gains for their reading and reading enjoyment.

ADHD were randomly assigned to the intervention (N = 27) or control group (N = 15, this group did not receive the intervention). Children worked on a set of cognitive-behavioural techniques (e.g., self-instruction) that focused on improving inhibitory control. Parents learnt how to apply behavioural modification strategies including anger management, relaxation, and problem-solving. Teachers received training in the behavioural and academic management of children using similar strategies. Children completed a set of behavioural tasks measuring interference control, verbal and visuospatial working memory, planning ability, and flexibility. Children with ADHD who received the intervention significantly improved in visuospatial memory and planning compared with those who did not receive the intervention. Also, parents and teachers reported an improvement in inattention and hyperactivity/impulsivity. Despite the lack of a properly matched control group of children without ADHD, these findings show that behavioural interventions could enhance EF and reduce the presentation of inattention and hyperactivity/impulsivity.

In a meta-analysis of 24 within-subject and 76 single-subject design studies with young people aged 6 to 17 years old, Gaastra et al. (2016) found that classroom interventions (antecedent-based, consequence-based, self-regulation, combined) decreased off-task behaviour (e.g. not attending to task or teacher) and classroom behaviour (e.g. disturbing classmates, the difficulty of remaining on the seat) in children with inattention and hyperactivity/impulsivity, with largest effects reported for consequence-based (e.g. praise, prizes) and self-regulation (e.g. self-instruction, self-monitoring) interventions. All interventions improved the behaviour of non-ADHD children, with more positive direct effects reported for the antecedent-based interventions (e.g., choice, computer-assisted instruction).

Research underlines the positive effects of medication and behavioural interventions on behaviour. Nevertheless, the great majority of these focused on behavioural outcomes (adaptive versus disruptive behaviour) and did not further examine the effects of antecedent and consequence-based strategies on academic performance, unless an academic measure was directly included as a dependent variable (DuPaul et al., 2012; Raggi & Chronis, 2006). Finally, inattentive students without a diagnosis are less likely to be medicated or receive behavioural interventions that typically aim to address behaviours such as aggression, observed in some children with ADHD (DuPaul et al., 2011). Thus, such interventions may be of limited educational value. The following section explores a range of educational interventions.

2.7.2 Educational Interventions in ADHD

Contrary to behavioural interventions, school-based educational interventions directly address the learning (e.g., academic performance) of children with ADHD-related characteristics and have been found to have moderate- to- strong positive effects on behaviour and learning (DuPaul & Weyandt, 2006; DuPaul et al., 2012; Moore et al., 2019). However, there is also some evidence reporting no significant benefits for academic interventions (Hodgson et al., 2014). This section discusses some of the most commonly used antecedent-based academic interventions targeting ADHD-related behaviour and particularly learning[19]. It also provides some explanations for the discrepancy in findings regarding the effects of school-based educational interventions on these outcomes.

Educational interventions include *task and instructional modification*, *peer tutoring*, *computer-aided instruction*, *self-monitoring*, and *strategy training*. These interventions manipulate academic antecedents and have been tested with children with ADHD or children with severe behavioural challenges. *Peer tutoring* is an individualised instructional practice during which children work with a tutor who supports learning based on children's strengths and needs (Raggi & Chronis, 2006). Peer tutoring has been found to increase adaptive learning

[19] Contrary to behavioural interventions, educational interventions include academic measures to assess directly academic performance (e.g., standardised performance during a reading or maths test). This section also presents findings regarding the effects of educational interventions on both behavioural and academic outcomes because these interventions typically assess both.

behaviour (e.g., on-task behaviour) and academic performance and decrease less desirable learning behaviour (e.g., off-task behaviour) (DuPaul & Henningson, 1993; DuPaul et al., 1998; Plumer & Stoner, 2005). In a study with 28 neurotypical and children at risk of ADHD aged 6 to 10 years old, Dupaul et al. (1998) found that work in tutoring pairs increased observed on-task behaviour (e.g., listening, writing), reduced off-task behaviour (e.g., visual inattention to task or teacher) and increased performance in standardised maths and spelling tests of most children with parent and teacher-reported ADHD. Neurotypical children also showed relatively improved on-task behaviour and academic performance. In a study with 24 boys with ADHD aged 9 to 13 years old, Watkins and Wentzel (2008) observed that work with a trained peer partner significantly improved the quality of social interaction, strategy planning, and planning efficiency. Peer tutoring may provide opportunities for children to develop their social motivation while working together with classmates to accomplish a task.

Self-monitoring and *self-reinforcement* practices include setting goals for on-task behaviour and learning, self-monitoring, and self-administering rewards following successful task completion (DuPaul et al., 2012; Raggi & Chronis, 2006; Reid et al., 2005). Similar to self-monitoring and self-reinforcement, *strategy training* interventions improve the behaviour and academic performance of children with ADHD (Raggi & Chronis, 2006). In a study with six medicated children with ADHD aged 8 to 11 years old, Harris et al. (2005) found that the self-monitoring of attention and performance improved on-task behaviour (e.g., eyes focusing on a spelling list, asking for help) and performance during spelling (total number of words written correctly). Nevertheless, it is difficult to conclude whether self-monitoring improves behaviour and learning in children with ADHD in general, due to the small sample size of the study, the absence of a control group, and the lack of control for medication usage. In a study with 41 college students with ADHD aged 18 to 32 years old, Scheithauer and Kelley (2017) reported an improvement in the self-reported academic behaviour (test-taking, reading, and inattention), self-reported inattention and hyperactivity/impulsivity, goal attainment, and GPAs of a group that received self-monitoring, study skills, and goal setting instruction, but no such improvements for students who received only goal setting and study skills instruction. The absence of a control group and condition, in which students would not receive any instructions, restricts interpretations as to whether the behavioural and academic benefits of self-monitoring are specific to ADHD populations. Finally, the researchers used the less standardised measure of GPAs (also prone to grade inflation) to explore academic performance and did not assess actual improvement in performance and learning.

Another strategy that could help educators and parents address the behaviour and learning of children with ADHD is modifying task assignments or the school environment. The NICE guidelines (2018) recommend that changes made to the school environment are important to support children manage their ADHD. Environmental modifications include changes to seating arrangements and quiet working space, breaking down targets and goals as well as the use of incentive/reward systems (NICE, 2018). *Task modification strategies* in the classroom include choice over assignments, reducing task length, modification of the delivery instruction based on the child's learning style (fast-paced or slow-paced), dividing the learning material into small chunks of information, setting small goals, and increasing task stimulation, for example through adding colour (Renninger et al., 2019). Increasing task stimulation to enhance classroom-related adaptive behaviour (e.g., on-task behaviour) and learning draws on Optimal stimulation theory, which suggests that attention span could increase when a task is stimulating and personally motivating. Sensory stimulating tasks could serve as a booster of situational interest that increases attention-related functions and motivates learning. Adding colour to a standardised reading test has been found to increase the reading accuracy of inattentive children aged 8 to 11 years old (Zentall et al., 2000). Similarly, added colour has previously improved the silent reading comprehension of young people at risk of ADHD

(Iovino et al., 1998). A review of 41 studies has shown that stimulation (auditory such as music or visual such as added colour) improves academic productivity and decreases off-task behaviour in young people with ADHD-related characteristics, irrespective of the presence of a diagnosis (Vostal et al., 2013). Such environmental features may not be specific to children with ADHD. For example, choice over reading material and use of non-textual features (scratch and sniff stickers) have also been reported to improve reading comprehension and enjoyment in neurotypical children (Fridkin, 2018).

Computer aided instruction combines visual and auditory stimulation and has been found to enhance on-task behaviour and learning for children with ADHD (Kang & Zentall, 2011; Mautone et al., 2005; Raggi & Chronis, 2006). Although computer-aided instruction involves multiple accommodations (reduced length of the content and feedback) in addition to stimulation, which poses a challenge as to whether computer-aided instruction alone can prove beneficial, research reports some positive findings (Hecker et al., 2002). Rabiner et al. (2010) explored whether Computerised Attention Training (CAT) and Computer-Assisted Instruction (CAI) could increase the attention and academic performance of 77 children aged 6 to 7 years old, identified as inattentive by teachers (16% of the children also had ADHD). CAT included a program with structured activities designed to train auditory and visual sustained attention. CAI involved a reading and maths program with age-appropriate graphics offering immediate and relatively frequent feedback based on performance. CAT or CAI reduced teacher-rated inattention, particularly in the case of children with more attention difficulties, compared to the no intervention (control) condition. Children who received CAI also showed gains in a standardised reading fluency task and teacher-rated academic functioning (e.g., percentage and accuracy of completed work, perceptions of the child’s skills in reading, maths, and written language), compared with children who did not receive this intervention.

In their synthesis of four systematic reviews including 138 studies, Moore et al. (2019)

found that non-pharmacological interventions, including behavioural interventions, improve behavioural and academic outcomes in young people with ADHD, however, there was a wide variation in terms of the effectiveness of different interventions. Contextual factors such as the relationship between students with ADHD and teachers, particularly in teacher-led interventions, the stigma that may be experienced by these students when participating individually in interventions, school attitudes, students' self-beliefs, and perceptions of agency could moderate the effect of interventions. The beneficial impact of interventions on behaviour and potential outcomes may also vary. For instance, interventions in this synthesis improved attention, but not hyperactivity/impulsivity. Because inattention and hyperactivity/impulsivity are experienced by most children to a degree, school-based interventions that support the learning of all children, irrespective of ADHD, might prove more attractive to general education teachers. Inclusive approaches may also be effective for children with such mild characteristics. Overall, the studies above underline the benefits of educational interventions on the behaviour and learning of children with and without ADHD, although information about the effects of these on the latter group is not always clearly reported (Gaastra et al., 2016). Considering the thesis' interest in the role of choice and rewards, the following sections examine the benefits of these motivators for children with ADHD-related characteristics, focusing on reading.

2.8 Choice and Reward as Motivators of Behaviour and Learning

This section explores choice and reward effects on the behaviour and learning/reading of children with inattention and/or hyperactivity/impulsivity in broad terms, and not only specific to children with diagnosed ADHD, due to the limited research testing for such effects in this population. It does not review theory and research related to choice and rewards in neurotypical children, as these have already been discussed in Chapter 1.

2.8.1 Choice as an Intrinsic Motivator of Academic-related Behaviour and Learning

Choice has been described as an autonomy-supportive practice that provides children with a sense of ownership over what they learn (Deci & Ryan, 1985; Patall & Wynn, 2010; Ryan & Deci, 2000; Schneider et al., 2018) and as a motivational trigger of situational interest (Guthrie et al., 2007b; Hidi & Renninger, 2006; Renninger et al., 2019; Wigfield & Guthrie, 1997). Choice (e.g., choosing learning material, task characteristics, and the difficulty level of questions) as a booster of situational interest has been found to increase intrinsic motivation, willingness to re-engage with a task, cognitive engagement, performance, and overall learning in neurotypical children (Cordova & Lepper, 1996; Flowerday & Schraw, 2003; Fridkin, 2018; Guthrie et al., 2007b; Patall, 2013; Patall et al., 2014). Interpreting the evidence, however, is complicated as studies have not always controlled for confounding factors, including prior interest and background knowledge (Assor et al., 2002; Flowerday & Schraw, 2003; Flowerday et al., 2004; Patall, 2013; Patall et al., 2014). Despite these methodological limitations, choice serves as an effective practice to build interest, and subsequent motivation, for tasks that are not genuinely interesting for a learner (Patall, 2013). Thus, choice may represent a promising avenue of educational intervention for children at risk of poor motivation (Smith et al., 2019) and reading underachievement (Sims & Lonigan, 2012), such as children with ADHD-related characteristics, who are more likely to experience reading as boring.

In ADHD literature, choice has been viewed both as an important task modification practice and antecedent-based strategy that reduces 'disruptive' task-related behaviour and increases on-task behaviour (DuPaul et al., 2011; Raggi & Chronis, 2006). *On-task behaviour* involves asking for help, engaging in a task by manipulating aspects of this towards its completion, or receiving feedback from the teacher (Howell et al., 2019; Parsons et al., 1990). '*Disruptive'* or *'challenging' behaviour*, as commonly referred in the literature, ranges from not attending to a task to physical aggression (Howell et al., 2019; Powell & Nelson, 1997). In a study with 47 educational psychologists, Hart (2010) explored the views of educational psychologists about effective classroom management strategies. The psychologists underlined the importance of strategies that promote choice and personal ownership in the classroom (e.g., teacher listens to children's views, offers opportunities for children to take ownership over what they learn). Drawing on Optimal stimulation theory, choice may provide the stimulation to motivate adaptive behaviour in children (Antrop et al., 2000; Beike & Zentall, 2012).

Dyer et al. (1990) examined the impact of choice over preferred reinforcers and tasks on the behaviour (aggression, tantrums, and object misuse) of three children with autism and/or intellectual disability aged 5 and 11 years old. Some children with ADHD may display such behaviours including aggression. In the Dyer et al. (1990) study, behaviour was observed during simple tasks including puzzles and sorting objects. Correct responses were measured for each task. Choice of reinforcers and tasks reduced the occurrence of disruptive behaviours, contrary to no choice that increased these behaviours, but not task accuracy. Lack of choice effects on task performance (e.g., accuracy) could be due to tasks already being familiar to children. Children may have already developed the skills required for these tasks, leaving no room for choice to further improve performance. Lack of clear distinction between choice and previous knowledge and interests also makes it difficult to conclude whether it is choice or prior task interest that enhances behaviour. Overall, choice improved behaviour, but it is difficult to generalise these findings to children with ADHD due to the case study design and lack of a properly matched control group. Further research that explores choice effects with a larger number of children with and without ADHD, while controlling for some of these confounding factors would generate more reliable findings regarding choice effects.

Dunlap et al. (1994) investigated the impact of choice on the task engagement (English and spelling) and disruptive behaviour of two Year 5 boys who attended a special education classroom. One child was diagnosed with ADHD and received medication, while the other child struggled with task engagement and disruptive behaviour. Task engagement and disruptive behaviour were assessed through observations of children's work on the assigned task, vocal and non-vocal noisemaking, leaving the seat without permission, and talking without teacher permission. In the no choice condition, academic assignments were selected by the teacher and presented on the blackboard, whereas in the choice condition children received an individualised written menu of 6-8 options and chose to review their materials and assignments. The children displayed greater task engagement and less frequent disruptive behaviours during the choice compared with the no choice condition. Children with behavioural difficulties and/or ADHD are more likely to engage in inattentive and/or hyperactive/impulsive behaviours to exercise control over their learning environment (Powell & Nelson, 1997; Wehmeyer et al., 1998). As seen earlier, these children are in high need of personal agency (Rogers & Tannock, 2018) and choice may, thus, provide a way to communicate this need for self-control in more adaptive ways.

The Dunlap et al. (1994) findings are interesting; nevertheless, this is a dated case study that did not measure academic performance, and, therefore, it is hard to conclude whether choice enhances learning similar to behaviour. This study also included children who attended a special education classroom and experienced certain challenges, however, children with ADHD are more likely to attend mainstream primary schools and do not necessarily experience such elevated behavioural difficulties, especially the predominantly inattentive ones. Choice effects on task-related behaviour and learning likely vary, based on the degree of ADHD-related characteristics.

Powell and Nelson (1997) observed the effects of choosing language arts assignments on the behaviour of a Year 2 child diagnosed with ADHD who attended a general classroom. Child behaviours such as avoidance of schoolwork, disturbing others, not following teacher rules, and being away from the desk decreased when the child chose their assignments. In a meta-analysis of 13 studies with a total of 30 young people aged 5 to 21 years old, Shogren et al. (2004) examined whether choice reduces off-task behaviour, aggression, and property destruction. Choice referred either to selecting the order in which children completed the assigned activities or to choosing between two tasks. Despite the fact that it is difficult to disentangle the independent effects of choice in children with ADHD (only 13% had a diagnosis), choice contributed to the decrease of behaviours such as disturbing others. As mentioned earlier, findings around choice effects in ADHD should be interpreted with caution, as the great majority of studies included in meta-analyses and systematic reviews (DuPaul et al., 2012; Howell et al., 2019) are dated case studies that have employed single-case designs.

During semi-structured interviews with young people aged 9 to 16 years old, Morsink et al. (2017) found that children with ADHD show less engagement and invest less cognitive effort when encountering boring[20] tasks than those without ADHD. Young people with ADHD were in greater need to experience autonomy, competence, and relatedness than their non-ADHD peers, suggesting that autonomy-supportive learning environments that support choice contribute towards a more positive learning experience. Choice may also be reinforcing and rewarding in itself. Children with ADHD regularly show poorer than average academic motivation, possibly due to a decreased activity in reward circuit mechanisms (Volkow et al., 2011). Recent neuroscientific studies with neurotypical people report that choice increases brain activity in the reward circuitry mechanisms (striatum), and therefore choice may be experienced as a reward that motivates behaviour and learning (Leotti & Delgado, 2011). The Four-Phase Model of Interest Development provides a further explanation for the mechanism that choice affects academic-related behaviour and learning. Hidi and colleagues (Hidi, 1990; 2001; Renninger & Hidi, 2016; 2020) suggested that situational interest, as promoted through choice, triggers a motivational experience that raises attention, cognitive effort, and persistence

[20] Morsink et al. (2017) found that young people with ADHD perceived repetitive and lengthy tasks as boring.

during a task. Attention is either automatic or effortful. Interesting information evokes a more automatic and effortless allocation of attention, whereas less interesting information requires more cognitive resources and effortful engagement. Interest triggered via choice contributes to the effortless and less conscious allocation of attention, freeing up attentional resources for other cognitive demands and, thus, enhancing task performance (Hidi, 2001; Renninger et al., 2019). Therefore, promoting interest in the classroom through choice may serve as a useful practice that supports the reading, particularly of children with ADHD-related characteristics (Beike & Zentall, 2012; DuPaul & Weyandt, 2006).

Choice has been viewed as a central motivational practice that enhances task-related behaviour and possibly learning in children with ADHD-related characteristics; however, this should not be viewed as a practice that 'normalises' children. Rather than trying to correct for such characteristics, this thesis suggests that choice can harness the strengths of children with ADHD. Children with diagnosed ADHD are in high need to experience autonomy and motivation in the classroom (Morsink et al., 2017; Rogers & Tannock, 2018). Therefore, the proposed thesis aims to manipulate choice experimentally to address this need of children for autonomy and generate greater gains for the motivation and learning of these children.

Current research provides some support for the positive effects of choice on the behaviour and learning of children with ADHD-related characteristics. Nevertheless, the majority of studies in ADHD have used either case study designs (Dunlap et al., 1994; Plummer & Stoner, 2005; Powell & Nellson, 1997) or relatively small samples of 20 to 40 children with ADHD during poor experimental designs (e.g., lack of a control group) (DuPaul et al., 1998; Morsink et al., 2017). Given the relatively low worldwide and UK prevalence rates of ADHD (Willcutt, 2012), practical difficulties associated with the identification of participants account, partially, for the small samples. The use of repeated measures designs that minimise the variability across the sample size could help control for such sample limitations to a degree.

Choice effects have also been tested with children with ADHD who experience severe behavioural difficulties, and thus it remains to be seen whether choice could motivate the learning of children with different degrees of ADHD-related characteristics, regardless of an ADHD diagnosis. A further methodological flaw is that researchers do not always match properly children with and without ADHD based on gender, chronological age, and academic ability. More robust study designs that control for prior motivation and ability could help secure with greater certainty that any differences as an outcome of the intervention would be due to the intervention itself rather than other confounding factors.

2.8.2 Reward as an Extrinsic Motivator of Behaviour and Learning

Children with ADHD show typically a greater sensitivity towards reinforcement contingencies including rewards, feedback, response cost, or a combination of these reinforcements than their non-ADHD peers (Luman et al., 2005; Sagvolden & Sergeant, 1998; Sonuga-Barke, 2002; Volkow et al., 2011; Yu et al., 2018). Therefore, rewards could provide an alternative way to motivate the behaviour and learning of children with ADHD-related characteristics. Contrary to intrinsic motivators (e.g., choice), the effects of extrinsic motivators (e.g., rewards) on behaviour primarily, and less on learning have been explored more consistently in ADHD research.

In a study with 435 neurotypical and 34 children with ADHD aged 8 to 16 years old, Morsink et al. (2021) found that rewarded task elements (e.g., gifts, points given) were perceived as equally motivating during learning by young people with and without ADHD. This is in line with Morsink's et al. (2017) qualitative research which reported that young people with (N = 17) and without ADHD (N = 22) aged 9 to 16 years old value similarly motivational factors (e.g., receiving material reinforcement, feeling free and independent, feeling competent) during everyday activities, although the effects of these factors may vary based on the severity of ADHD-related characteristics. In this study, children with ADHD reported to be more motivated by the fast passage of time (e.g., boring activities were perceived as being slow and taking too long) and less motivated during familiar and predictable activities. External incentives were perceived as highly motivating for both groups. This study explored motivation during everyday tasks, and thus it is difficult to apply confidently findings in the classroom, in which children perform more cognitively complex tasks including reading.

In a literature review of 22 studies with 1181 children aged 5 to 14 years old, Luman et al. (2005) investigated the impact of reinforcement contingencies on the motivation and task performance of children with and without ADHD. In this review, performance was measured during cognitive tasks such as Go/No-Go tasks, Continuous performance tests, or general numeracy and literacy tasks. Reinforcements included primarily tangible rewards (money or tokens) contingent on performance, response cost (the deduction of reward following an incorrect response), feedback, and a combination of feedback and reward, or response cost. Response cost (negative reinforcement) and reward (positive reinforcement) improved the motivation and cognitive performance of children with and without ADHD compared to no-reinforcement, however, these effects were particularly salient for the former group. External reinforcers influenced the performance of neurotypical children less than that of children with ADHD, with the former group performing well irrespective of the presence of external reinforcers (Carlson & Tamm, 2000; Marx et al., 2018).

In one of the studies of the Luman et al. (2005) review, Carlson et al. (2000) explored the effect of rewards such as tokens (positive reinforcement), response cost (negative reinforcement), and no-reinforcement on the performance and motivation of 40 neurotypical children and 40 children with ADHD. Performance was assessed through the number of correct answers found during an arithmetic task. After the arithmetic task, intrinsic motivation was assessed via a self-report and a free-choice task, in which children could choose to further engage in similar arithmetic tasks or spelling tasks. Children with ADHD answered fewer problems than those without ADHD across all three conditions (reward, response cost, and no-reinforcement); however, their accuracy rates were higher under the reinforcement conditions particularly in the response cost condition. There was no effect of condition for the neurotypical children. Neither response cost nor reward negatively affected the intrinsic motivation of children with ADHD. Response cost increased intrinsic motivation, as measured through the free-choice task, whereas reward improved self-rated motivation. Response cost increased cognitive performance more than rewards, although children with ADHD performed better in both reinforcement conditions compared with the no-reinforcement (control) condition. External reinforcers may offer more opportunities for children with ADHD to satisfy their intrinsic need for high motivation.

In another study of the Luman et al. (2005) review, Slusarek et al. (2001) explored the effects of motivational incentives (points) on inhibitory control (inhibition rate and Reaction time [RT]) during a stop-signal task with 33 neurotypical children, 33 children with ADHD and 33 children with severe depression, anxiety and oppositional or conduct disorder aged 6 to 14 years old. Children were matched based on gender and age. Children received continuous feedback during low (1 point) or high (5 points) incentive conditions. Children with ADHD showed lower inhibition rates and longer (slower) RT in the low incentive condition, however, they performed equally well with the other two groups in the high incentive condition. The other two groups did not differ in performance across the conditions. Findings underline the benefits of rewards for cognitive performance, especially for children with ADHD. Nevertheless, it is relatively difficult to disentangle the independent effects of rewards on performance as children received both continuous feedback and incentives.

Rosch et al. (2016) further examined the effects of reinforcement (points to be spent on preferred prizes including toys, video games, and gift cards), stimulant medication (methylphenidate), and their combination on the response inhibition (stop signal RT [SSRT]) of primary-aged children[21] with combined ADHD (N = 111) and without ADHD (N = 33) during a stop-signal task. Children with ADHD showed lower baseline response inhibition control than children without ADHD. Medication improved response inhibition in children with ADHD. Small medication dosage resulted in no statistically significant difference in response inhibition between the two groups and high dosage led to significantly better response inhibition in children with ADHD compared with their non-ADHD peers. Reinforcement improved response inhibition to a greater extent in children with ADHD than their non-ADHD peers. When combined, medication and reinforcement improved response inhibition more in children with ADHD compared with medication or reinforcement alone, with these children showing similar performance to that of their non-ADHD peers. Considering that medication is less likely to benefit predominantly inattentive children (Beery et al., 2017), it is difficult to generalise these findings to all inattentive children. It is also challenging to draw any conclusions about the effects of rewards on learning, due to the absence of academic measures. Arguably, the rewards offered in the Rosch et al. (2016) study cannot be applied easily in the classroom. It remains to be seen whether more commonly used classroom rewards could still motivate the learning of children with and without ADHD.

Reinforcement contingencies, such as reward and response cost, are motivating particularly for the cognitive performance of people with ADHD (Fosco et al., 2015; Marco et al., 2009; Marx et al., 2018; Stark et al., 2011). Nevertheless, similar to research with neurotypical people (Cameron & Pierce, 2004; Deci et al., 1999; McGeown et al., 2012), evidence is not always consistent confirming the complexity of the reinforcement mechanisms (Luman et al., 2009). For example, reinforcers could be administered based on either task participation or performance. However, differences in the cognitive performance and motivation of people with ADHD have not been reported consistently due to different

[21] Children's mean age is not provided in the study.

reinforcement allocation policies (Carlson & Tamm, 2000). Reinforcers are also expected to have the largest effect when provided immediately after performance due to the steeper delay-or-reinforcement gradient in children with ADHD (Marx et al., 2018). Reward effects on motivation may also differ based on the type of motivation assessment with moderate-to-large reward effects being more easily identified by self-reports than behavioural measures (free-choice period) (Carlson et al., 2000; Luman et al., 2005). This could be because self-reports measure perceptions of reward effects, whereas behavioural measures assess voluntary engagement with rewards. People may also typically hold positive beliefs about reward effects on intrinsic motivation (Murayama et al., 2016), which could affect their ratings.

Despite some inconsistency in findings, rewards can boost motivation and cognitive performance in children with and without ADHD, with these effects being more salient for the former group (Ma et al., 2016). Nevertheless, there is a dearth of literature manipulating experimentally, whether rewards offer a promising practice to enhance similarly the learning of children with ADHD-related characteristics, irrespective of an ADHD diagnosis.

2.9 Conclusion

Chapter 2 discussed the adverse role of ADHD-related characteristics in reading, with a particular focus on inattention. Inattentive children are at high risk of reading underachievement, irrespective of an ADHD diagnosis, and thus they require extra reading support. Medication interventions are informative; nevertheless, their effects on learning are typically short-term and minimal. Medication is also less likely to be prescribed in the case of primarily inattentive children. Behavioural interventions have focused on decreasing the presence of ADHD-related characteristics, rather than increasing learning outcomes. Educational interventions in ADHD have proved to be effective for the learning of all children, with these effects being more pronounced for children with ADHD. Choice (intrinsic motivator) and reward (extrinsic motivator) have been found to motivate task-related behaviour and cognitive performance in people with ADHD; however, their effects on learning and specifically reading have not been tested systematically.

The present thesis includes three main studies conducted with children attending mainstream primary schools. These studies aimed to extend our understanding of the role of choice and reward in the reading of children towards the end of primary school, and also test the extent to which any effects of choice and rewards are different for young readers with ADHD or ADHD-related characteristics more generally. There is extensive literature around the role of motivation in the reading of neurotypical children, however little is known about the potential positive impact of motivational choice and reward on the reading of children with such characteristics. Study 1 (Chapters 3 and 4) explored choice effects on the reading comprehension and enjoyment of primary-aged children, further testing for any positive effects of choice on the reading of those who displayed minimal and severe ADHD-related characteristics, focusing on inattention. The children of this study did not have a diagnosis of ADHD. Study 2 (Chapter 4) extended the findings of Study 1 as this examined the effects of both choice (intrinsic motivator) and reward (extrinsic motivator) on the reading comprehension and enjoyment of children with and without diagnosed ADHD.

Using interviews, Study 3 (Chapter 5) sought the perspectives of children with and without ADHD around the role of interest and motivation in reading. Seeking children's perspectives around the contribution of reading motivation was considered important, as their voices have not been systematically consulted in reading research. By incorporating both quantitative and qualitative approaches, this thesis aimed to generate more meaningful findings around reading practices related to motivation that support children's reading comprehension and enjoyment in the classroom.

The following section presents the experimental and data-driven aims and hypotheses of the thesis studies. The experimental aims and hypotheses refer to those than have been originally developed (a priori) to investigate choice and reward effects on reading outcomes. The data-driven aims and hypotheses refer to those that emerged during the data analyses in Studies 1 and 2 (a posteriori) and the reasons for their inclusion are further explained in Chapters 4 and 5. Overall, detailed information regarding the rationale of each study (e.g., how the studies address research gaps) is provided in the relevant study chapter (Chapters 3, 4, 5, and 6).

2.10 Research Aims and Hypotheses of the Thesis Studies

Study 1

Aim 1: To investigate choice effects on the reading comprehension and enjoyment of children.

Experimental Hypothesis 1: Choice will increase the reading comprehension and enjoyment of children compared with no choice.

Aim 2: To examine choice effects on the reading comprehension and enjoyment of children with inattention, hyperactivity/impulsivity, and poor inhibitory control, with emphasis on children with attentional difficulties.

Experimental Hypothesis 2: Choice will increase the reading comprehension and enjoyment of children with both minimal and severe inattention (and other ADHD-related characteristics) compared with no choice.

Aim 3: To test for any greater differences in choice effects on the reading comprehension and enjoyment of children with severe ADHD-related characteristics rather than those with such minimal characteristics, with emphasis on the interaction between choice and inattention.

Experimental Hypothesis 3: There will be an interaction between choice and inattention (and other ADHD-related characteristics), such that choice will increase particularly the reading comprehension and enjoyment of severely inattentive children rather than those with minimal inattention.

Data-driven Aim: To examine the convergent (agreement) and divergent validity (disagreement) between rating scales and behavioural measures of ADHD-related characteristics.

Data-driven Hypothesis: Convergent and divergent validity will not be always confirmed between rating scales and behavioural measures.

Study 2

Aim 1: To extend the findings of Study 1 and explore whether choice and reward improve the reading comprehension and enjoyment of children with and without diagnosed ADHD.

Experimental Hypothesis 1: Choice and reward will increase the reading comprehension and enjoyment of all children compared with no motivation.

Aim 2: To examine whether choice and reward enhance reading comprehension and enjoyment in both children with and without ADHD.

Experimental Hypothesis 2: Choice and reward will improve the reading comprehension and enjoyment of both groups, irrespective of ADHD, compared with no motivation.

Aim 3: To explore whether there are any differences in the effects of choice and rewards between the two groups compared with no motivation, such that choice and reward effects would be more salient for the reading comprehension and enjoyment of children with diagnosed ADHD compared with those without ADHD.

Experimental Hypothesis 3: Children with diagnosed ADHD will benefit more from choice and reward compared with no motivation in terms of reading comprehension and enjoyment than their non-ADHD peers.

Data-driven Aim 1: To examine the convergent or divergent validity between the rating scales and behavioural measures of ADHD-related characteristics.

Data-driven Hypothesis 1: Convergent and divergent validity will not be always confirmed across the ADHD-related measures.

Data-driven Aim 2: To define any differences between children with and without ADHD across the key study variables (ADHD-related characteristics, baseline motivation).

Data-driven Hypothesis 2: There will be differences between children with and without ADHD, such that children with ADHD would show greater inattention, hyperactivity/impulsivity, and lower inhibitory control and motivation than children without ADHD.

Study 3

Aim 1: To explore the perspectives of children with and without diagnosed ADHD about their reading experiences and the role of interest and motivation (intrinsic and extrinsic) in their reading.

Aim 2: To examine whether there will be any qualitative differences in the motivational profiles and reading experiences of children with and without ADHD.

Chapter 3. Pilot and Main Study 1

The Effects of Choice on the Reading Comprehension and Enjoyment of Year 4 Children With ADHD-related Characteristics

Chapter 3 presents Study 1. The study explored three aims. The first aim was to investigate whether the *perceived choice* of stories improves the reading comprehension and enjoyment of children aged 8 to 9 years old who attended mainstream primary schools. *Experimental Hypothesis 1* was that choice would increase reading comprehension and enjoyment compared with no choice. Choice serves as a powerful intrinsic motivator with significant cognitive (e.g., task performance) and affective (e.g., enjoyment) outcomes (Ryan & Deci, 2000). Further research on choice effects is necessary, however, as findings are inconsistent, probably due to the choice presentation (meaningful or not) and manipulation (control for prior interest and story knowledge or not). This study first replicated Fridkin's study (2018) that reported positive effects of perceived story choice as a potential trigger of situational interest, compared with no choice, on the reading comprehension and enjoyment of children aged 8 to 9 years old. Similar to Fridkin's study (2018), the novelty of the present study is that it employed a robust repeated measures design that counterbalanced story and condition order to test for choice effects on reading.

By designing new stories and offering perceived story choice, Fridkin (2018) controlled for children's prior interests and background knowledge, two key confounding factors that have not always been controlled for in the literature (Flowerday & Schraw, 2000; Patall, 2013), making it difficult to understand the independent effects of choice on reading outcomes. These findings are of strong educational value, suggesting that the act of choosing itself can motivate reading and reading for pleasure, irrespective of whether children hold an initial interest in reading or not.

Given the key educational implications of Fridkin's study (2018) as well as the recent increasing need for replicating research (Maxwell et al., 2015) in social sciences, I decided to replicate Fridkin's design to help further confirm and generalise her findings around the role of choice in the reading of primary-aged children. Interpreting evidence around choice effects is complicated, and thus further replication of previous high-powered and methodologically strong studies, such as Fridkin's study (2018), could help develop more empirically validated practices of supporting choice during reading.

The second aim was to explore whether choice increases the reading comprehension and enjoyment of a community sample of children displaying minimal and severe inattention, hyperactivity/impulsivity, and interference control, focusing on inattention. *Experimental Hypothesis 2* was that choice would increase the reading comprehension and enjoyment of children with minimal and severe inattention (and other ADHD-related characteristics) than no choice. Whilst research adopted principally a categorical approach focusing on the reading of children with and without ADHD, inattentive children who do not hold a diagnosis may also struggle with their reading (Rabiner et al., 2016). This study extended research showing the benefits of choice for the reading of children with and without ADHD (Beike & Zentall, 2012; Fridkin, 2018) to test for such reading benefits in those with different degrees of inattention.

The third aim was to investigate whether choice enhances the reading comprehension and enjoyment, specifically of those children who display severe inattention (and other ADHD-related characteristics) than those with minimal inattention. This study extended research (Luman et al., 2005; Ma et al., 2016) reporting the more pronounced effects of motivational interventions for children with ADHD to test the hypothesis that choice effects would be more salient on the reading of children with non-diagnosed severe attentional difficulties than those with such minimal difficulties. By testing this hypothesis, the study aimed to fill in the research gap as to what kind of practices could support educators with the reading of children with varying degrees of inattention, a population at risk of reading underachievement, irrespective of the severity of inattention (Merrell et al., 2017; Miller et al., 2013).

In the first half, Chapter 3 presents the pilot for Study 1. A pilot study tested whether the two stories and comprehension questions designed by Fridkin (2018) and previously empirically validated ADHD-related tasks (rating scales, behavioural tasks) worked appropriately. Due to the small sample size, the pilot study did not examine the Study 1 experimental aims and hypotheses. In Fridkin's study (2018), children achieved higher comprehension scores in one out of two stories, suggesting that the stories may be processed differently. The comprehension questions were modified and further tested by Fridkin and Hurry's Master's students (Cheng, 2017). However, the reading materials were re-administered in the pilot study to provide an additional check of story reliability and assess whether the stories were of similar reading difficulty. Further to this, the pilot study explored the associations between behavioural tasks and rating scales assessing inattention, hyperactivity/impulsivity, and inhibitory control to finalise the measures of the main study. This chapter describes the methodology of the pilot study, and then, it presents a brief analysis and discussion of results as well as the pilot study implications for the main study.

In the second half, Chapter 3 presents the main Study 1 methodology. Due to similarities with the pilot study in terms of design, materials, and procedure, similar information is not further included here to avoid any repetition. Variables are measured similarly unless stated otherwise. The similarities between the two studies are stated clearly and information is provided when additions are necessary. Before testing the experimental aims and hypotheses, preliminary analyses explored the associations between the behavioural tasks and rating scales of ADHD-related characteristics (*Data-driven Aim*). The *Data-driven Hypothesis* was that the convergent and divergent validity of the measures would not be always confirmed. The inconsistent associations across measures became a central issue that led to further challenges and later informed the analysis plan. Thus, it proved necessary to address this emerging issue more extensively alongside the experimental hypotheses. This chapter is split into two sections that explore a) the associations between the variables/measures b) the validations of experimental hypotheses. It discusses key study findings, limitations, and educational/clinical implications, while others are discussed more broadly in the *General Discussion* chapter (Chapter 6).

3.1 Pilot Study

3.1.1 Method

3.1.1.1 Participants

Twenty-nine Year 4 children (8-9 years old; 17 boys, 12 girls) of a single classroom were invited to participate in the pilot study. Children attended a community mainstream primary school (four-form entry) rated as 'Good' in the most recent Ofsted report. Information letters and opt-in consent forms were sent to parents/carers and teachers before the study. Twenty-two children returned the signed parent consent form (11 boys, 11 girls). Six of these children (4 boys, 2 girls) did not participate in the reading comprehension tasks due to severe reading difficulties, following the teacher's recommendations. All children performed the ADHD-related tasks. Due to the small sample size, children were not excluded based on additional criteria, and thus the final sample included all 22 children who returned a written consent. There are no hard rules for determining the sample size of a pilot study, although a number of 10 to 30 participants (approximately 10% of the projected sample size) is considered satisfactory (Connelly, 2008). The pilot study received ethical approval as part of a larger study by the Department of Psychology and Human Development at University College London (UCL), Institute of Education, was covered by the UCL Data Protection Registration and received a reference number Z6364106/2018/04/69 under the category of social research. It began in late November 2017 and lasted until December 2017. Children who did not return a signed consent form continued with their regular reading after the teacher's suggestions or completed only the group activities to minimise the likelihood of children feeling marginalised. However, the data of these children were not processed and included in the study. Parents/carers could withdraw at any stage. No request for withdrawal was received.

3.1.1.2 Measures

Measures of ADHD-related Characteristics

This pilot study explored children's ability to focus their attention for particular amounts of time (sustained attention) with and without the presence of irrelevant stimuli, hyperactivity, behavioural inhibition/impulsive control, and interference control. The selection of measures was informed by research with children with and without ADHD. Rating scales and behavioural tasks were tested for a multi-method assessment of inattention and hyperactivity/impulsivity. Rating scales are more likely to measure children's daily functioning, whereas behavioural tasks may assess children's task-specific performance (Sims & Lonnigan, 2012). Combined use of these measures offers a more thorough assessment of inattention, hyperactivity/impulsivity, and interference control. Information for all these measures is provided in the following sections.

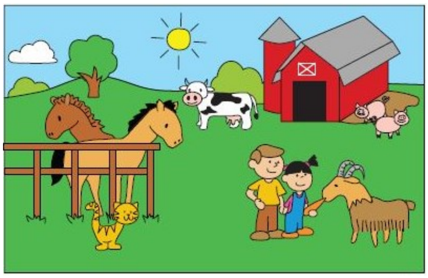
Spot-the-Difference Task. *Visual selective attention* was assessed through an easily administered task. Children with ADHD usually perform more poorly than average in visual attention tasks (Lin et al., 2017). Children received four sets of pictures; two of which included 5 differences and the other two included 10 differences (Cheng, 2017). Each set of pictures was presented separately, and children had to spot as many differences as they could between these two similar, but not identical pictures within 1 min (see Figure 3.1). The task duration was 4 min approximately. One point was awarded for each correct answer and the maximum score of correct answers was 30. Children had access to both pictures in each set for the whole time to control for any working memory effects. As an additional check on this task, data collected by

Fridkin and Hurry's Master's student showed a value of .73 for Cronbach's alpha, when testing this task with Year 4 neurotypical children (Cheng, 2017). This value showed satisfactory internal consistency[22].

Figure 3.1

Example Pictures in the Spot-the-Difference Task

A)



B)

Note. Children received four sets of pictures (8 pictures in total), two of which were similar but not identical. They had to find five differences for two sets (example A) and 10 differences for the other two sets (example B).

Whack-A-Mole Task. This computerised task is a version of the Go/No-Go paradigm (Casey et al., 1997). Go/No-Go tasks are designed to measure behavioural inhibition in children with and without ADHD (Simmonds et al., 2008). *Behavioural inhibition* (*or self-control*) refers to a child's ability to control behaviour (Noreen & MacLeod, 2015). These tasks explore difficulties with the regulation of inhibitory control in children with ADHD (Barkley, 2011; Nig, 2001). It has been argued that Go/No-Go tasks are more sensitive than parent and teacher rating scales when measuring inattention and hyperactivity/impulsivity and could help better distinguish between these constructs (Bezdjian et al., 2009).

A computerised version of the Whack-A-Mole Task was implemented using E-Prime (version 2.0; Schneider et al., 2007). The task was presented on a laptop computer with a game controller connected to the laptop. Stimuli were courtesy of Sarah Getz and the Sackler Institute

[22] Due to the small sample size of the pilot study, internal consistency was not assessed.

for Developmental Psychobiology (sacklerinstitute.org). The task used the instructions and task parameters suggested on the institute's website. The task consists of four runs lasting for approximately two min and twenty-one s each, and each run involves 42 Go trials and 12 No-Go trials, a total of 54 trials per run. Stimulus duration lasts 1500 ms and the interstimulus interval is 5 s with more Go trials preceding No-Go trials during the first and last runs. Children should press the game controller button when the Go-stimulus (Mole) appears on the screen, whereas inhibiting this action when a No-Go stimulus (Veggie) is presented less frequently on the screen. The mole would try to trick them into different disguises (see Figure 3.2). Children receive task feedback when they respond both correctly and incorrectly.

This task tested the child's ability to suppress the prepotent response to press the Go stimulus (Mole) during the No-Go trials (Veggie). This version also manipulated task difficulty by varying the amount of Go trials that preceded the No-Go trials, which could influence one's ability to suppress a prepotent response. As the frequency of the Go trials increases, the prepotent tendency for the Go responses increases and a conflict is expected between the two responses requiring increased inhibitory control. The task duration is approximately 10 min. Total accuracy scores in the Go and No-Go trials and Reaction Times (RTs) in the Go trials were measured. Accuracy Scores in the Go Trials (Mole) refer to the child's ability to respond correctly to the targeted stimulus (Mole) and RTs in the Go Trials refer to their ability to quickly respond to the targeted stimulus. Accuracy Scores in the No-Go Trials (Veggie) reflect the child's ability to correctly not press the button in the presence of the non-targeted stimulus (Veggie). Low accuracy scores in the Go Trials are similar to Omission errors, which occur when the child should respond to the target stimulus, but they do not. Omission errors are indicative of inattention (Bezdjian et al., 2009). Lower Accuracy scores in the Go Trials reflect greater inattention. Accuracy Scores in the No-Go Trials are similar to Commission errors, which occur when the child responds to a stimulus on trials where they should not respond.

Commission errors reflect poor behavioural inhibition (Bezdjian et al., 2009). Lower Accuracy Scores in the No-Go Trials show lower behavioural inhibition. Greater (slower) RTs are indicative of poor behavioural inhibition. Data were analysed using E-DataAid and E-Merge.

Figure 3.2

Example Stimuli in the Whack-A-Mole Task

Go-stimulus No-Go stimulus Go-stimulus No-Go stimulus Go-stimulus

Note. The child has to press the game controller button when the Mole (Go stimulus) appears on the screen and not press the button when the Veggie (No-Go stimulus) appears on the screen. Throughout the activity, the Mole would attempt to trick children into different disguises.

Stroop Colour and Word Test. A paper-pencil child version of the widely used Stroop Colour and Word Test assessed interference control (Golden, 1978). *Interference control* is an inhibitory control process and describes one's ability to inhibit cognitive interference that takes place when the processing of a certain aspect of a stimulus influences the simultaneous processing of another aspect of this stimulus (Scarpina & Tagini, 2017). Children with ADHD-related characteristics exhibit frequently lower interference control than their non-ADHD peers when performing the Stroop Colour and Word Test (Cao et al., 2013; Mullane et al., 2009; Savitz & Jansen, 2003). A paper-pencil version of the Stroop test was administered to incorporate both paper-pencil and computerised tasks. The Stroop and Simon are easily applicable tasks and, when combined, could result in a better understanding of children's interference control.

The Stroop test has three pages, and each page consists of 100 items presented in five columns of 20 items. The Word Page includes 100 words printed in black, the Colour Page consists of 100 items, all written as XXXX strings and printed in different colours. The Colour-Word page comprises 100 words derived from the Word Page and printed in the colours of the Colour Page. Each child receives a booklet including all three pages and reads one page at a time. Instructions are given and one or two examples are provided to ensure that children understand the task rules. On the Word page, children read as many black-and-white words as they can, while on the Colour page they name the colours of the XXXX strings. Finally, for the Colour-Word page children name the colour ink of the words rather than the name of the words (Colour Word scores). In this incongruent condition, the child performs a less automated and well-learnt action (name the colour ink of the words) and inhibits the cognitive interference occurring by a more automated and prepotent response (read the words). The task duration is 4 min approximately.

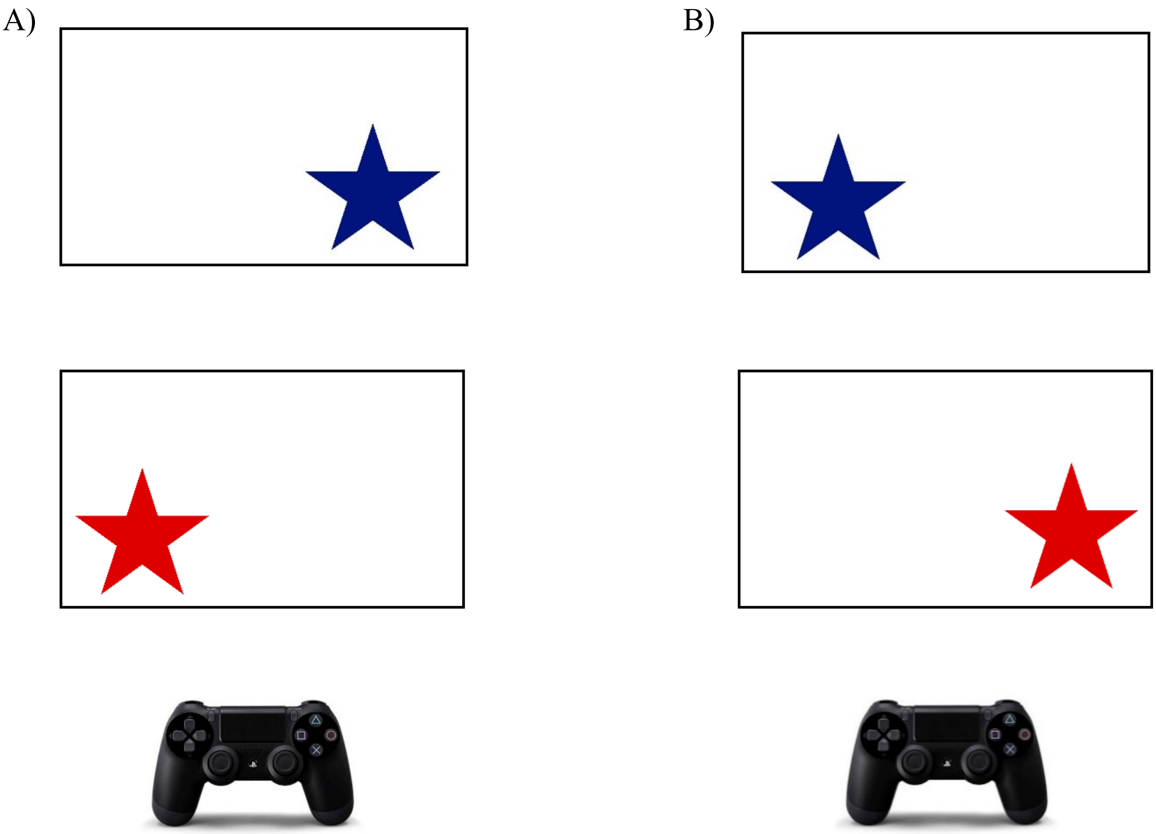
Two different methods are usually applied to calculate total scores across each condition: a) total time needed to read correctly all the items of each page and b) number of items named correctly in each card within 45 s (Golden's version, 1978). The latter method has been commonly used (Lansbergen et al., 2007), and thus applied in the pilot study. After confirming that children had familiarised themselves with the task through practising two example words, each child had 45 s to go through each page and read as many items as they could. Raw scores for total Word (W), Colour (C), and Colour-Word (CW) scores were obtained and T-scores were calculated at the end, derived from means and standard deviations by age. Age norms are typically used to examine whether a child's performance differs from the one expected in this developmental stage. In Jensen's study (1965) test-retest reliability gave values of .88, .79, and .71 for Word, Colour, and Colour-Word raw scores respectively. In Golden's study (1975), these reliabilities were .86, .82, and .73 respectively for individual administration supporting the high reliability of the measure.

Simon Task. The Simon Task is a well-established non-verbal computerised task that measures *interference control* in children with and without ADHD (Mullane et al., 2009; Simon, 1990). This task has several advantages. First, the Simon task paradigm builds on the well-validated Attention Network Theory (Posner & Petersen, 1990), which describes three central neural networks of attention and views interference control as one of the central functions of the executive network, associated with the inhibition and control of goal-directed behaviour. This measure offers more quantifiable, experimentally manipulated, and valid data about interference control in terms of RTs and Accuracy. It does not require any verbal response or ability to read, which minimises any confounding effects due to poor verbal skills.

In this study, a computerised version of the Simon Task (Simon & Wolf, 1963) was conducted using E-Prime (version 2.0; Schneider et al., 2002; 2007). This version was designed by Naeem et al. (2018). The task was presented on a laptop computer with a game controller connected to the laptop. Each trial starts with a fixation cross (+) in the middle of the display, which appears for 500ms and then is followed by a blue or red star. Stars are presented for 1000 ms. The child should press the blue button on the right side of the controller (see Figure 3.3) when a blue star is presented on the right corner of the computer screen (congruent trial). Contrariwise, they should press the red button on the left side of the controller, when the red star is presented on the left side of the screen (congruent trial). In the meantime, both blue and red stars are presented on the left and right sides of fixation on the computer screen (incongruent trials). Children should press the corresponding button as quickly and accurately as possible, irrespective of the position of stars on the screen. Children receive one point when they press the correct button and failure to respond to the stimulus within 1000 ms is recorded as an error. The task consists of 36 trials in total and involves 18 congruent and 18 incongruent trials. Blue stars and red stars are presented equal times (18 times). The task duration is 2 min approximately. Blue and red dot stickers were added on the corresponding game controller buttons to ensure that instructions are clear to the children. RTs are expected to be faster when the task-relevant stimulus is presented in the expected location (when the star is presented on the right side of the location rather than the opposite side). Data were analysed using E-DataAid and E-Merge. Accuracy scores and RTs during accurate trials (both congruent and incongruent) were calculated to check the correlations between the Simon task and the other measures.

Figure 3.3

Congruent and Incongruent Trials in the Simon Task



Note. In congruent trials (see Example A), the child has to press the blue button, when the blue star is presented on the right side of the screen, whereas press the red button when the red star is presented on the left side of the screen. In incongruent trials (see Example B), blue and red stars are displayed on the opposite side of the screen.

AULA: Advanced Virtual Reality Tool for the Assessment of Attention. Virtual reality tasks are of high ecological validity and reliable tools to analyse the cognitive profiles of children, as they enable one's dynamic interaction with a three-dimensional environment, similar to their real environment while manipulating real-world stimuli and distractors (Bioulac et al., 2012; Iriarte et al., 2016). The Nesplora AULA team developed the AULA as an aid for the ADHD diagnosis, previously testing this with children with and without ADHD (Díaz-Orueta et al., 2014). The AULA has been designed based on Sergeant's state regulation model, according to which a certain level of effort is needed to adjust to the cognitive demands of the environment and accomplish personal goals (Sergeant, 2000). In line with Barkley's theory (1997, 2012), children with ADHD are more likely to struggle with state regulation than their non-ADHD peers. In this study, the AULA secured more objective assessments of children's ability to sustain cognitive performance and was not used for clinical diagnostic purposes.

Children completed the AULA individually. Each child wore a set of 3-D virtual glasses with movement sensors. In the task, the child is placed in one of the classroom desks (see Figure 3.4) in a virtual reality classroom looking directly at the blackboard (student perspective). All tasks are explained by a virtual teacher. Before testing, the child has 2 min approximately to familiarise themselves with the evaluation setting and the AULA equipment (VR headset and Flic button) performing a short task, in which they pop four balloons by pressing the button. According to the AULA developers, this task also controls for the child's excitement triggered during a novel task (Iriarte et al., 2016). The task duration is 20 min.

The AULA comprises two different paradigms i) a No-X paradigm, in which children press the button when they do not see or hear the word 'apple', and ii) an X paradigm, in which children press the button when they see or hear the number 'seven'. Children see a blank blackboard in between presentations of the visual stimuli. The No-X paradigm precedes the X exercise as the former is expected to trigger an overstimulating state leading to more imprecise answers, whereas the latter generates more hypoactive activity with slow and inaccurate answers. This task sequence may better reflect a child's difficulty in regulating attention to adjust to novel situations after having experienced previously an overstimulating state (Díaz-Orueta et al., 2014). During both paradigms, stimuli are presented in the visual and auditory domains at equal frequencies (see Table 3.1), and simultaneously randomised distractors (visual and auditory) occur on 50% of trials, again presented in both sensory modalities. Distractors are similar to those occurring in real classrooms, such as classmates talking with each other and teacher walking in the room

Table 3.1

Visual and Auditory Stimuli in AULA

	Auditory	Visual	Auditory	Visual
1	tree		five	5
2	bottle		six	6
3	book		seven	7
4	apple		eight	8
5	cake		nine	9

Note. Table reproduced based on the paper of Iriarte et al. (2016).

Figure 3.4

Example Pictures of the AULA Evaluation Setting (A) and Testing Environment (B)

A)  B) 

The AULA generates direct raw scores for 54 variables; however, the pilot study used only Omission errors (sustained attention) and Commission errors (behavioural inhibition/impulsivity), variables, which were also assessed by the rest of the pilot study measures. Omission errors occur on trials in which children are required to respond to the target, but they do not respond to this. Greater Omission errors are indicative of poorer sustained attention. Commission errors occur when children respond to a stimulus on trials, in which they should not respond. Greater Commissions are indicative of lower behavioural inhibition/impulsive control.

The AULA has several advantages over other measures that focus particularly on one sensorial modality such as the Conners' Continuous Performance Test[23] ([CPT], Conners, 1994) or include both sensorial modalities, but lack in ecological validity including the Integrated Visual and Auditory Continuous Performance Test (IVACPT). Assessments such as the Test of Everyday Attention for Children (TEA-Ch) also lack in ecological nature (Manly et al., 1998), as they do not measure inattention and hyperactivity/impulsivity in realistic everyday situations. These measures are informative and have been tested widely with children; however, the AULA provides a more robust measure that also does not require any additional reasoning or language skills that could interfere with ADHD assessment. A further advantage of the AULA over the parent, teacher, and self-reports is that this provides separate scores for inattention (Omission errors) and behavioural inhibition/impulsive control (Commission errors), allowing to distinguish between the two constructs.

Studies testing AULA have shown that 93.5% of children are classified correctly as having ADHD (Nesplora AULA, 2018). The task has shown a sensitivity of 95.2 % and specificity of 91.8 % that suggests excellent diagnostic power (Rufo-Campos et al., 2012). Test-retest reliability in an ADHD sample with a 1-week interval has been secured with no

[23] A latest version enables the Conners CPT 3 task to be used in conjunction with the Conners Continuous Auditory Test of Attention.

differences between the first and second AULA data (Fernández –Fernández et al., 2012). Using discriminant analyses, Areces et al. (2018) found that 76.1% of children were classified correctly (66% from the control group and 89.5% from the ADHD group) based on Omission errors. Convergence with the CPT of Conners has also been significant ($p < .01$ and $p < .05$), r ranging between 0.6 and 0.8 in a sample of 57 children with ADHD (Díaz-Orueta et al., 2014). Therefore, the AULA serves as a reliable and robust measure to extract more ecologically valid data about child cognitive performance.

Conners 3rd Edition-Parent (Conners 3-P), Teacher (Conners 3-T), and Self-Report (Conners 3-SR) Rating Scales (Short Version). Parents, teachers, and children completed the short version of the Conners 3 rating scales (Conners, 2008), each of which includes 11 items on inattention and hyperactivity/impulsivity for use with young people aged 6 to 18 years old (see Appendix A). Conners 3 scales are well-cited informative tools that incorporate the DSM diagnostic checklist. The scales include items scored on a 4-point Likert-type scale. High scores suggest increased inattention and/or hyperactivity/impulsivity. More specifically, 0 represents a response of *not at all*, 1 a response of *just a little true*, 2 a response of *pretty much true,* and 3 a response of *very much true*. Raw scores are converted into T scores and age and gender are considered for improved accuracy.

The Conners 3 scales have high reliability and validity (Conners et al., 2003). The Conners 3 measure has been tested with a large representative normative sample of 3.400 young people in the U.S. and Canada, including 50 boys and 50 girls from each age group (6-18 years old for the Parent and Teacher group, 8-18 years old for the Self- Report) and various racial/ethnic backgrounds (Conners, 2008). Drawing on research by Gallant et al. and Gallant, internal consistency (Cronbach's alpha) gave a value of .91, .94, and .88 for the Parent, Teacher and Self-Report scales (long version), respectively; 2-to 4-week test-retest reliability coefficients (Pearson's r) gave a value of .85, .94 and .88 for the Parent, Teacher and Self-

Report scales respectively; inter-rater reliability was assessed using correlations between Parent and Teacher reports and ranged between .70 and .84 (as cited in Kao & Thomas, 2010). These scores indicate the high reliability of the Conners 3 scales. Validity of the measure has been confirmed through factorial analytic techniques and the convergent and divergent validity was confirmed with other measures such as the Achenbach System of Empirically Based Assessment (*r* ranged between .72 and .96) and the Behaviour Rating Inventory of Executive Functioning (*r* ranged between .76 and .92) (Kao & Thomas, 2010). The overall discriminative validity is also good (72.92% for Self-Report, 75.59% for Teacher Report, and 77.61% for the Parent Report) suggesting that this measure can discriminate effectively between children with and without ADHD. Izzo et al. (2019) reported values ranging from .84 to .94 for the Teacher scale (short version) confirming the high reliability of the measure.

Stories, Reading Comprehension Questions, and Scoring. Two short stories, written by Fridkin (2018) and matched for word length and difficulty level, assessed reading comprehension. The selection of Fridkin's stories was strategic as these stories are age-appropriate and have been applied previously with children (Cheng, 2017; Fridkin, 2018). The two stories were tested through an online readability formula tool (readabilityformulas.com) that assigned both stories at Grade Level 5, a reading age of 8 to 9 years old and an 'easy to read' text difficulty level (see Appendix B for a list of the 7 formulae included in this tool). In Fridkin's study, teachers' suggestions were also sought to assess the difficulty level of the stories. Story A (Wishing on a Star/A Snowy Adventure) included 682 words and 7 images, while Story B (Just Another Ordinary Day/Something's Going On) comprised 627 words and 7 pictures. The two stories were similar in structure to ensure that any differences across the two conditions would be explained by choice (motivation) rather than story characteristics.

Eleven reading comprehension questions were developed by Fridkin (2018) using Key Stage 2 Statutory Assessment Tests (SATs) as a model and included literal and inferential questions. In Fridkin's study, internal consistency for the 11 questions of Story A gave a Cronbach's value of .54 and a value of .73 for the 11 questions of Story B. Adjustments were made to these questions, and five more questions were added and tested by Fridkin and Hurry's Master's students (Cheng, 2017), showing an internal consistency of .78 for Story A and .73 for Story B. A set of 16 questions was previously developed with a total of 19 questions for each of the stories. Both stories included multiple-choice and open-response questions (see Appendix C). The comprehension questions were scored based on whether the children had provided a correct answer. One point was awarded for each correct answer and where the answer was missing or was incorrect, no point was awarded. For one of the questions for both stories, children had to choose three correct answers by ticking three boxes. A maximum of three points was awarded for this question. If more than three answers were ticked, one point was deducted for each incorrect answer. For example, if a child chose five answers and three were correct, then only one point was awarded. The maximum score was 19.

Titles, Prologues, and Child Reviews. Similar to Fridkin's study (2018), four titles, four prologues, and four short story reviews, two for each story, developed by Fridkin were used in the Choice condition. The child reviews gave generic positive story reviews without sharing any plot information. The titles, prologues and child reviews were used as the means of enabling perceived choice during the reading task. The reviews were written based on children's comments in Fridkin's pilot study. The reviews were similar in word length and structure. Two reviews were attributed to boys and two reviews were attributed to girls. The use of child reviews could help increase task meaningfulness by giving children the opportunity to read story reviews made by other children of their age.

The 'Story Enjoyment/Interest' Scale. Children rated the story they had just read via a 14-item Likert scale. This scale was an adapted version of Fridkin's (2018) enjoyment questionnaire and was administered to check its reliability. The format of the questionnaire was similar to the format of the empirically validated Motivation for Reading Questionnaire (MRQ) designed by Wigfield and Guthrie (1997). The format ranged from 1= *very different from me* to 4= *a lot like me*. Items 3, 4, 6, 7, 8 were reverse coded. High total raw scores indicated high enjoyment (scores on the scale were summed for each child across both conditions). The scale included items on enjoyment ('I really enjoyed this story') and interest ('I was interested in what was going to happen'). Enjoyment and interest have been considered as two closely related, but distinct motivational constructs (Ainley & Hidi, 2014). *Interest* motivates exploration and novelty seeking, whereas *enjoyment* refers primarily to the feelings of satisfaction experienced during an activity. For the measurement of interest, behavioural indicators such as understanding ('The questions were easy to answer') and voluntary engagement ('I would like to read more stories like this') were explored (Renninger & Hidi, 2016). Direct statements were also included ('This story was boring').

3.1.1.3 Design

A repeated measures design tested the difficulty level of the two stories. Children were randomly assigned to the Choice (experimental: motivation) or No Choice condition (control: no motivation). All children read both stories and experienced both conditions by the end of the pilot study. A crossover counterbalanced design was not employed, as the aim was to test the difficulty level of the stories rather than address the experimental aims and hypotheses.

3.1.1.4 Procedure

The study took place across five days. During the first school visit, children completed the No Choice condition (control) first and the Choice condition (experimental) after one week. Children received Story A (two versions) in the Choice condition and Story B in the No Choice condition. The stories were administered in children's regular classroom during a morning session. In the Choice condition, children received two A4 envelopes. Each envelope included a story. The number of stories was restricted to two as the unlimited choice could be burdensome and, thus, demotivating (Clark & Phythian-Sence, 2008). Stapled to the front of the envelope each child found a different cover page for each story, a different prologue for each story, and two different child reviews (see Appendix D). The choice was perceived; the actual stories inside the envelopes were the same, though with different titles, prologues, and reviews. Children had 5 min to choose their story. Further information about the rationale behind decisions related to the main study design is provided later.

Once children chose their story in the Choice condition, they placed the rejected story on the floor and opened the envelope with their preferred story. There was a full version of the chosen story and a set of comprehension questions inside the envelope. Children read the story and answered the questions within 45 min. They were reminded that they should work individually and could refer back to the story while answering the questions. In the No Choice condition children were assigned one of the two stories. Again, they read the story and answered the questions within 45 min. The procedure followed in the No Choice condition was identical to that of the Choice condition, except for the part of the story selection. In both conditions, after the completion of the reading tasks, children completed the 14-item 'Story Enjoyment/Interest' scale to assess whether they enjoyed the story they had just read. At this stage, children were read aloud the scale items and rated their story.

The ADHD-related measures were administered individually in a quiet schoolroom during morning or afternoon sessions. Children completed these measures across the five dates, before or after the completion of the reading tasks. Before individual testing, child verbal consent was ensured, and study aims/instructions were discussed. No request for withdrawal was made. Due to time constraints and the need to test all measures, half the children performed the AULA (Díaz-Orueta et al., 2014). The other half completed the rest of the behavioural tasks including the Stroop Colour and Word test (Golden, 1978), the Simon Task (Simon, 1990), the Spot-the-Difference Task (Cheng, 2017), and the Whack-A-Mole

Task (Casey et al., 1997). Individual testing lasted 25 min approximately. Further to this, I administered the Conners 3 Self-Report (Conners, 2008) in the classroom reading aloud the items, while children were completing this individually. Parent and Teacher Reports (Conners, 2008) were collected before, during, or after the study (up to 1 month after its completion). The pilot study ran smoothly, and no ethical issues were reported. Ethical issues for Study 1 (pilot and main) are discussed in Chapter 4. Table 3.2 presents the pilot study schedule.

Table 3.2

Pilot Study Schedule

Day	Procedure
Day 1	Collection of the Conners 3 Parent and Teacher scales
	Individual administration of the behavioural tasks (morning/afternoon)
Day 2	Classroom administration of the story 'Just Another Ordinary Day' and 'Story Enjoyment/Interest' scale in the morning (No Choice)
Day 3	Individual administration of the behavioural tasks (morning/afternoon)
Day 4	Individual administration of the behavioural tasks (morning/afternoon)
Day 5	Classroom administration of the story 'Wishing on a Star/ A Snowy Adventure' and 'Story Enjoyment/Interest' scale in the morning (Choice presented one week after No Choice)
	Classroom administration of the Conners 3 Self-Report (morning)

3.1.2 Summary of Results and Discussion

Regarding the internal consistencies of the two stories, Cronbach's alpha gave a value of .72 for Story A and a value of .67 for Story B. These values showed moderate-to-good reliability, given the small number of items (Koo & Li, 2016). Due to the data not being normally distributed, the small sample size ($N \leq 30$), and the presence of three outliers for reading enjoyment, the non-parametric Wilcoxon Signed Ranks Test compared reading comprehension and enjoyment scores across the two stories. There was no significant difference in reading scores between Story A, *Mdn* = 9.00 and Story B, *Mdn* = 8.00, $Z = -1.86$, $N = 16$, $p = .062$, $r = 0.5$. Therefore, the stories were of similar difficulty level. There was a significant difference in the reading enjoyment scores between the two stories, such that for Story A, *Mdn* = 41.50, whereas for Story B, *Mdn* = 35.50 $Z = -2.15$, $N = 16$, $p = .032$, r[24] = 0.13. Children enjoyed reading better during Story A than Story B. However, due to the lack of a cross-over counterbalancing design, it is difficult to conclude whether this significant difference in reading enjoyment scores was due to Story A being perceived as more interesting than Story B or due to children being motivated more by choice when reading Story A than not being motivated while reading Story B. Administration of both stories during a No Choice condition or use of a cross-over design could have allowed mitigating this limitation.

The internal consistency for the 'Story Enjoyment/Interest' scale gave a value of .60 showing moderate reliability. Further amendments were made to this scale during the main Study 1. In the pilot study, Cronbach's alpha gave a total value of .62 for the Self-Report, a value of .87 for the Parent Report, and a value of .96 for the Teacher Report. For the inattention scale, Cronbach's alpha gave a value of .34 for the Self-Report, a value of .88 for the Parent Report, and a value of .93 for the Teacher Report. Finally, regarding the hyperactivity/impulsivity scale Cronbach's alpha had a value of .47 for the Self-Report, a value of .51 for the Parent Report, and a value of .89 for the Teacher Report. These values indicate moderate-to-excellent reliability for the Parent/Teacher Report and inattention/hyperactivity scales, but poor-to-moderate reliability for the Self-Report and inattention/hyperactivity

[24] Throughout the thesis, Rosenthal's *r* statistic (Rosenthal, 1991) was applied as a measure of effect size for the non-parametric analyses and partial-eta squared η_p^2 was used to report effect size in repeated measures ANOVAs. Rosenthal's *r* statistic is calculated using the formula $r = Z/\sqrt{N}$ (Rosenthal, 1994). Effect size using the Rosenthal's *r* statistic is interpreted based on the Cohen's guidelines (1988). Therefore, effect size is small as $\eta_p^2 = 0.01$ (Rosenthal's $r = 0.10$), effect size is medium as $\eta_p^2 = 0.06$ (Rosenthal's $r = 0.30$) and effect size is large as $\eta_p^2 = 0.14$ (Rosenthal's $r = 0.50$).

scales[25]. The poor-to-moderate reliability of the Self-Report suggests that some children may have not fully developed the metacognitive ability to reflect accurately on the abstract constructs of inattention and hyperactivity/impulsivity.

Table 3.3 presents the correlations between the variables. In general, weak-to-strong correlations were observed. These results were in line with previous research reporting inconsistencies across the ADHD-related measures (Sims & Lonigan, 2012). These correlations should be interpreted with caution, however, due to the small sample size. Moderate but non-significant correlations were reported between the AULA inattention variables and the Conners 3 scales, except for the correlation between self-reported inattention and commissions. A possible explanation for these results is that AULA is a measure of task-specific performance, while the Conners 3 scales are observational scales that explore cognitive functioning retrospectively and ADHD-related characteristics more broadly (Díaz-Orueta et al., 2014). Despite such inconsistencies, Conners 3 scales and AULA were selected for use in the main study as these measures could complement each other and help identify children with ADHD-related characteristics. In the main study, only the Parent and Teacher scales were administered as the Conners 3 Self-Report showed moderate internal consistency (a = .62) in total and poor internal consistency for the inattention and hyperactivity/impulsivity scales separately.

Significantly strong correlations were found between the Simon Task and the Whack-A-Mole variables. The Stroop Test correlated well with the Simon Task and the Conners 3 Teacher Report. The Spot-the-Difference Task showed relatively weak correlations with other measures including the Conners 3 scales. Such weak correlations may have been because the Spot-the-Difference Task was not standardised, or as well-validated, as the other measures and therefore did not serve as a good measure to assess attention. This task may be a less crystallised

[25] Reliability values taken as: <.50 = poor; .50-.75 = moderate; .75-.90 = good; >.90 = excellent (Koo & Li, 2016).

measure of attention as it does not control for other cognitive components including working memory and visuospatial processing.

Table 3.3

Bivariate Correlations Among Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Reading comprehension_ No Choice																			
2. Reading enjoyment_ No Choice	**.57***																		
3. Reading comprehension_ Choice	**.62****	.47																	
4. Reading enjoyment_ Choice	.39	.20	.11																
5. Visual attention_ Spot- the-Difference	-.01	-.09	.20	.30															
6. Interference_ Stroop	.49	.28	**.84****	.53	.49														
7. Interference (Accuracy)_ Simon	**.71***	-.03	.26	**.91****	.05	.38													
8. Interference (RT)_ Simon	-.32	-.33	-.06	**-.38**	**-.75***	**-.69***	-.29												
9. Inattention (Omissions)_ AULA	**-.79***	-.63	-.37	.05	.[c]	.[c]	.[c]	.[c]											
10. Behavioural inhibition (Commissions)_ AULA	.16	.03	-.67	.43	.[c]	.[c]	.[c]	.[c]	-.07										
11. Inattention_ Teacher Report	**-.73****	-.24	**-.64****	-.49	-.11	**-.66***	**-.88****	.28	.50	.20									
12. Hyperactivity_ Teacher Report	-.23	**-.50***	**-.62***	-.10	-.06	-.53	.05	.14	.18	.12	.34								
13. Inattention_ Parent Report	-.39	.03	**-.62***	-.15	.08	-.38	-.49	.02	.23	.44	**.63****	.42							
14. Hyperactivity_ Parent Report	.04	.04	-.39	.14	-.37	-.23	.02	-.43	-.44	-.31	.17	.33	**.60***						
15. Inattention_ Self-Report	**-.53***	-.48	**-.73****	-.19	.0	-.51	-.45	.30	.11	**.71***	**.56***	**.45***	**.68****	**.66****					
16. Hyperactivity_ Self-Report	.25	-.49	.16	-.02	.21	.25	.42	.30	-.55	.0	-.30	.19	-.38	-.10	-.21				
17. Inattention (Accuracy)_ Go Trials	**.73***	.09	.31	**.78****	.05	.29	**.88****	-.05	.[c]	.[c]	**-.75***	.16	-.47	.03	-.52	.46			
18. Inattention (RT)_ Go Trials	**-.70***	-.27	-.52	**-.82****	-.6	**-.66***	**-.70***	.54	.[c]	.[c]	**.72***	.06	.32	.25	.56	-.24	**-.75***		
19. Behavioural inhibition (Accuracy)_ No-Go Trials	.23	.04	.36	.10	**-.64***	.15	.30	.18	.[c]	.[c]	-.46	-.45	-.67	-.01	-.38	.28	.24	.20	

Note. $N = 16$ for the reading tasks. $N = 22$ for the behavioural tasks and Conners 3 scales. Half children performed the AULA and the other half the rest of the tasks. Parent and teacher scales were completed for all children. Raw scores are provided for the Reading tasks, the Spot-the-Difference Task, the Simon Task, the AULA, and the Whack-A-Mole Task. For the Stroop Test, raw Colour Word scores were converted into T scores based on age. For the Conners 3 scales, raw scores were converted into T scores based on age and gender. Significant correlations are marked in bold. * $p < .05$. ** $p < .01$ (two-tailed).

.[C] Correlations cannot be computed, because at least one of the variables is constant. Half children took part in the AULA and the other half completed the rest of the behavioural tasks.

3.1.3 Implications for the Main Study and Conclusion

The pilot study provided an opportunity to test the overall procedures and examine the internal consistency of the two stories as well as the associations between the ADHD-related measures. Results informed decisions around measure selection in the main study.

The two stories showed moderate-to-good internal consistency and did not differ significantly in terms of comprehension. Thus, the two stories were similarly administered in the main study. Further slight adjustments were made to the ‘Story Enjoyment/Interest’ scale as explained in Chapter 4. It was decided to administer the Stroop Colour and Word Test, the Simon Task, the AULA, and the Conners 3 Parent and Teacher Reports in the main study and omit the Spot- the- Difference Task, the Whack-A-Mole Task, and the Conners 3 Self-Report.

The Stroop Test showed good correlations with other measures such as the Simon Task and Conners 3 scales. The Simon Task, rather than the Whack-A-Mole Task, was selected to measure interference control in the main study to limit the test burden. The tasks measured similar skills and correlated well with each other. As mentioned earlier, half children performed the AULA and the other half the rest of the behavioural tasks due to time constraints. As a result, it was not feasible to check for any associations between similar constructs in AULA (e.g., Commission errors) and the other behavioural tasks (e.g., Accuracy Scores in No-Go Trials in the Whack-A-Mole Task). Nevertheless, the AULA was selected for use in the main study as this proved to be a relatively easy measure to apply with children. The AULA also represents a more ecologically valid measure that can separate easily between inattention and behavioural inhibition/impulsivity, as indicated by the weak associations between Omission and

Commission errors in the pilot study. Considering that the primary focus of the main study has been on inattention, the use of the AULA could also help distinguish more reliably between the two main ADHD constructs of inattention and behavioural inhibition/impulsivity.

The Conners 3 Parent and Teacher Reports showed good-to-excellent internal consistency, however, the Self-Report showed poor internal consistency, and thus it was not further employed. The Spot-the-Difference Task was dropped from the main study as this showed relatively weak correlations compared with the other measures. Further to this, it became apparent that many children of the pilot study were familiar with similar tasks, and such familiarisation could make it difficult to control for practice effects. Overall, the selection of the measures in the main study was led by a range of factors such as the need to reduce the test burden, to assess major constructs, the internal consistency of the measures, and their inter-correlations. Table 3.4 shows the ADHD-related measures employed in the pilot and main studies.

Table 3.4

Measures of ADHD-related Characteristics in the Pilot and Main Study 1

Behavioural tasks and rating scales	Pilot study	Main study
Spot-the-Difference Task	✓	
Whack-a-Mole Task	✓	
Stroop Colour and Word Test	✓	✓
Simon Task	✓	✓
AULA	✓	✓
Conners 3 Parent Report	✓	✓
Conners 3 Teacher Report	✓	✓
Conners 3 Self-Report	✓	

3.2 Main Study

3.2.1 Method

3.2.1.1 Participants

Using the G* Power 3.1 software, an a priori analysis showed that a minimum sample of 42 children was necessary to report medium effects (η_p^2 = 0.06) and significant interactions between Choice and ADHD-related variables (e.g., inattention) at a power (alpha) of .05 (Faul et al., 2007). Children who attended mainstream primary schools and did not hold an ADHD diagnosis were only included in the study. Children were recruited from six classes of two mixed primary community schools in London (simple random sampling technique). One school was a two-form entry school and the other was a four-form entry school. Both schools were rated as 'Good' based on the most recent Ofsted report.

The study began in December 2017 and lasted until January 2019. Information letters and opt-in consent forms were sent to parents/carers, via teachers (see Appendix E). Children who did not return a signed consent form completed only the whole-classroom activities to minimise the likelihood of children feeling marginalised, but their data were not processed and included in the study. One-hundred and nineteen Year 4 children (62 boys, 57 girls) returned their parent/carer letters and agreed to participate in the study (*M* age = 8.88 years, *SD* = 0.34). Eleven children (6 boys, 5 girls) were excluded as they received an Education, Health and Care plan (EHC)[26] or Special Education Needs (SEN) support. Out of these 11 children, no child had a diagnosis of ADHD, but no further information was sought about the diagnoses of these children. Children were not further excluded based on their baseline scores at the New Group Reading Test (e.g., NGRT below 1 *SD*), as the primary aim was to examine whether reading

[26] An EHC is for children and young people aged up to 25 who need more support than is available through special educational needs support. Since September 2014, the EHC plan has replaced SEN statement. Contrary to the SEN statement, the EHC Plan covers not only the young person's educational needs, but also their needs in health and care. Typically, the primary type of needs for students with SEN statement or EHC Plan is autism and moderate learning difficulties.

comprehension and enjoyment would improve with choice provision. As reported later, considering the association between some Attention variables and the NGRT, it was likely that by excluding children with poorer reading performance (as indicated by lower NGRT scores) I could have ended up excluding children with ADHD-related characteristics, who represented the primary sample of the study. Nevertheless, such a decision may have also led to include children with severe reading comprehension difficulties (NGRT data were normally distributed though), which could interfere with the outcomes of the reading intervention. To minimise this likelihood, teachers' suggestions were sought before the reading intervention.

Overall, the final sample consisted of 108 Year 4 children (56 boys, 52 girls) recruited from six classes of two mixed primary community schools in London (*M* age = 8.89 years; *SD* = 0.34). Year 4 children were sought as reading motivation and enjoyment were reported to decline towards the end of the primary phase (Sainsbury & Schagen, 2004), and therefore children of this age may benefit more from motivational choice. In addition to this, most studies explored choice effects on potential outcomes with middle school, college students, and adults (Flowerday & Schraw, 2003; Flowerday et al., 2004; Patall, 2013). Here, I investigated whether choice would benefit similarly the learning of children (Fridkin, 2018). ADHD-related characteristics were assessed through behavioural tasks and rating scales. Teachers provided information about child ethnicity, EHCP/SEN status (yes or no format), English as an Additional Language (EAL) (yes or no format), eligibility for free school meals (yes or no format), and pupil premium (yes or no format). The collection of this information was not initially feasible for one classroom (*N* = 17) that was tested in the summer term, due to the main teacher's leave. This information was requested by the new teachers at the beginning of the new school year. Demographic information for participants is presented in Table 3.5.

Table 3.5

Demographic Characteristics of the Final Sample in Study 1[a]

Baseline characteristic	*N*	*% total*
Gender		
Boys	56	51.9
Girls	52	48.1
Total	108	
Ethnic group		
White group	25	23.1
Asian group	20	18.6
Black group	39	36.1
Mixed	6	5.6
Other Ethnic group	6	5.6
Refused	1	.9
Missing	5	4.6
Total	108	
Eligibility for free school meals		
Yes	13	12
No	90	83.3
Missing	5	4.7
Total	108	
Pupil premium		
Yes	18	16.7
No	85	78.7
Missing	5	4.6
Total	108	
English as an Additional Language		
Yes	53	49.1
No	52	48.1
Missing	3	2.8
Total	108	

Note. Information was provided by teachers. Children were grouped into five ethnic groups (White, Asian, Black, Mixed, and Other Ethnic group) according to the 2011 Census report that explores the development of ethnic group questions in England (Office for National Statistics, 2012). The 'Refused' category refers to parents ($N = 1$) who refused to provide information about their child's ethnicity. The 'Missing' category refers to missing data. Information about eligibility for free meals ($N = 5$), pupil premium ($N = 5$), ethnicity ($N = 5$), and EAL status ($N = 3$) was not collected for the children who had moved to a different school with the new school year.

[a]$N = 108$

3.2.1.2 Measures

The New Group Reading Test (NGRT). Children completed the 2A form of the NGRT, which provides a standardised measure of baseline reading (Burge et al., 2010). This 48-item form has been designed for children between Year 2 (6 to 7 years old) and Year 4 (8 to 9 years old) and explores various components of reading comprehension including vocabulary, grammatical knowledge, inference-making, and deduction skills. The NGRT test includes two sections (see Appendix F). The first section comprises 20 sentence completion items in a multiple-choice format, in which children select which word best completes the sentence. The second section includes three passages with 9 or 10 multiple-choice reading comprehension questions. Based on the NGRT manual, children have 45 min approximately to answer the questions. The maximum score is 48. Raw scores were converted to standardised scores by age ($M = 100$, $SD = 15$). Cronbach's alpha was previously reported to be above 0.9 for both test sections ensuring high reliability (GL Assessment, 2018). Validity can be demonstrated based on the high internal consistency and test-retest correlations reported previously ($r = .85$, GL Assessment, 2018). In the present study, Cronbach's alpha gave a value of .91, ensuring the effectiveness of this measure to assess reading ability.

The NGRT controls for factors irrelevant to reading, such as writing, through the use of a multiple-choice format that enables the efficient assessment of the construct of reading (Fridkin, 2018; William, 2008). The multiple-choice format also minimises the possibility of researcher bias and ensures standardised and accurate marking. Unlike other measures that require individual administration such as the York Assessment of Reading for Comprehension

(YARC; Snowling et al., 2012), the Gray Oral Reading Test - Fifth Edition (GORT-5; Bryant & Wiederholt, 2011) and the Woodcock Reading Mastery Tests - Third Edition (WRMT-III; Woodcock, 2011), the NGRT can be administered both individually and in groups making it a timesaving and easy to apply measure in classroom.

The Adapted Version of the Motivation for Reading Questionnaire (MRQ). An adapted version of the widely used MRQ measured baseline reading motivation (Wigield & Guthrie, 1997). The original version consists of 54 items and explores 11 dimensions of reading motivation including reading efficacy, challenge, curiosity, involvement, importance of reading, reading work avoidance, competition for reading, recognition for reading, reading for grades, social reasons for reading, and compliance. As part of the implementation of the Concept-Oriented Reading Instruction programme (CORI), the researchers tested the MRQ with large and diverse samples of children aged 7 to 10 years old (Guthrie et al., 2004; Guthrie et al., 2007b; Wigfield & Guthrie, 1997). The reliability for all the items ranged between .43 and .81 (Guthrie et al., 2004; Guthrie et al., 2007b; Wigfield & Guthrie, 1997). Work avoidance and reading for grades showed different reliabilities at different time points, however, for all the other aspects consistent reliabilities were reported ranging from .52 to .81. Construct validity was also reported (Wigfield & Guthrie, 1997) and the majority of associations between the reading motivation dimensions were positive and varied from low to moderately strong, except for work avoidance which showed negative associations with all the motivation scales apart from the competition. Unrau and Schlackman (2006) later administered the MRQ in a large sample of middle school readers to test the validity of the measure. A confirmatory index (CFI) of .90 showed a relatively good model fit, proving the high validity of the measure.

In the present study, a revised 38-item version with two practice questions modified by Fridkin (2018) was administered. This adapted version was selected to decrease the number of items and make these more readily intelligible to children in British schools (see Appendix G).

In addition, this included only those items that were relevant to the study (e.g., intrinsic motivation including challenge) excluding items that explored solely extrinsic motivation. The response format ranged from 1= *very different from me* to 4= *a lot like* me. Total scores were computed using the sum of the items. Six items made negative statements related to reading and were reverse coded. Similar to Fridkin's study, Cronbach's alpha in this study gave a value of .86 that indicated good-to-excellent reliability. Internal consistency was moderate for some sub-scales (a ≤ 75, see Appendix H). Concurrent validity was ensured through checking the association between the MRQ and the enjoyment/interest scale in the No Choice (control) condition, which showed a moderate positive association, $r(103) = .51$, $p < .001$ (Cohen, 1988).

Stroop Colour and Word Test. The paper-pencil version of the Stroop Colour and Word test (Golden, 1978) measured Interference control. In the pilot study, I calculated accuracy and RTs in accurate trials to assess Interference. However, in the main study, I measured Interference scores using a different empirically validated method. A standard method to measure Stroop interference is to calculate the difference score between the Colour and the Colour-Word raw scores. A low difference score suggests low Interference in the incongruent condition (Colour-Word condition). Golden's alternative scoring method has been adopted widely in literature (Scarpina & Tagini, 2017). Based on this method, I calculated the number of items read correctly in 45 s for the Word (W), Colour (C), and Colour-Word (CW) conditions. The Predicted Colour-Word (Pcw) score was then calculated using Golden's formula (Pcw = [W × C] / [W + C]). The Interference score (I) was measured by subtracting the Pcw score by the actual number of items correctly named in the CW condition. A low Interference score indicates poor interference control.

Simon Task. The computerised version of the Simon Task (Simon & Wolf, 1963) designed by Naeem et al. (2018) was conducted using E-Prime (version 2.0; Schneider et al., 2002; 2007). The Simon Task measures Interference control (Simon, 1990). In the pilot study, I reported the Accuracy scores and RTs in accurate trials to check the correlations between the Simon Task and the other measures. Nevertheless, in the main study, I measured difference scores in Accuracy and RTs to assess Interference in line with previous research (Mullane et al., 2009). At the end of the Simon Task, the amount of Interference was measured by subtracting mean RTs in congruent trials by mean RTs in incongruent trials. Similarly, difference scores in Accuracy were also calculated to measure Interference. Large difference scores indicate weak Interference control. Difference scores could control for individual differences in speed of responding when RTs are the dependent variable.

AULA: Advanced Virtual Reality Tool for the Assessment of Attention. The AULA is a more ecologically valid measure of inattention, hyperactivity, and behavioural inhibition/impulsivity than the standard psychometric tests (Díaz-Orueta et al., 2014). In the present study, the same procedure was followed as in the pilot study. Total raw scores were extracted for six variables including Omission errors (inattention), Reaction Time (RT) (inattention), Reaction Time Variability (RTV) (inattention), Commission errors (behavioural inhibition/impulsive control), RT to Commissions (behavioural inhibition/impulsive control) and RTV to Commissions (behavioural inhibition/impulsive control). Omission errors occur when children have to respond to the target, but they do not. Commission errors occur when children respond to a stimulus, while they should not. RT (often defined as processing speed) refers to the time needed to answer a stimulus. RT is expected to be longer in inattentive children, because of slow information processing (Bolfer et al., 2010). RTV reflects occasional lapses in attention. These failures in sustained attention are not severe enough to produce omission errors (Tamm et al., 2012). Despite the inconsistency in findings, RTV is more strongly related to inattention than hyperactivity (Wahlstedt, 2009). RTV has been associated with weaknesses in word reading, reading fluency, and reading comprehension in children with ADHD (Tamm et al., 2014). RT and RTV were also measured when Commissions took place

(RT to Commissions and RTV to Commissions respectively). For Omission errors, Commission errors, and RT, activity is typically measured across six conditions: visual versus auditory condition, presence versus absence of distractors, X versus No-X paradigm. In this study, total raw scores were included in the analyses. As explained later, a focus was given to exploring the interactions between Choice and Attention, measured by Omission errors and RTV. Due to technical issues, six children did not perform the AULA and one child refused to complete this due to previous negative experiences with virtual reality tasks.

Conners 3rd Edition-Parent (Conners 3-P) and Conners 3rd Edition-Teacher (Conners 3-T) Rating Scales (Short Version). Parents and teachers completed the short versions of the Conners 3 rating scales (Conners, 2008) offering information about children's inattention and hyperactivity/impulsivity. Raw scores were converted to T scores based on age and gender and used in analyses. T scores have a mean of 50 and a standard deviation of 10. T scores equal and/or above 65 indicate elevated attentional difficulties (more concerns than are typically reported). The overall Cronbach's alpha gave a value of .91 for the Parent rating scale and a value of .96 for the Teacher rating scale. In particular, Cronbach's alpha gave a value of .80 for the Parent Inattention scale and a value of .70 for the Parent Hyperactivity scale. For the Teacher Inattention scale, the Cronbach's value had a value of .91 and for the Teacher Hyperactivity scale, this value was .93. Seven parents/carers did not return the scales. Teachers could not complete the Conners 3 for five children. Table 3.6 shows the ADHD-related measures and variables used in this study.

Table 3.6

ADHD-related Measures and Variables in Study 1

Measures of ADHD-related characteristics	Inattention	Impulsive control/inhibitory control and hyperactivity
Stroop Colour and Word Test		Interference control (inhibitory control)
Simon Task		Interference control (inhibitory control)
AULA	Selective and focalised attention (Omission errors) Attention span, time to process information (RT) Lapses in attention/failures of sustained attention (RTV)	Impulsive control and behavioural (response) inhibition (Commission errors) RT when commission errors take place (RT to commission errors) RTV when commission errors take place (RTV to commission errors)
Conners 3 Parent Report	Inattention sub-scale	Hyperactivity/Impulsivity sub-scale
Conners 3 Teacher Report	Inattention sub-scale	Hyperactivity/Impulsivity sub-scale

Stories, Reading Comprehension Questions, and Scoring. Similar to the pilot study, the two short stories written by Fridkin (2018) assessed reading comprehension. Children completed a set of 16 questions. The maximum score was 19. In this study, internal consistency was .75 for Story A and .68 for Story B. This level of internal consistency was acceptable, considering the small number of items (Gliem & Gliem, 2003). Concurrent validity was explored by measuring Pearson's r correlation coefficient for the two stories and the well-established NGRT (standardised scores). Pearson correlation between Story A and the NGRT was $r(103) = .61$, $p < .001$, the correlation between Story B and the NGRT was $r(103) = .62$, $p < .001$ and the correlation between Story A and Story B was $r(103) = .51$, $p < .001$. Statistics showed a medium (positive) correlation strength (Cohen, 1988), providing evidence for the concurrent validity of the measure, given the small number of items. A possible explanation for the medium-strength correlations is that the NGRT assesses both passage comprehension and sentence completion, whereas the story questions measured only reading comprehension. Interestingly, children achieved significantly higher scores for Story A across both conditions, M = 9.09, $SD = 4.01$ than Story B, $M = 8.26$, $SD = 3.21$, $t(102) = 2.3$, $p = .023$, *d*[27] = 0.23 (two-tailed). Therefore, children found Story A easier to comprehend than story B. This is a limitation that will be discussed later. Difference scores were computed subtracting comprehension scores in the No Choice condition by comprehension scores in the Choice condition. The additional reading material such as titles, prologues, and reviews remained the same. Five children did not complete the reading tasks due to their absence.

The 'Story *Enjoyment/Interest*' Scale. On the completion of the reading comprehension tasks across both conditions, children rated the story they had just read via a 13-item Likert scale. During the pilot study, each child completed a 14-item scale that showed a Cronbach's

[27] Cohen's d was used to indicate effect size in paired-samples t-tests. Cohen (1988) proposed values for Cohen's d as follows: .02 - 0.5 = small; 0.5 – 0.8 = medium; > 0.8 = large.

alpha of .60; however, in the main study one item was deleted and a 13-item scale was administered to secure higher reliability with a value of .70 before the main study (see Appendix I). In the main study, this scale gave a Cronbach's alpha value of .78 suggesting good reliability. Concurrent validity was measured by checking the association between the 13-item scale across both conditions and the well-established MRQ, a practice that is commonly used in reading research (Guthrie et al., 2007b). The 'Story Enjoyment/Interest' scale in the No Choice condition had a moderate (positive) correlation with the MRQ, $r(103) = .51$, $p < .001$, the scale in the Choice condition had a moderate (positive) correlation with the MRQ, $r(103) = .49$, $p < .001$, and the two scales across both conditions had a moderate (positive) correlation, $r(102) = .49$, $p < .001$ indicating the concurrent validity of the measure. The moderate association between the Story Enjoyment/Interest scale and the MRQ may be because the former explored only aspects of interest and enjoyment, whereas the latter examined additional dimensions of motivation as mentioned earlier. Children achieved higher, but not significantly different scores for Story A across both conditions, $M = 39.02$, $SD = 7.71$ than Story B, $M = 37.73$, $SD = 6.57$, $t(101) = 1.81$, $p = .074$, $d = 0.18$. Difference scores were computed subtracting enjoyment scores in the No Choice condition by enjoyment scores in the Choice condition. There are certain challenges when measuring interest through self-reports (Renninger & Hidi, 2016). However, due to the lack of an effective measure of interest to date, a scale that explored enjoyment and interest both through direct statements and behavioural indicators (voluntary engagement, understanding of story) was administered to ensure more reliable data about children's enjoyment/interest.

Measurement of Socio-Economic Status (SES). Literature reports regularly a significant relationship between socioeconomic status and academic achievement (Thomson, 2018). Children from low socio-economic backgrounds usually perform more poorly at school than children from high socioeconomic backgrounds, with such differences in academic performance showing an increase as children progress in education (Caro et al., 2009). Children from low socio-economic backgrounds are at great risk of reading difficulties, including difficulties with vocabulary, and reading comprehension (Hart et al., 2013; Kieffer, 2010; 2012). Socioeconomic status is a multi-dimensional construct that combines several variables such as parental income, education, occupation, children's eligibility for free or reduced school lunch meals, family size, and family structure (Sirin, 2005; Thomson, 2018).

The present study measured SES by checking children's eligibility for free school meals (yes or no format) and pupil premium (yes or no format). Teachers completed this information for each child after checking school records. Typically, children are eligible to free school meals, if they attend a state-funded school and their parents have a low income or claim any benefits. Since 2011, schools can receive pupil premium funding for children who are eligible to free school meals and also looked-after and previously looked-after children (Ofsted, 2012). Pupil premium is additional government funding offered to schools to improve the academic outcomes of socio-economically disadvantaged children (Department for Education [DfE], 2015) and has been introduced based on research showing that these children have a greater likelihood to perform poorly at school. Eligibility for free meals serves as a good income-related measure of socio-economic disadvantage and has been used widely in school research (Taylor, 2017). Access to such information is also readily available to researchers and they do not need to ask any direct questions to parents regarding occupation, education, and annual income.

English as an Additional Language (EAL). A recent report published by the DfE (2019b) revealed that approximately 17% of children have a first language other than English at the end of Key Stage 2. In 2018, 63% of children who had English as an Additional Language reached the expected standard in reading, writing, and maths in comparison to 65% of children whose first language was English (DfE, 2018). Children whose language was other than English showed similar academic attainment to children whose first language was English; however, the gap between these groups was the greatest for reading. EAL children may struggle with reading, particularly due to vocabulary knowledge rather than decoding skills (Burgoyne et al., 2009). In this study, teachers indicated which children had an EAL status (yes or no format). Due to the study aims, further important data (e.g., the academic year that EAL children first appeared in a state-funded school in England) were not collected. Such information is rather necessary when research focus is primarily on EAL children because EAL children who join the school in reception are more likely to achieve the expected standard in reading than those EAL children who join an English school after reception (DfE, 2019b).

3.2.1.3 Design

A repeated measures design with Choice as the within-subjects variable and trichotomised Inattention measured via Teacher-rated Inattention, Omission errors, and RTV (Minimal, Moderate, Severe) assessed any differences in reading comprehension and enjoyment, due to the choice provision, in children with minimal and severe inattention. Children were randomly assigned to the *Choice* (experimental) or *No Choice* (control) *condition*. A crossover design was applied, and all children experienced both conditions by the end of the reading intervention. Half the children completed the Choice condition first and the No Choice condition after and the other half of the children vice versa. Half of the children received Story A in the Choice condition, half Story B. All four text versions (two for each story) were rotated and administered across both conditions, counterbalancing the condition order. To measure ADHD-related characteristics, both behavioural tasks and rating scales were administered. The repeated measures design and sample size (N = 108) provided sufficient power to explore the main effects of choice on reading and enjoyment, as well as interactions between Choice and ADHD-related variables.

3.2.1.4 Procedure

Children and teachers were informed about the study aims and procedures before, during, and after the study. In the first school visit, children completed, individually, the NGRT first and then the MRQ in the classroom during a one-hour morning session. Children received instructions for both tasks. After the NGRT administration, I administered the MRQ reading aloud the scale items while children were filling in their answers. In the second school visit, children of each classroom were randomly assigned to the Choice or No Choice condition (a group randomised trial). In the first classroom of the first school, children participated in the Choice condition (experimental) with the No Choice condition (control) following on a different date (third visit). In the second classroom of the first school, children took part in the No Choice condition first with the Choice condition taking place later (third visit). The stories were administered in children's regular classroom during morning sessions that lasted one hour each. All stories were administered across all six classes counterbalancing the condition order. The three main school visits were between two to seven days apart to fit the school schedule and minimise the burden placed on children. Further visits took place in-between the three main visits, during which children completed the behavioural tasks (Stroop, Simon, and AULA) individually.

In the Choice condition, each child received two A4 envelopes as in the pilot study. Children would find a different cover page and title for each version of the story, a different prologue for each story, and two different child reviews stapled to the front of the envelope. The choice was perceived; the actual stories inside the envelopes were the same; only the cover pages, titles, prologues, and reviews were different. Perceived choice enables to control for any confounding effects of background knowledge and individual/topic interest. Failure to control for such effects is a common methodological flaw in choice studies and makes it difficult to disentangle the independent effects of choice on potential outcomes. To ensure a more meaningful and informed choice, children had 5 min to read through this stapled material. Once children made their decision, they placed the rejected story on the floor and opened the envelope with the story they chose to read. There was a full version of the chosen story and a set of questions for this inside the envelope. Children read the story and answered the questions within 45 min individually. In the No Choice condition, children were assigned a different story. Again, they had 45 min to read the story and answer the questions. The procedure was identical to that of the Choice condition, except for the part of the story selection. In both conditions, children could refer back to the story while answering the questions.

Regarding the testing of the first two classes, all children of a classroom received the same stories (two different versions of the same story in Choice) across both conditions. However, for the other four classes, I changed the design slightly to ensure that children did not realise that the two stories were identical, for example, by checking the story chosen by the child sitting next to them. Therefore, Stories A and B were finally administered in a way that Child 1 would read Story A, Child 2 (sitting next to Child 1) would read story B, Child 3 (sitting next to Child 2) would read story A, and so on[28]. In both conditions, after the completion of the reading tasks, I read aloud the 'Story Enjoyment/Interest' scale items and children rated the story they had just read. Children who returned their written parental consent provided verbal consent and completed the behavioural tasks (Stroop, Simon, and AULA) individually in a quiet schoolroom during morning or afternoon sessions for approximately 30 min. Parent scales were collected before the study. Teacher scales were collected before, during, or after (up to one month time except for one classroom) the completion of the study. Table 3.7 shows the story presentation across both conditions by classroom and visit.

[28] In the UK, most primary classrooms are arranged in rectangular clusters with children sitting in tables of five or six based on their academic ability.

Table 3.7

Example of Condition and Story Administration by Classroom and Visit in Study 1

Class	First visit	Second visit
Class 1	A Snowy Adventure/Wishing on a Star (Story A) Choice condition	Just Another Ordinary Day (Story B) No Choice condition
Class 2	Just Another Ordinary Day (Story B) No Choice condition	A Snowy Adventure/ Wishing on a Star (Story A) Choice condition
Class 3	Just Another Ordinary Day/Something's Going On OR A Snowy Adventure/Wishing on a Star Choice condition	A Snowy Adventure OR Just Another Ordinary Day No Choice condition
Class 4	Something's Going On OR Wishing on a Star No Choice condition	A Snowy Adventure/Wishing on a Star OR Just Another Ordinary Day/Something's Going On Choice condition
Class 5	Just Another Ordinary Day/Something's Going On OR A Snowy Adventure/Wishing on a Star Choice condition	Wishing on a Star OR Just Another Ordinary Day No Choice condition
Class 6	Something's Going on OR A Snowy Adventure No Choice condition	A Snowy Adventure/Wishing on a Star OR Just Another Ordinary Day/Something's Going On Choice condition

Note. All four versions, two for each story, were rotated across both conditions (Choice, No Choice). The condition order was counterbalanced. All children of the first two classrooms received the same stories across both conditions. For the four remaining classes, I changed the design slightly to ensure that children are not aware that the two stories in the Choice condition are identical, for instance, by checking the stories of children sitting next to them. As a result, Child 1 read story A, Child 2 (sitting next to Child 1) read story B, Child 3 (sitting next to Child 2) read Story A, and so on.

3.2.2 Ethics

Ethical issues were considered throughout the research. This study has been covered by the UCL Data Protection Registration and received a reference number Z6364106/2018/04/69 under the category of social research. The Department of Psychology and Human Development at UCL, Institute of Education has also granted ethical approval. Primary mainstream community schools were sought in the area of London. School access was challenging; however, two mixed primary schools were finally recruited. Before the study, the classroom teachers and I had meetings to discuss the study aims and procedures. Following these meetings, information letters and opt-in consent forms were sent to parents/carers, via teachers. Parents/carers and children had the right to withdraw from the study at any stage; however, no requests for withdrawal were received. Teachers' suggestions were valuable at different stages of the study. For instance, teacher advice was sought regarding participant recruitment. Teachers' suggestions were also helpful to identify any children with severe reading difficulties (e.g., pilot study).

During the first school visit, children were informed about the study aims/benefits and shared questions. They were reminded that more information would be shared after the study completion. During individual testing, child verbal consent was sought. At this stage, an effort was made to create a friendly atmosphere through a set of warm-up questions. Children could withdraw from the study and return to the classroom if they wished. All children completed the behavioural tasks, except for one child who asked not to perform the virtual reality task due to previous negative experiences with virtual reality games. After the completion of the study, I visited the classroom to explain the study aims in further detail. Children received a certificate of participation and teachers vouchers as a thank-you for their involvement. Summary reports of the findings and copies of publications have been, or will be, sent to the schools.

Data were initially stored in the researcher's personal encrypted computer and then transferred to UCL computers. Each child received an individual ID number and anonymity has been kept strictly for all participants. Data has been reported in research anonymously, ensuring that no sensitive information is included, and no participant could become identifiable. School names or names of the school personnel have been kept confidential and no personal information of the staff has been reported in research papers, seminars, and conferences. Data were not transferred outside the European Economic Area (EEA). Personal (paper) data will be processed so long as it is required for the study and then destroyed. De-identified data collected for this study will be perpetually available in the UCL Data Repository after publications.

3.2.3 Results

3.2.3.1 Data Screening

Data were analysed using the IBM SPSS Statistics 25 package. Failure to complete the ADHD-related measures or reading tasks either due to absence or technical difficulties (e.g., internet connection during AULA) led to missing data for some children across different measures (see Section 3.1.2 for missing data across the measures). Considering that the present study employed a multi-method approach including a range of measures, I decided to include these children in the final sample, despite the presence of missing data across a variable, as they still completed the rest of the measures. Additionally, statistical analyses were less likely to be biased, considering that missing data across each variable were less than 10% (Bennett, 2001).

Data screening showed that some items on the Parent Report were not completed at random (e.g., parents skipped some items accidentally) and thus for these missing data, an Expectation Maximisation (EM) method (Scheffer, 2002) was employed, which uses other data of the same variables to impute a value (expectation), until it reaches the most likely value (maximisation). This method was used as the exclusion of children with missing data on certain items would reduce the statistical power of the design (Schafer & Olsen, 1998; Scheffer, 2002). A paired samples t-test showed that scores for Parent-rated Inattention after the EM method, $M = 3.78$, $SD = 3.20$ significantly differed from scores with missing data before the imputation, *M* = 3.71, *SD* = 3.12 $t(100) = 2$, $p = .049$ (two-tailed), $d = 0.2$. Similarly, after the EM method, scores for Parent-rated Hyperactivity, *M* = 4.55, *SD* = 3.33 differed significantly from scores that included missing data before the imputation, *M* = 4.41, *SD* = 3.29, $t(100) = 3.46$, $p = .001$ (two-tailed), $d = 0.34$. Complete parent data after imputation were finally used. The EM method was also used for the MRQ data. Similarly, a paired samples t-test showed that MRQ scores after the EM method, *M* = 109.84, *SD* = 16.92 differed significantly from scores that included missing data before the imputation, *M* = 109.15, *SD* = 16.98, $t(107) = 3.59$, $p = .001$ (two-tailed), $d = 0.35$. Complete MRQ data after imputation were used in the end.

The distributions of all variables were assessed during an Exploratory Data Analysis (EDA) to check for normality and decide whether parametric or non-parametric tests should be applied, focusing particularly on skewness, kurtosis, and the Shapiro-Wilk Test. Hair et al. (2010) and Byrne (2010) suggested that data are normally distributed if skewness is between -2 to +2 and kurtosis is between -7 to +7. Data showed some skewness and kurtosis; however, values were within the acceptable range (see Table 3.8). The Shapiro-Wilk Test showed that data were only normally distributed for the NGRT scores (standardised), the MRQ scores (raw), the reading scores in the Choice condition (raw), the enjoyment scores in the No Choice condition (raw), the Stroop Colour Word scores (T scores), the RTV scores (raw), the RTV to commission scores (raw) and the Simon RT difference scores (raw). For the rest of the variables, data were not normally distributed.

Table 3.8

Descriptive Statistics for all Variables in Study 1

Measures	*N*	*M* (*SD*)	*Range*	*K*	*S*
Baseline reading ability NGRT	108	99.81 (12.13)	75 - 131	-0.20	0.50
Baseline reading motivation MRQ	108	109.84 (16.92)	70 - 144	-0.42	-0.23
Reading intervention Reading difference	103	1 (3.59)	-9 - 12	0.45	0.37
Enjoyment difference	102	1.40 (7.24)	-18 - 19	-0.29	-0.11
Conners 3 Parent report Inattention	101	54.63 (12.83)	40 - 90	-0.09	0.69
Hyperactivity	101	55.20 (11.39)	40 - 88	-0.04	0.71
Conners 3 Teacher report Inattention	103	52.38 (10.51)	42 - 90	0.88	1.22
Hyperactivity	103	52.75 (14.46)	42 - 90	1.28	1.58
AULA Inattention _ Omissions	102	40.45 (33.07)	2 - 127	-0.57	0.78
Behavioural inhibition/ impulsivity _ Commissions	102	15.57 (8.93)	1 - 49	2.63	1.33
Inattention _ RT	102	907.26 (174.15)	608.08 -1375.81	0.14	0.77
Inattention _ RTV	102	405.78 (75.71)	237.78 -577.56	-0.51	0.19
Behavioural inhibition/impulsivity _ RT to Commissions	102	786.13 (246.61)	391.82 -1729.20	2.40	1.36
Behavioural inhibition/impulsivity _ RTV to Commissions	102	454.75 (153.93)	0 - 890.95	0.59	0.02
Stroop Test Interference	108	-.03 (4.52)	-10 - 12	-0.24	0.19
Simon Task Interference_ Accuracy difference	108	0.42 (.51)	-0.11-1	-1.95	0.25
Interference_ RT difference	108	35.91 (63.18)	-94.78-198.34	-0.24	0.11

Note. N = 108. *M* = Mean; *SD* = Standard deviation; *K* = Kurtosis; *S* = Skewness; NGRT = New Group Reading Test scores converted to standardised scores based on the child's age; MRQ = Motivation for Reading Questionnaire (raw scores); Conners 3 Parent and Teacher raw scores converted to T scores based on the child's age and gender; AULA = Advanced Virtual Reality Tool for the Assessment of Attention (raw scores for all variables); Omissions = Omission errors; Commissions = Commission errors; RT = Reaction Time; RTV = Reaction Time Variability; Stroop interference = Predicted Colour-Word raw scores subtracted by the actual number of items correctly named in the Colour-Word condition; Simon Interference = mean Accuracy and RT raw scores in congruent trials subtracted by mean Accuracy and RT scores in incongruent trials respectively. Sample sizes on reading intervention, rating scales, and AULA vary due to missing data (e.g., absence of information, technical difficulties). Reading and Enjoyment difference scores were computed by subtracting comprehension/enjoyment scores in the No Choice condition by comprehension/enjoyment scores in the Choice condition respectively.

Log10 transformations were performed on all variables which were not normally distributed to address issues with normality (Field, 2013). However, it was not possible to transform the data successfully to be normally distributed. Outliers were observed for the NGRT scores, the enjoyment scores in the Choice and No Choice conditions, the AULA Commission scores, RT scores, RT to Commission scores and RTV to Commission scores, Teacher-rated Inattention scores, and Teacher-rated Hyperactivity scores. Outliers were not excluded as they varied across each variable, and thus it would not be practical to exclude different outliers each time that a different variable would be assessed. Based on the Central Limit Theorem ($N \geq 30$), the assumption of normality is not necessary (Lumley et al., 2002) in moderately large samples. Considering that the sample size was relatively large ($N = 108$) and that all histograms looked quite normal despite the skewness and kurtosis (no bimodal or multimodal distributions were observed), parametric tests were employed to test hypotheses with greater power.

3.2.3.2 Analysis Plan

Descriptive statistics and bivariate correlations among all study variables were explored. The associations between the ADHD-related variables were initially examined to check for their convergent and divergent validity (*Data-driven Hypothesis*). As mentioned earlier, exploration of these associations was not a primary aim of this study, but rather emerged as an important issue during the data analysis with significant implications for the field. After this, a FA was conducted to reduce the amount of data generated due to the number of variables.

To address the *Experimental Hypothesis 1*, I conducted a repeated measures analysis of variance (ANOVA) with Condition (Choice, No Choice) as the two-level within-subjects variable. For *Experimental Hypotheses 2* and *3*, I followed two methods of analysis. First, I applied a whole-sample analysis to preserve the continuous nature of the ADHD-related variables, by checking the correlations between the difference scores in Reading comprehension, Enjoyment, and the ADHD-related variables to test for any interactions between Inattention (and other ADHD-related constructs such as behavioral inhibition/impulsive control) and Choice. Greater difference scores would indicate that children achieved greater Reading comprehension and Enjoyment scores in the Choice than the No Choice condition and vice versa. Use of difference scores could help infer an interaction from the correlation; significant positive correlations between the difference scores in Reading comprehension and Attention variables and between the difference scores in Enjoyment and Attention variables would suggest that there is an interaction effect, such that severely inattentive children would benefit more from choice than no choice compared with children with minimal inattention. This method better aligns with a dimensional approach to ADHD (Gathercole et al., 2018).

In addition to this, three mixed 2x3 repeated measures ANOVAs with a within-subjects variable (Choice) and a trichotomised between-subjects variable (Minimal, Moderate, Severe) for each of the three attention variables (Teacher-rated Inattention, Omission errors, and RTV) tested the hypotheses. Due to the study's focus on inattention, only results from analyses including these three attention variables are reported in-text. However, the extracted factors generated during the FA were similarly trichotomised and then used as between-subjects factors in mixed 2x3 repeated measures ANOVAs to check for main effects and interactions across reading comprehension and enjoyment for children with minimal and severe inattention and other ADHD-related characteristics, including behavioural inhibition and interference control. These results are not reported in-text, but in tables for the reader's reference.

Categorisation of a continuous variable has been used regularly in developmental research (de Wied et al., 2012; Hwang et al., 2020; Vitale et al., 2005) and the trichotomisation method has been applied regularly (Gilman & Huebner, 2006; Proctor et al., 2010). In this study, I employed the trichotomisation method after running a whole-sample analysis to maximise the comparison between the two main groups of interest, the 'Minimal Inattention' and 'Severe Inattention' groups. Contrary to the median split method, trichotomisation is a more refined method that enables to discretise a continuous variable (inattention as measured by Conners 3 and AULA) into three groups and then compare the upper and lower third group. Here, the median was selected and 33rd, 66^{th,} and 99th percentiles were calculated based on this for the three attention variables (Hagmar et al., 1994). The trichotomisation method produced three groups labelled as the 'Minimal Inattention' group, the 'Moderate Inattention' group, and the 'Severe Inattention' group. All three groups were included in the ANOVA analysis to consider the full sample (Gilman & Huebner, 2006; Proctor et al., 2010). The middle category was not excluded to avoid any significant data loss (approximately 30% of data). Pairwise comparisons after Bonferroni's corrections (.05/3 = .017 for the group comparisons) were checked as the primary focus was on the effects of choice on the Reading comprehension and Enjoyment of the 'Minimal Inattention' and the 'Severe Inattention' groups.

Splitting a continuous variable has received some criticism in research as it could increase the likelihood of Type 1 error (Wright, 2003). However, in this study, the trichotomisation method did not reduce dramatically the statistical power. For example, the total sample size of the two groups (Minimal, Severe) for Teacher-rated Inattention (N = 77), Omission errors (N = 68), and RTV (N = 68) still met power calculation requirements as indicated by the power analysis (N ≥42). In addition to this, EDA showed that results were primarily normally distributed with no serious skewness and kurtosis, the variables were not highly correlated to indicate an issue with multicollinearity (Iacobucci et al., 2015) and results remained consistent across all mixed ANOVAs analyses, minimising the likelihood of falsely reporting positive choice effects due to Type 1 error. Also, violations of normality are not considered a problem with relatively large sample sizes and sphericity can pose major challenges when there are at least three conditions (Field, 2013). In this study, there were only two conditions, Choice and No Choice; therefore, sphericity was not considered an issue.

Table 3.9 shows the means and standard deviations for the 'Minimal Inattention' and 'Severe Inattention' groups across the key Attention variables (Teacher-rated Inattention, Omissions errors, and RTV). The 'Minimal Inattention' group was rated by teachers within the average range based on the Conners 3 thresholds for T scores (40 to 59), while the 'Severe Inattention' group showed elevated attentional difficulties ($T \geq 65$). In the Iriarte et al. (2016) study with a community sample of 141 9-year-old children, descriptive statistics for Omission errors showed $M = 23.51$, $SD = 24.23$ and for RTV, $M = 376.42$ and $SD = 75.59$. Based on the Iriarte et al. (2016) study, in the present study mean scores for Omission errors and RTV were reported within the average range for the 'Minimal Inattention' group, whereas these scores were well above the average for the 'Severe Inattention' group (more than two *SD* above the mean for Omission errors and more than one *SD* above the mean for RTV). Such congruence between statistics reported in the present study and previous research further confirms the reliability of the trichotomisation method.

Table 3.9

Means and Standard Deviations for the Attention Variables Across the 'Minimal Inattention' and 'Severe Inattention' Groups in Study 1

Measure	Group	*N*	*M (SD)*
Conners 3	Minimal Inattention	42	43.71(1.50)
Teacher-rated Inattention	Severe Inattention	35	64.57(8.68)
AULA	Minimal Inattention	33	8.94(3.54)
Omission errors	Severe Inattention	35	80.69(19.91)
AULA	Minimal Inattention	33	322.43(30.96)
RTV	Severe Inattention	35	489.28(41.26)

Note. N = 108. M = Mean; SD = Standard Deviation; T scores converted from raw scores based on age and gender are presented for Teacher-rated Inattention; Raw scores are presented for Omission errors and RTV.

3.2.3.3 Testing of Data-driven and Experimental Hypotheses

Data-driven Hypothesis: Convergent and divergent validity will not be always confirmed between rating scales and behavioural measures.

Before the testing of the experimental hypotheses, the convergent (agreement) and divergent validity (disagreement) of behavioural tasks and scales measuring inattention, hyperactivity/impulsivity, and interference control were explored. This emerged as an important issue with implications for ADHD assessment. Cohen's (1988) guidelines[29] were followed to determine the strength of correlations. Several measures correlated significantly with each other (see Table 3.10), however, across assessment measures the strength of relationships was typically small, only once reaching a moderate level (Conners 3 Teacher Report and AULA).

Overall, results highlighted the inconsistencies between the rating scales and behavioural tasks. Parent-rated Inattention and Teacher-rated Inattention showed a positive

[29] According to Cohen's guidelines (1988), correlation coefficient values are determined as small (.10), medium (.30) and large (.50).

correlation, $r(94) = .46$, $p < .01$ providing some evidence for the convergent validity of these measures. Parent-rated Inattention also correlated with Parent-rated Hyperactivity $r(99) = .53$, $p < .01$ and Teacher-rated Inattention with Teacher-rated Hyperactivity $r(101) = .79$, $p < .01$. This fails to confirm the clear discrimination between the two sub-scales. In terms of inattention, Omission errors (accuracy) in AULA correlated only with Parent-rated Inattention, $r(92) = .20$, $p < .05$ (small correlation) and Teacher-rated Inattention, $r(96) = .40$, $p < .01$ (moderate correlation), achieving a certain level of convergent validity. However, in terms of behavioural inhibition/impulsivity, Commission errors in AULA did not correlate with Parent-rated Hyperactivity and Teacher-rated Hyperactivity making it difficult to establish convergent validity between these measures. Finally, Stroop Interference showed a small negative correlation with Interference (Accuracy difference scores) in the Simon Task, $r(106) = -.30$, $p < .01$, which suggests that these two tasks could measure similar constructs.

Associations Between the ADHD-related Measures, NGRT and MRQ

Small-to-medium negative correlations were reported between the NGRT and AULA variables such as Omission errors, $r(100) = -.42$, $p < .01$, RT, $r(100) = -.35$, $p < .01$ and RT to Commission errors, $r(100) = -.20$, $p < .05$. Small negative correlations were also reported between Parent-rated Inattention and MRQ, $r(99) = -.27$, $p < .01$ as well as RTV and MRQ, $r(100) = -.22$, $p < .05$. Therefore, children who showed greater inattention (Omission errors, RT) and behavioural inhibition/impulsivity (Commission errors) as assessed by AULA were more likely to achieve poorer reading scores as measured by the NGRT. Less motivated children, as assessed by the MRQ, showed greater inattention based on the Conners 3 Parent scale and AULA (RTV). Therefore, some measures of inattention and behavioural inhibition/impulsivity were associated with baseline reading ability (NGRT) and baseline reading motivation (MRQ), however, these relationships were not consistent across all of them. Finally, there were differences in the strength of associations ranging from small to medium.

Table 3.10

Bivariate Correlations Among Variables in Study 1

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Baseline reading_ NGRT																	
2. Baseline motivation_ MRQ	.08																
3. Reading difference	-.05	.07															
4. Enjoyment difference	.02	.01	.16														
5. Inattention_ Parent Report	-.08	**-.28****	-.17	**-.28****													
6. Hyperactivity_ Parent Report	.04	-.08	-.09	-.12	**.53****												
7. Inattention_ Teacher Report	-.18	-.11	.02	-.06	**.46****	.18											
8. Hyperactivity_ Teacher Report	-.01	-.02	.08	-.09	**.40****	**.32****	**.79****										
9. Inattention (Omissions)_ AULA	**-.42****	-.11	-.04	.12	**.20***	.04	**.40****	**.22***									
10. Behavioural inhibition (Commissions)_ AULA	.07	-.04	.05	-.07	.05	.08	-.04	-.05	-.13								
11. Inattention (RT)_ AULA	**-.35****	-.15	-.05	.15	.08	.03	**.26***	.13	**.72****	**-.47****							
12. Inattention (RTV)_ AULA	-.08	**-.23***	.02	.12	.18	.07	**.26****	.19	**.44****	.04	**.56****						
13. Behavioural inhibition (RT to Commissions) _ AULA	**-.20***	-.17	-.05	.02	.15	.13	**.25***	.17	**.54****	**-.28****	**.72****	.40**					
14. Behavioural inhibition (RTV to Commissions) _ AULA	-.06	-.18	.07	.01	-.02	.	**.31****	**.26****	**.30****	.09	**.40****	.57**	**.45****				
15. Interference_ Stroop	.09	.02	-.01	.02	-.14	-.04	-.08	-.1	-.1	.	-.06	-.02	-.13	-.07			
16. Interference (Accuracy)_ Simon	-.03	.18	.02	-.09	.14	.03	.14	.13	.	-.06	.02	.06	.02	.14	**-.30****		
17. Interference (RT)_ Simon	-.06	.12	**-.21***	-.1	.11	-.06	.	-.05	.14	.02	.08	-.01	.1	-.03	-.08	**.38****	

Note. $N = 108$. NGRT = New Group Reading Test scores converted to standardised scores based on child's age; MRQ = Motivation for Reading Questionnaire (raw scores); Reading and Enjoyment difference scores measured subtracting raw scores in No Choice condition by raw scores in Choice condition; Conners 3 Parent and Teacher raw scores converted to T scores based on age and gender; AULA = Advanced Virtual Reality Tool for the Assessment of Attention (raw scores for all variables); Omissions = Omission errors; Commissions = Commission errors; RT = Reaction Time; RTV = Reaction Time Variability; Stroop Interference = Predicted Colour-Word raw scores subtracted by the actual number of items correctly named in the Colour-Word condition; Simon Interference = mean Accuracy and RT raw scores in congruent trials subtracted by mean Accuracy and RT scores in incongruent trials respectively. Significant correlations are marked in bold. * $p < .05$ ** $p < .01$ (two-tailed).

Factor Analysis (FA)

FA was applied to reduce data and check whether variables would load to factors. All the ADHD-related measures were entered into a Principal Components Analysis (PCA) with varimax (orthogonal) rotation. Assumptions for FA were tested. The sample size was considered adequate, given that this was over 100 children (MacCallum et al., 1999). The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO-test) gave a value of .620 (KMO should be greater than 0.5) suggesting that the sample size is adequate (Field, 2000). Normality was also assumed considering the overall sample size and the fact that data did not show serious skewness and kurtosis. Multicollinearity was met as variables were intercorrelated, but they did not correlate too highly and the determinant of the correlation matrix was .003 (greater than 0.00001, Field, 2000). The communalities of the variables were high and above the commonly used cut-off of .40 (Yong & Pearce, 2013).

Four factors were identified accounting for 66% of the variance in total (Table 3.11). Factor loadings of .45 and above were used as a guide to interpret the structure of FA (Tabachnick & Fidell, 1996). Parent-rated Inattention, Parent-rated Hyperactivity, Teacher-rated Inattention, and Teacher-rated Hyperactivity loaded into one factor. A logical explanation for this loading may be that these variables represented a measure of children's *Daily functioning*. This factor explained 29.16% of the variance. Regarding the AULA variables, Omission errors, RT, RTV, RT to Commission errors, and RTV to Commission errors loaded to one factor. This factor reflected *Task-specific performance*. This factor explained 16.31 %

of the variance. Commission errors and RT were the only AULA variables that loaded to a factor labelled as *Behavioural inhibition/Impulsive control* explaining 11.81% of the variance. Correlations between these two variables showed that children with more Commission errors were more likely to respond to stimuli impulsively across all trials (faster RT). This correlation may explain why Commission errors and RT loaded to one factor (quick/impulsive children) and not with Omission errors and RTV (slow/inattentive children). Stroop Interference and Interference in the Simon Task, as measured through Accuracy and RT difference scores, loaded to one factor. This factor represented *Interference* and explained 8.71% of the variance.

Table 3.11

Factor Loading Scores (Rotated Component Matrix) and Communalities from Principal Component Analysis of ADHD-related Measures in Study 1

	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*	*Communalities*
Inattention_ Parent Report	**.76**	.	-.08	.19	.63
Hyperactivity_ Parent Report	**.65**	-.04	-.28	-.02	.5
Inattention_ Teacher Report	**.78**	.31	.18	.04	.73
Hyperactivity_ Teacher Report	**.81**	.2	.09	.04	.71
Inattention (Omissions)_ AULA	.26	**.63**	.38	-.01	.6
Hyperactivity (Commissions)_ AULA	.09	-.03	**-.85**	-.06	.74
Inattention (Omissions)_ AULA	.06	**.76**	**.54**	-.03	.88
Inattention (RTV)_ AULA	.16	**.79**	-.1	-.08	.67
Behavioural inhibition (RT to Commissions) _ AULA	.03	**.81**	.18	.15	.71
Behavioural inhibition (RTV to Commissions) _ AULA	.06	**.86**	-.24	.03	.79
Interference_ Stroop	-.11	-.03	.22	**-.61**	.43
Interference (Accuracy)_ Simon	.05	-.013	.25	**.67**	.51
Interference (RT)_ Simon	.13	.032	.05	**.80**	.66

Note. N = 108. The extracted method was Principal Components Analysis (PCA) with varimax rotation. Values in bold are in excess of .45. Factor 1 is labelled as *Daily functioning*. Factor 2 represents *Task-specific performance*. Factor 3 is referred to as *Behavioural inhibition/Impulsive control* and Factor 4 reflects *Interference*.

Implications of FA

FA resulted in the extraction of four factors: The *Daily functioning* factor, the *Task-specific performance* factor, the *Behavioural inhibition/Impulsive control* factor, and the *Interference* factor. It was difficult to provide a theoretical basis for these factors as during FA the variables were grouped mostly based on the type of measure (rating scales, behavioural tasks) rather than the constructs they were expected to measure (inattention, hyperactivity, behavioural inhibition/impulsive control), except for the AULA that separated between inattention (Omission errors, RT, RTV) and behavioural inhibition/impulsive control (Commission errors). Variables correlated primarily with other variables within the same measure and then loaded to one factor. For example, Conners 3 rating scales loaded to one factor reflecting daily functioning. Initially, FA aimed to produce factors that could be used in analyses to test the experimental hypotheses. Nevertheless, these factors did not reflect theoretically ADHD constructs (e.g., inattention factor) except for the interference factor.

Considering that inattention is related more strongly to reading than hyperactivity as supported by research (Lahey & Willcutt, 2010; Rabiner & Coie, 2000; Sims & Lonigan, 2012) and this study's findings (associations), attention variables and not hyperactivity variables were included in the analyses to test the experimental hypotheses. This decision was important to reduce the amount of data and develop a more coherent rationale that would be easier for the reader to follow. Teacher-rated Inattention (Conners 3), Omission errors, and RTV (AULA) were included in analyses. Teachers' accounts may be the most informative for this study that explored children's reading in the classroom. Omission errors and RTV were included as they represent more objective indicators of task-specific inattention. Omission errors are one of these key variables that can predict ADHD group membership and distinguish between children with and without ADHD (Areces et al., 2018; Iriarte et al., 2016), and thus probably useful when testing community samples with different degrees of inattention (Minimal, Severe). RTV is also considered as a more stable characteristic of ADHD, and thus more meaningful than mean RTs (Kofler et al., 2013). Although FA did not generate factors that represent pure theoretical constructs (e.g., inattention), I decided to further include these factors in analyses similar to the attention variables to test the experimental hypotheses. Failure to use these factors would lead to data loss, not allowing to test empirically the interactions between choice and other important ADHD-related constructs, including hyperactivity and interference, which had already been assessed in this study.

Hypothesis 1: Choice will increase the reading comprehension and enjoyment of children compared with no choice.

A repeated measures ANOVA[30] with Condition (Choice) as the within-subjects variable showed that there was a statistically significant difference in reading comprehension scores between the Choice (M = 9.17, SD = 3.73) and No Choice condition (M = 8.17, SD = 3.51), $F(1,102) = 7.97$, $p = .006$ (two-tailed), $\eta_p^2 = 0.07$ ($d = 0.3$). A repeated measures ANOVA with Condition (Choice) as the within-subjects variable showed that there was no significant difference in reading enjoyment scores across the two conditions, but rather a non-significant statistical trend in reading enjoyment between the Choice (M = 39.09, SD = 7.15) and No Choice condition (M = 37.69, SD = 7.18), $F(1,101) = 3.82$, $p = .053$ (two-tailed), $\eta_p^2 = 0.04$ (d = 0.2). Story and condition order affected reading comprehension/enjoyment (see Appendix J).

Hypothesis 2: Choice will increase the reading comprehension and enjoyment of children with both minimal and severe inattention (and other ADHD-related characteristics) compared with no choice.

[30] Partial-eta squared η_p^2 was used to report effect size in repeated measures ANOVAs, as this is most commonly used. Based on the Cohen's guidelines (1988), effect size can be small as $\eta_p^2 = 0.01$, medium as $\eta_p^2 = 0.06$ and large as $\eta_p^2 = 0.14$. Nevertheless, Cohen's d values are also reported in brackets, only for the parametric and non-parametric analyses testing Experimental Hypothesis 1 in Studies 1 (Chapter 3) and 2 (Chapter 4), to allow better comparisons of findings across studies in the General Discussion chapter (Chapter 6).

Hypothesis 3: There will be an interaction between choice and inattention (and other ADHD-related characteristics), such that choice will increase particularly the reading comprehension and enjoyment of severely inattentive children rather than those with minimal inattention.

Whole-sample Analysis

The correlations between the reading difference scores, enjoyment difference scores, and inattention (and other ADHD-related measures) were explored. Significant positive correlations would suggest that there is an interaction effect, such that children with severe inattention (and other ADHD-related characteristics) would benefit more from choice than no choice during reading comprehension and enjoyment than children with minimal inattention. As shown in Table 3.10 earlier, such positive correlations were not reported. Weak negative correlations were reported between Reading difference scores and Interference in the Simon Task, $r(101) = -.21$, $p < .05$ as well as between Enjoyment difference scores and Parent-rated Inattention, $r(93) = -.28$, $p < .01$; however, following Bonferroni's corrections these correlations ended up to be non-significant.

Mixed Repeated Measures ANOVAs for Reading Comprehension

A mixed 2x3 ANOVA was employed with Choice as the two-level within-subjects variable and trichotomised Teacher-rated Inattention (Minimal, Moderate, Severe) as the between-subjects variable. There was a main effect of Choice, $F(1,95) = 7.10$, $p = .009$ (two-tailed), $\eta_p^2 = 0.07$, such that all children achieved higher reading comprehension scores in Choice compared with No Choice, irrespective of the severity of inattention. There was also a main effect of Teacher-rated Inattention, $F(2,95) = 4.87$, $p = .010$, $\eta_p^2 = 0.09$. Following Bonferroni adjustment for multiple comparisons, pairwise comparisons showed that severely inattentive children produced significantly poorer reading comprehension scores than children with minimal inattention as rated by teachers ($p = .007$). Taken together, these results suggested that severely inattentive children achieved lower reading comprehension than those with minimal inattention; however, both groups did better in Choice compared with the No Choice condition. There was no interaction between Choice and Teacher-rated Inattention, $F(2,95) = 0.39$, $p = .676$, $\eta_p^2 = 0.01$.

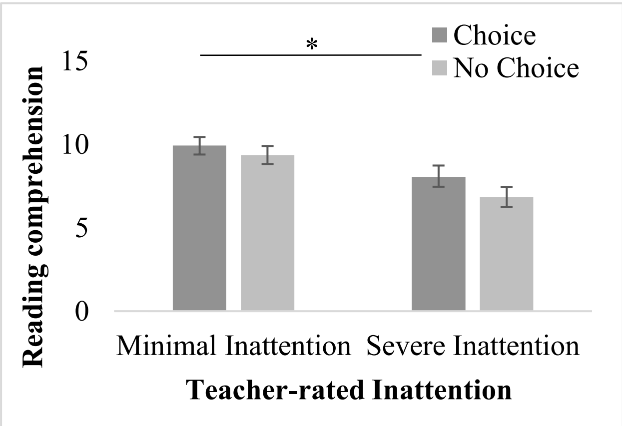
A second mixed 2x3 ANOVA was employed with Choice as the two-level within-subjects variable and trichotomised Omission errors (Minimal, Moderate, Severe) as the between-subjects variable. There was a main effect of Choice, $F(1,94) = 7.27$, $p = .008$ (two-tailed), $\eta_p^2 = 0.07$, such that children achieved greater reading comprehension in Choice than No Choice. There was a main effect of Omission errors, $F(2,94) = 6.89$, $p = .002$, $\eta_p^2 = 0.13$. Following Bonferroni adjustment for multiple comparisons, pairwise comparisons showed that children with severe inattention produced significantly poorer reading comprehension scores than children with minimal inattention as indicated by Omission errors ($p = .001$). Taken together, these results showed that children with severe inattention achieved lower reading comprehension than children with minimal inattention, however, both groups had better reading comprehension in Choice compared with the No Choice condition. There was no interaction between Choice and Omission errors, $F(2,94) = 0.22$, $p = .803$, $\eta_p^2 = 0.01$.

A further 2x3 mixed ANOVA was applied with Choice as the two-level within-subjects variable and trichotomised RTV (Minimal, Moderate, Severe) as the between-subjects variable. Again, there was a main effect of Choice, $F(1,94) = 7.63$, $p = .007$ (two-tailed), $\eta_p^2 = 0.08$, such that children achieved greater reading comprehension in Choice than No Choice, irrespective of the severity of inattention. There was no main effect of RTV, $F(2,94) = 1.98$, $p = .143$, $\eta_p^2 = 0.04$. Both groups did significantly better in reading during Choice contrary to No Choice. There was no interaction between Choice and RTV, $F(2,94) = 1.05$, $p = .353$, $\eta_p^2 = 0.02$. In Figure 3.5, bar graphs show the reading comprehension scores for the 'Minimal Inattention' and 'Severe Inattention' groups across the Choice and No Choice condition. This study focused on inattention; however, it was decided to present the effects and interactions across all measured variables (see Table 3.12) and factors (see Table 3.13) for reading comprehension to allow a more holistic understanding of the overall results. Appendix K1 presents the means and standard deviations for all the three groups (Minimal, Moderate, Severe) in reading comprehension across the two conditions for the reader's reference.

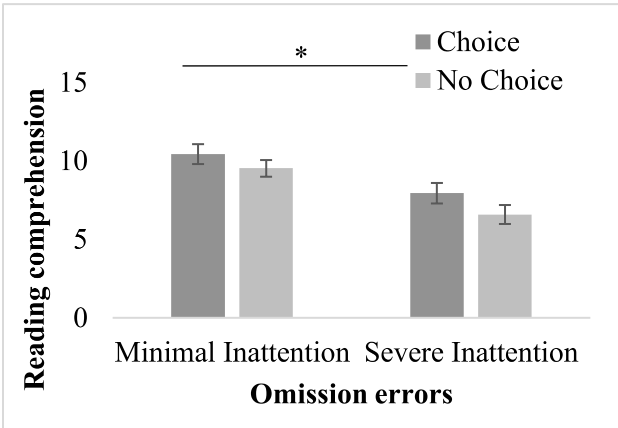
Figure 3.5

Reading Comprehension Scores by Teacher-rated Inattention and Condition (A), Omission Errors and Condition (B), and RTV and Condition (C) in Study 1

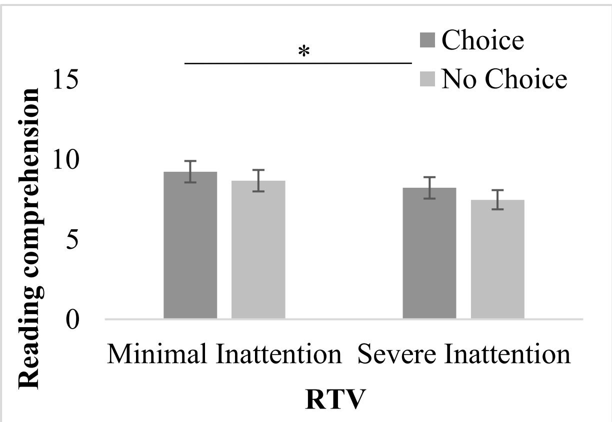
A)



B)



C)



Note. Error bars represent standard errors. Choice effects were significant across the sample. Asterisks and lines represent significance. * p <.05 (two-tailed).

Table 3.12

Main Effects and Interactions Between Choice and ADHD-related Variables for Reading Comprehension in Study 1

	Main effect: choice			Main effect: attention group			Interaction: choice effects across attention groups		
Measure	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2
Conners 3									
Inattention_ Parent	6.18	**.015***	0.06	1.87	.159	0.04	5.77	**.004***[a]	0.11
Hyperactivity_ Parent	5.98	**.016***	0.06	2.10	.129	0.04	0.20	.816	< .001
Inattention_ Teacher	7.10	**.009***	0.07	4.87	**.010***	0.09	0.39	.676	< .001
Hyperactivity_ Teacher	8.62	**.007***	0.07	0.02	.982	< .001	1.02	.365	0.02
AULA									
Inattention (Omissions)	7.27	**.008***	0.07	6.89	**.002***	0.13	0.22	.803	0.01
Inattention (RTV)	7.63	**.007***	0.08	1.98	.143	0.04	1.05	.353	0.02
Inattention (RT)	7.39	**.008***	0.07	4.82	**.010***	0.09	0.29	.748	0.01
Behavioural inhibition (Commissions)	7.26	**.008***	0.07	0.24	.791	0.01	0.06	.945	< .001
Behavioural inhibition (RT to Commissions)	7.97	**.006***	0.08	6.17	**.003***	0.12	2.45	.092	0.05
Behavioural inhibition (RTV to Commissions)	7.45	**.008***	0.07	0.75	.476	0.02	0.34	.711	0.01
Stroop									
Interference	7.87	**.006***	0.07	2.15	.122	0.04	0.17	.848	< .001
Simon[b]									
Interference (Difference in RT)	8.23	**.005***	0.08	0.20	.817	< .001	1.17	.314	0.02

Note. *N* = 108. Conners 3 Parent and Teacher raw scores converted to T scores based on the child's age and gender; AULA = Advanced Virtual Reality Tool for the Assessment of Attention (raw scores for all variables); Omissions = Omission errors; Commissions = Commission errors; RT = Reaction Time; RTV = Reaction Time Variability; Stroop Interference = Predicted Colour-Word raw scores subtracted by the actual number of items correctly named in the Colour-Word condition; Simon Interference = mean Accuracy and RT raw scores in congruent trials subtracted by mean Accuracy and RT scores in incongruent trials respectively. Significance levels are marked in bold. * $p < .05$ (two-tailed).

[a] = Following Bonferroni correction, interaction between Parent-rated Inattention and Choice was still significant (.05/12 = .004).

[b] = Main effects and interactions could not be computed for Accuracy difference scores, because each accurate answer was coded as 1 and each inaccurate answer was coded as 0.

Table 3.13

Main Effects and Interactions Across the Four Factors for Reading Comprehension in Study 1

	Main effect: choice			Main effect: cognitive factor			Interaction: choice effects across cognitive factors		
Factors	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2
Factor 1	4.35	**.040***	0.05	1.44	.244	0.03	0.75	.478	0.02
Factor 2	4.41	**.039***	0.05	1.60	.209	0.04	1.17	.852	< .001
Factor 3	4.50	**.037***	0.05	1.24	.296	0.03	1.02	.366	0.02
Factor 4	4.84	**.031***	0.06	2.20	.118	0.05	1.99	.143	0.05

Note. N = 108. Factor 1 = Daily functioning; Factor 2 = Task-specific performance; Factor 3 = Behavioural inhibition/Impulsive control; Factor 4 = Interference. Significance levels are marked in bold. * p <.05 (two-tailed).

Mixed Repeated Measures ANOVAs for Reading Enjoyment

A mixed 2x3 ANOVA was employed with Choice as the two-level within-subjects variable and trichotomised Teacher-rated Inattention (Minimal, Moderate, Severe) as the between-subjects variable. There was no main effect of Choice, $F(1,94) = 3.48$, $p = .065$ (two-tailed), $\eta_p^2 = 0.04$. There was no main effect of Teacher-rated Inattention, $F(2,94) = 0.22$, $p = .801$, $\eta_p^2 = 0.01$. There was no interaction between Choice and Teacher-rated Inattention, $F(2,94) = 1.39$, $p = .254$, $\eta_p^2 = 0.03$.

A mixed 2x3 ANOVA with Choice as the two-level within-subjects variable and trichotomised Omission errors (Minimal, Moderate, Severe) as the between-subjects variable. There was a main effect of Choice, $F(1,93) = 4.38$, $p = .039$, $\eta_p^2 = 0.05$, but no main effect of Omission errors, $F(2,93) = 0.93$, $p = .398$, $\eta_p^2 = 0.02$. There was no interaction between enjoyment scores in Choice condition and Omission errors, $F(2,93) = 1.76$, $p = .178$, $\eta_p^2 = 0.04$.

Finally, a mixed 2x3 ANOVA was employed with Choice as the two-level within-subjects variable and trichotomised RTV (Minimal, Moderate, Severe) as the between-subjects variable. There was a main effect of Choice, $F(1,93) = 4.25$, $p = .042$, $\eta_p^2 = 0.04$, such that children achieved greater reading enjoyment in Choice than No Choice. There was a main effect of RTV, $F(2,93) = 2.78$, $p = .067$, $\eta_p^2 = 0.06$. Following Bonferroni adjustment, pairwise comparisons showed that children with severe inattention did not significantly differ in reading enjoyment from children with minimal inattention ($p = .172$). Again, no interaction[31] was reported between Choice and RTV, $F(2,93) = 0.34$, $p = .715$, $\eta_p^2 = 0.01$.

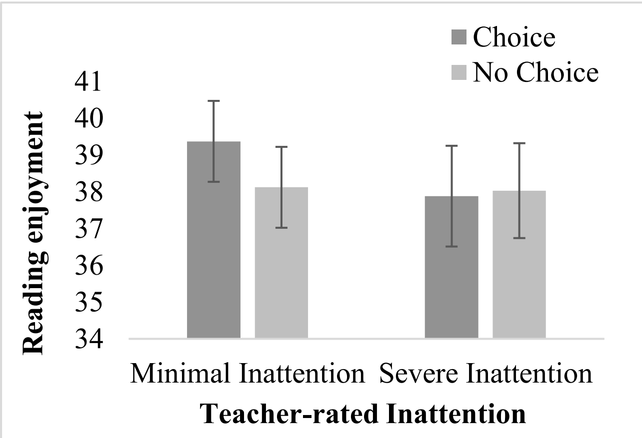
In Figure 3.6, bar graphs show reading enjoyment scores for the 'Minimal Inattention' and 'Severe Inattention' groups across the Choice and No Choice conditions. Similar to reading comprehension, Table 3.14 presents the main effects and interactions across all measured variables, and Table 3.15 shows the main effects and interactions across factors. Finally, Tables 3.16 and 3.17 provide a summary of the effects and interactions for reading comprehension and enjoyment. Appendix K2 presents the means and standard deviations for all the three groups (Minimal, Moderate, Severe) in reading enjoyment across the two conditions for the reader's reference.

[31] No significant interactions between Choice and Attention were found for reading comprehension and enjoyment in further moderation analyses (see Appendix L), confirming the results of the whole sample and trichotomisation analyses (Montoya 2019).

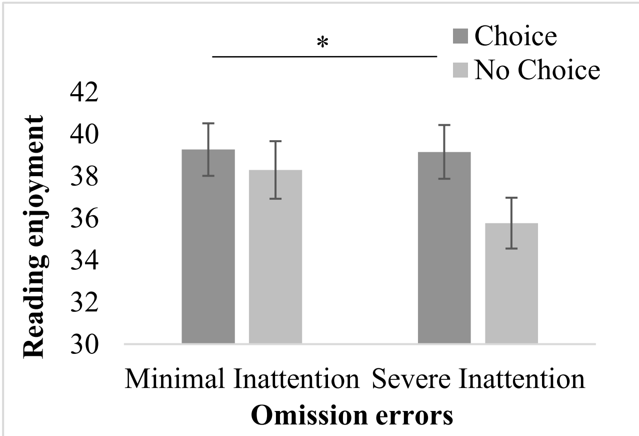
Figure 3.6

Reading Enjoyment Scores by Teacher-rated Inattention and Condition (A), Omission Errors and Condition (B), and RTV and Condition (C) in Study 1

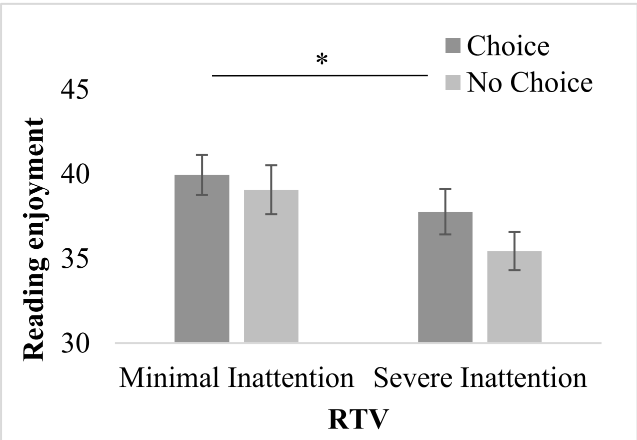
A)



B)



C)



Note. Error bars represent standard errors. Choice effects were significant across the attention variables, except for Teacher-rated Inattention. Asterisks and lines represent significance. * p <.05 (two-tailed).

Table 3.14

Main Effects and Interactions Between Choice and ADHD-related Variables for Reading Enjoyment in Study 1

Measure	Main effect: choice			Main effect: attention group			Interaction: choice effects across attention groups		
	F ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2
Conners 3									
Inattention_ Parent	3.49	.065	0.04	5.05	**.008***	0.10	3.40	**.037***[a]	0.07
Hyperactivity_ Parent	3.81	.054	0.04	0.84	.436	0.02	1.97	.146	0.04
Inattention_ Teacher	3.48	.065	0.04	0.22	**.**801	0.01	1.39	.254	0.03
Hyperactivity_ Teacher	1.68	.199	0.02	0.76	.471	0.02	0.13	.881	< .001
AULA									
Inattention (Omissions)	4.38	**.039***	0.05	0.93	.398	0.02	1.76	.178	0.04
Inattention (RTV)	4.25	**.042***	0.04	2.78	.067	0.06	0.34	.715	0.01
Inattention (RT)	4.74	**.032***	0.05	1.07	.348	0.02	1.81	.170	0.04
Behavioural inhibition (Commissions)	4.20	**.043***	0.04	1.23	.299	0.03	0.49	.615	0.01
Behavioural inhibition (RT to Commissions)	4.33	**.040***	0.05	0.86	.428	0.02	0.13	.876	< .001
Behavioural inhibition (RTV to Commissions)	4.52	**.036***	0.05	1.90	.155	0.04	0.70	.497	0.02
Stroop									
Interference	3.80	.054	0.04	1.54	.221	0.03	1.01	.366	0.02
Simon[b]									
Interference (Difference in RT)	3.84	.053	0.04	0.29	.746	0.01	0.32	.724	0.01

Note. N = 108. Conners 3 Parent and Teacher raw scores were converted to T scores based on the child's age and gender; AULA = Advanced Virtual Reality Tool for the Assessment of Attention (raw scores for all variables); Omissions = Omission errors; Commissions = Commission errors; RT = Reaction Time; RTV = Reaction Time Variability; Stroop Interference = Predicted Colour-Word raw scores subtracted by the actual number of items correctly named in the Colour-Word condition; Simon Interference = mean Accuracy and RT raw scores in congruent trials subtracted by mean Accuracy and RT scores in incongruent trials respectively. Significance levels are marked in bold. * $p < .05$ (two-tailed).

[a] = Following Bonferroni correction, interaction between Parent-rated Inattention and Choice was still significant (.05/12 = .004).

[b] = Main effects and interactions could not be computed for Accuracy difference scores, because each accurate answer was coded as 1 and each inaccurate answer was coded as 0.

Table 3.15

Main Effects and Interactions Across the Four Factors for Reading Enjoyment in Study 1

	Main effect: choice			Main effect: cognitive factor			Interaction: choice effects across cognitive factors		
Factors	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2	*F* ratio	*p*	η_p^2
Factor 1	2.95	.090	0.04	0.74	.482	0.02	0.31	.733	0.01
Factor 2	3.22	.077	0.04	2.46	.092	0.06	1.34	.267	0.03
Factor 3	3.07	.084	0.04	0.08	.920	< .001	1.79	.174	0.04
Factor 4	3.05	.085	0.04	0.33	.721	0.01	0.99	.376	0.02

Note. N = 108. Factor 1 = Daily functioning; Factor 2 = Task-specific performance; Factor 3 = Behavioural inhibition/ Impulsive control; Factor 4 = Interference. * p <.05 (two-tailed).

Table 3.16

Summary of Main Effects and Interactions Across Attention Variables for Reading Comprehension in Study 1

Measure	Main effect: Choice	Main effect: Attention	Interaction: Choice-Attention
Teacher-rated Inattention (Conners 3)	✓	✓	
Omissions (AULA)	✓	✓	
RTV (AULA)	✓		

Note. Checkmarks indicate statistical significance. No main effect was reported for RTV. No interactions were reported between Choice and Attention variables for reading comprehension.

Table 3.17

Summary of Main Effects and Interactions Across Attention Variables for Reading Enjoyment in Study 1

Measure	Main effect: Choice	Main effect: Attention	Interaction: Choice-Attention
Teacher-rated Inattention (Conners 3)			
Omissions (AULA)	✓		
RTV (AULA)	✓	✓	

Note. Checkmarks indicate statistical significance. No main effect was reported for Choice on Teacher-rated Inattention. No main effects were reported for Teacher-rated Inattention and Omission errors. No interactions were reported between Choice and Attention variables for reading enjoyment.

3.2.4 Discussion[32]

3.2.4.1 Associations Between Study Variables and FA Implications

Before the testing of the experimental hypotheses, I examined the associations between the different ADHD-related variables and measures. The initial intention was to create overall constructs of inattention, behavioural inhibition/impulsive control and hyperactivity made robust by assessment using a range of measures. Nevertheless, whilst associations between inattention and hyperactivity/impulsivity were found within measures (e.g., Conners 3 parent and teacher scales), associations between different measures aiming to address the same construct were typically small. The greatest medium association was found between Teacher-rated Inattention and Omission errors (inattention) in AULA, $r(98) = .40$, $p < .001$. These findings are in line with the literature, which highlights the inconsistencies between measures

[32] Some information in this chapter has been published in the paper of Kakoulidou et al. (2021).

that assess ADHD-related characteristics (Barkley & Fischer, 2011; Diamond, 2013; Sims & Lonigan, 2012). They raise issues about how effectively the different measures capture the intended underlying constructs.

After checking the associations (correlations) between the different variables, I conducted a FA including all the ADHD-related measures. I decided to employ a variety of measures to secure a multi-method assessment of ADHD-related characteristics. FA could help reduce the significant amount of data through the extraction of theoretically supported factors, such as an inattention factor and hyperactivity factor. However, FA revealed four factors, namely, the *Daily functioning*, *Task-specific performance*, *Behavioural inhibition/Impulsive control,* and *Interference* that did not reflect these ADHD-related theoretical constructs, except for the interference factor. FA rather confirmed the picture emerging from the associations, scores clustered within measures, across constructs, and not across measures within constructs.

Parents and teachers correlated highly on inattention and hyperactivity. Previous literature reported frequently weak-to-moderate parent-teacher agreement on ADHD rating scales (Sollie et al., 2013; Willcutt et al., 2012), and also highlighted a trend towards a higher parent-teacher agreement with increasing age of the child (Narad et al., 2015). These findings may explain why in the present study a relatively high inter-rater agreement was found on Conners 3 scales with children aged 8 to 9 years old, compared with studies that found a weak-to-moderate agreement in preschool children (Murray et al., 2007). In this study, teachers, and parents who rated children as inattentive were also more likely to rate them as hyperactive/impulsive. A possible explanation for these findings is that teachers and parents could not rate independently and distinguish between these two constructs, and as a result, the presence of one behaviour (e.g., inattention) may have led raters to report erroneously the presence of another ADHD-related behaviour (e.g., hyperactivity/impulsivity). This evidence is consistent with previous research (Abikoff et al., 1993; Power et al., 1998; Sims & Lonigan,

2012) indicating that parents and teachers may not fully understand the different presentations of ADHD-related characteristics. Nevertheless, it is also difficult to preclude the possibility that the children who were described as inattentive were also more likely to be hyperactive in the study. For example, the lack of a clear distinction between inattention and hyperactivity in parent and teacher reports may be due to the combined ADHD subtype being the most common type of diagnosis for children with ADHD (Reale et al., 2017). In this latter scenario, it can be better understood why the data analysis showed weak, but positive correlations between omission errors and teacher-rated hyperactivity, although the two variables are typically expected to measure inattention and hyperactivity respectively.

Findings that show the high association between inattention and hyperactivity/impulsivity have important implications for clinical practice. They stress the need to develop integrated models that acknowledge the overlap and interaction between inattention and hyperactivity/impulsivity and capture the greater heterogeneity and complexity of the clinical presentation of ADHD, rather than focusing on ADHD subtypes or inattention and hyperactivity/impulsivity separately (Sokolova et al., 2016; Toplak et al., 2009). Consideration of both dimensions may also help to address the diagnostic instabilities in ADHD over time (only 35% of people met the DSM-IV criteria for the same subtype over time in the Willcutt et al., [2012] study). Considering the educational and clinical implications of the association between inattention and hyperactivity/impulsivity, interventions that enhance inattention may also improve the manifestation of hyperactivity/impulsivity; nevertheless, further research would help explore with greater certainty the effects of such interventions on both dimensions and the potential direction of their relationship, for example, as to whether inattention leads to hyperactivity/impulsivity or vice versa.

Contrary to the Conners 3 rating scales, the AULA distinguished between inattention (measured through omission errors) and behavioural inhibition/impulsivity (measured through commission errors). A certain level of convergent validity was confirmed between omissions, parent-rated inattention, and teacher-rated inattention, although such convergent validity could not be ensured in the case of hyperactivity/impulsivity. For example, commission errors did not correlate with parent-rated hyperactivity and teacher-rated hyperactivity as expected. These results showed that virtual reality tasks may serve possibly as standardised measures of ADHD-related characteristics that distinguish more effectively between inattention and hyperactivity while controlling for potential subject bias such as the halo effect. Nevertheless, there is a need to further investigate the relationships between newly introduced virtual-reality tasks and more widely researched measures, including the Conners 3 rating scales, to establish the convergent validity of the measures.

Interference control, as measured by the Stroop and Simon tasks, did not correlate with ADHD-related measures such as the Conners 3 rating scales and the AULA. Lack of such associations finds some support in previous research, which reported that difficulties with EF processes, such as interference, are not necessarily characteristic of children with ADHD-related characteristics (Jonsdottir et al., 2006; Willcutt et al., 2005). Given the focus of this study, it was difficult to examine the relationship between interference control, inattention, and hyperactivity/impulsivity and further test for such assumptions. Some researchers suggest that EF tests should not provide the sole source of evaluating executive functioning as stronger associations between EF and ADHD-related characteristics are more likely to be documented when EFs are measured through rating scales rather than behavioural tasks (Barkley & Fischer, 2011). Rating scales of inhibition/interference were not included in this study, and thus the relationship between inhibition-related processes, such as interference, and inattention as well as hyperactivity/impulsivity could not be examined. Our failure to report an association between inhibitory control tasks and ADHD measures may also be attributed to the task impurity problem of the EF tasks (Friedman & Miyake, 2017; Willcutt et al., 2005). Inhibitory control tasks including the Stroop and Simon tasks may also tap into other EF skills, such as working memory (child needs to remember when to press the blue or red button in the Simon Task) as well as non-EF skills, including reading ability and visual search skills (Stroop Test). Therefore, these additional non-EF skills may interfere with (mask) performance on EF (e.g., interference) tasks.

Despite the discrepancies across some ADHD-related variables, a multi-method assessment of ADHD-related characteristics could help capture different manifestations of these characteristics (Toplak et al., 2009; Toplak & Stanovich, 2013). The results from the FA provide some support for this proposition. For instance, parent and teacher scales loaded to one factor named as *Daily functioning* factor, whereas the majority of AULA variables loaded to another factor named *Task-specific* performance, except for commissions and RT. Drawing on previous literature, rating scales could provide a general measure of children's daily functioning (how a child performs typically daily), whereas behavioural tasks such as the AULA may rather assess task-specific performance (how well a child performs under relatively optimal conditions) (Toplak et al., 2013). Therefore, inconsistencies between similar measures may not suggest necessarily that these assess different ADHD constructs. Such inconsistencies may rather indicate that these types of measures explore different expressions of similar ADHD-related constructs. Considering that the National Institute of Health and Care Excellence guidelines (NICE, 2018) highlight the importance of using a variety of assessment tools such as interviews and scales to assess ADHD, the combined use of more objective measures, including virtual reality tasks, and subjective measures, such as rating scales, could provide valuable information to better identify children with more severe ADHD-related behaviours. It remains an issue, however, for researchers to further test the relationship between objective and subjective measures to develop valid assessments of ADHD-related characteristics.

Associations between the ADHD-related measures, baseline reading ability, and baseline reading motivation showed that inattention, as indicated by omission errors and RTs in AULA, was more strongly correlated with baseline reading ability than hyperactivity. Again, this finding is supported by research, which proposed that inattention may serve as a greater predictor of reading comprehension than hyperactivity (Plamondon & Martinussen, 2015; Rabiner et al., 2000). Due to the cross-sectional design of this study, it was not possible to investigate whether inattention, rather than hyperactivity, more strongly predicts reading. In addition to this, the fact that baseline reading ability, as indicated by NGRT scores, better negatively correlated with the AULA variables (omission errors, RTs, RTs during commission errors) than the Conner 3 scales could be because the NGRT is essentially a behavioural task. Baseline reading motivation weakly correlated with attention measures, such as parent-rated inattention and RTV, indicating that the more motivated children were in this study, the less likely they were to display inattention. Although these correlations were weak and not reported for the rest of the attention variables, they suggest that inattentive children, who do not hold an ADHD diagnosis, may also display poor reading motivation as children with diagnosed ADHD. Given the relationship between reading motivation and reading comprehension (Wigfield et al., 2016), non-diagnosed inattentive children may also be at risk of reading underachievement.

Surprisingly, no association was found between baseline reading ability (NGRT) and baseline reading motivation (MRQ) in this study. Similar findings were also reported in Fridkin's study (2018). These findings are consistent with previous studies that reported a decline in children's reading motivation and positive reading attitudes towards the end of the primary phase and particularly in children aged 8 to 11 years old (Sainsbury & Schagen, 2004; Topping, 2010). The decline in reading motivation may be partially due to developmental changes with children beginning to value aspects of their social life more than school-related activities, such as reading, as well as due to the less flexible school curriculum structure that may discourage reading for pleasure (LaFontana & Cillessen, 2010; Sainsbury & Schagen, 2004).

Another possible explanation for the lack of association between reading motivation and baseline reading ability is that proficient reading does not necessarily mean that children are motivated. As discussed in Chapter 1, skilled reading also requires a good level of baseline reading skills such as decoding. Children aged 8 to 9 years old are typically expected to have good decoding skills, however, some children of the study may likely have struggled to develop these skills or have had additional reading difficulties, considering that 49.1% of children in the study had an EAL status (NGRT scores were normally distributed though). Children with severe ADHD-related characteristics are also at risk of experiencing challenges with word reading, decoding, and reading comprehension (Gray & Climie, 2016). Given the focus of the study, children's word reading and decoding skills were not assessed. In addition to this, although the MRQ is a reliable measure (a = .85) that has been used widely with children (Davis et al., 2018), reflection on past reading behaviour may be a relatively challenging cognitive process particularly for severely inattentive children. As further discussed in Chapter 6, self-reports may also not always represent valid measures for use with children, given that these are subject to rater bias. Considering the above, the lack of identifying an association between motivation and reading could be attributed, to a degree, to measure selection and sample characteristics and may not necessarily provide evidence for the absence of such a relationship in this age group.

3.2.4.2 Testing of Experimental Hypotheses and Implications

This study tested the hypotheses that i) 108 eight- to- nine-year-old children attending mainstream schools would show increased reading comprehension and enjoyment when given a (perceived) choice of a story rather than no choice; ii) choice effects would be present for all children, irrespective of the severity of inattention (teacher-rated inattention, omission errors and RTV); and iii) choice effects would be significantly stronger for children with severe inattention than those with minimal inattention. Children participated in a reading intervention with two conditions, a Choice, in which they selected one out of two stories, and a No Choice, in which they were assigned a story. Children completed a virtual reality task designed to assess inattention in a classroom setting (AULA) and measures of baseline reading ability and motivation. Teachers and parents rated children's ADHD-related characteristics (Conners 3 scales). Children completed behavioural tasks measuring interference control (Stroop, Simon).

Testing of *Experimental Hypothesis 1* showed that all children achieved greater reading comprehension (medium choice effects, η_p^2 = 0.07) when they had the option to choose their story compared with no choice. There was also a strong trend with children enjoying their reading better in choice compared with no choice condition, although these results were not significant (*p*-value was slightly above the significance level). These findings replicated Fridkin's findings (2018), who also found that choice improved reading comprehension in Year 4 children, although they did not offer support for the significant effects of choice on reading enjoyment. Considering that the study tested for the possibility of the relationship in one direction (whether choice would improve reading enjoyment), it could be argued to a degree that the difference in enjoyment scores reached statistical significance at the level of a one-tailed test[33], appropriate for the testing of Experimental Hypothesis 1.

Theory and empirical research confirm the beneficial role of choice in children's learning particularly for affective engagement (attitudes, liking, and enjoyment), however, evidence regarding choice effects on cognitive engagement has not been ubiquitously positive as certain factors may decrease or reverse its effects (Cordova & Lepper, 1996; Flowerday &

[33] To find the *p*-value for a one-tailed test, the *p*-value offered in the SPSS output (two-tailed test) is divided in half.

Schraw, 2003; Patall, 2013). Inconsistency in findings around choice effects on reading comprehension may be due to the operationalisation of choice. By developing new stories and offering perceived story choice, the present study aimed to control for previous story knowledge and personal (topic) interest. Therefore, these findings are of significant educational value as they propose that choice triggers a fleeting cognitive and potentially affective response (situational interest) that occurs independently of prior reading interests. This offers supportive evidence for the value of choice and, potentially, other triggers of situational interest as practical tools for educators who struggle to motivate those children who have not yet developed a genuine interest in reading (Hidi & Harackiewicz, 2000) or those who struggle with motivation, such as inattentive children (Smith & Langberg, 2018).

Similar to Fridkin (2018), children chose their story based on generic story-related reading materials (titles, prologues, reviews), which may have increased children's perceptions of task meaningfulness. Children who perceive their reading as personally meaningful are more likely to attend to and invest themselves in this (Katz & Assor, 2007). A possible explanation for the positive effects of choice on reading comprehension is that through choice children experienced a sense of personal agency and ownership over their reading, which increased, in turn, their reading comprehension. This sense of personal control may have led to higher levels of effort, attention, and perseverance as reflected on their reading comprehension scores (Ryan & Deci, 2000). It is also likely that choice created better conditions for situational interest to develop, which then contributed to an increase in affective and cognitive engagement (Renninger & Hidi, 2016). Hidi and Berndoff (1998) proposed that situational interest may be an extrinsically triggered process, however, this targets integration directly. In the context of reading, this means that once a reading activity becomes interesting, it may not require conscious decision-making, but the child may rather allocate effortlessly their attention and effort to engage in this. As a result, such integration may improve affective (enjoyment) and cognitive engagement (reading comprehension).

Choice effects on reading enjoyment were not significant, although it could be argued that there was a non-significant close trend ($p < .1$) with children achieving greater enjoyment scores in choice than no choice. In theoretical terms, choice has been regarded as a trigger of situational interest, which represents the first phase of interest development (Hidi & Renninger, 2006). During this initial phase, children may not be fully aware of their situational interest and enjoyment. Thus, they may lack the ability to report on these constructs, which explains this study's failure to report such significant choice effects (Renninger & Hidi, 2016). As mentioned earlier, the use of self-reports with children may not be a valid measure due to the nature of situational interest, and therefore any findings should be treated with caution. Measuring situational interest is a major challenge in interest literature, as more emphasis has been traditionally given to individual interest. Thus, future studies should explore more reliable ways of evaluating this type of interest. It is important to acknowledge, however, that there is a possibility that choice may not increase enjoyment similar to reading comprehension. Nonetheless, the findings of Study 1 suggest that choice could motivate children to engage more cognitively with their reading, regardless of whether children are engaged on a more affective level.

Findings should be examined carefully considering that the internal consistency of the stories was good and not excellent (a = .75 for Story A; a = .68 for Story B). Descriptive statistics also showed that children achieved higher reading (significantly different) and enjoyment (not significantly different) scores for Story A than Story B. Amendments were made to both stories following Fridkin's findings (2018) to improve internal consistency, however, statistics showed that the stories may have been processed and experienced differently by children. A cross-over design was selected to control for the confounding effects of story type and mitigate this problem, nevertheless, it is difficult to preclude the possibility that the story type could have masked the magnitude of choice effects on reading comprehension and enjoyment.

Considering that FA did not produce factors with a theoretical basis and the fact that baseline reading ability was more strongly related to inattention (omission errors, RT) rather than behavioural inhibition or interference control, choice effects were further tested focusing on the reading outcomes of children with minimal and severe inattention. Although the particular focus was on inattention, as measured through teacher-rated inattention, omission errors, and RTV, all the variables and factors were similarly analysed, and the results summarised. Inclusion of the rest of the variables in further analyses was also considered important given the relatively high correlation between inattention and hyperactivity/impulsivity (e.g., Conners 3 parent and teacher scales). As shown in the *Results* section, findings were relatively consistent across analyses. To test *Experimental Hypotheses 2* and *3*, I applied the trichotomisation method after checking for any interactions using a whole-based approach that tested for significant correlations between reading difference scores, enjoyment difference scores, and attention variables (teacher-rated inattention, omission errors, and RTV).

By using a whole-sample analysis, the study aimed to shift the interest towards a more dimensional approach that views inattention as present in different degrees within a community sample of children. Dimensional approaches do not underestimate the struggles that children with severe inattention and/or ADHD usually encounter. These approaches rather provide an opportunity to address the potential reading challenges that inattentive children may face, even in the absence of an ADHD diagnosis. Contrary to previous literature that employed a relatively strict hypothesis-driven approach, the present study combined a theory and data driven-approach. Results remained relatively consistent across the whole-sample and trichotomisation analyses for each of the different measures of inattention (teacher-rated inattention and AULA).

Testing of *Experimental Hypothesis 2* showed that all children achieved greater reading comprehension and enjoyment when provided with choice compared with no choice, irrespective of the severity of inattention (Minimal, Severe). Further analyses showed that choice effects remained significant, after including all ADHD-related variables and factors in the analyses. These findings extend previous research regarding the benefits of choice for the reading of non-diagnosed inattentive children and advance current theoretical knowledge proposing that choice improves the reading comprehension (and enjoyment less consistently) of all children, including those children with attentional difficulties, who are usually at risk of reading underachievement (Rabiner et al., 2016). This is consistent with the mechanisms proposed by the Four-Phase Model of Interest Development (Hidi & Renninger, 2006), specifically relating to attention. Within this model, choice, among other situational factors (e.g., novelty), triggers subconscious interest resulting in an automatic and effortless allocation of attention and thereby increasing focused attention and leading to enhanced reading performance. Although the effects of choice were not large in this study, ranging from small-to-moderate this is nonetheless notable given the fairly minor nature of the situational manipulation. It suggests that manipulating situational factors could provide a possible way to support the reading of children with different attentive profiles. Whilst there are some studies with small sample sizes that demonstrate the benefits of motivation practices during learning for children with ADHD (Powell & Nelson, 1997), less is known about the effects of motivation in children will a less severe profile as the effects of these on the latter group are not always clearly reported in the literature (Gaastra et al., 2016).

Findings from this study have important implications for school practice. Offering opportunities in the classroom for children to exercise a sense of control over their reading could boost the reading comprehension, and potentially reading enjoyment, of all children, irrespective of the severity of inattention. Inclusive approaches that target the whole classroom rather than individual children could prove more attractive and easily applicable for general education teachers (Moore et al., 2019; Sparks & Malkus, 2015), who may have limited freedom over classroom instruction and planning due to high-stakes testing. Nevertheless, findings should be examined carefully considering that this study did not control for other important reading-related factors. For instance, due to the focus on the interaction between choice (motivation) and attention, the study did not control for child socioeconomic status and intelligence, although both factors could be associated with reading comprehension and attentional difficulties (Johann et al., 2020; Kieffer, 2010).

During the testing of *Experimental Hypothesis* 3, I extended theory and research that underlined the importance of motivation in ADHD (Luman et al., 2005; Sonuga-Barke, 2005) to test for such effects of motivational choice on the reading of children with non-diagnosed severe inattention, considering that high-risk community and clinical samples present relatively equivalent inattentive and/or hyperactive/impulsive behaviours, performance and response to interventions (Beike & Zentall, 2012; Loe & Feldman, 2007). I did not confirm this hypothesis, as choice did not have a greater effect on the reading comprehension and enjoyment of severely inattentive children than their peers with minimal inattention, as indicated by the lack of interaction between choice and inattention. Similar results were found with the rest of the variables (e.g., hyperactivity, interference) and factors included in further analyses.

Motivational interventions to date are particularly effective at improving the cognitive performance of children with ADHD than their non-ADHD peers (Luman et al., 2005; Ma et al., 2016). Previous literature in ADHD examined systematically the positive effects of extrinsic (e.g., rewards), rather than intrinsic, motivators on behaviour (Carlson et al., 2000; Ma et al., 2016), which adds a further difficulty when interpreting choice effects. Considering that situational interest, as promoted by choice, represents the first phase of individual interest development (Hidi & Renninger, 2006), it is likely that provision of story choice may not be sufficient enough to increase especially the reading performance of severely inattentive children. Also, most studies in ADHD reported positive effects of motivation on behavioural performance as measured via Go/No-Go tasks (Marx et al., 2018; Slusarek et al., 2001), however, they did not examine for such motivation effects on school-related subjects including reading. Contrary to these behavioural tasks, reading represents a more cognitively demanding activity and therefore the effects of motivation on reading may differ for children with severe ADHD-related characteristics and/or ADHD. It is also likely that children may have already developed stronger motivations for reading than random behavioural tasks, which could, in turn, relate to fewer or more difficulties with reading.

Beike and Zentall (2012) provided some evidence for the greater positive effects of novelty (surprisingness, vividness, intensity), as another motivational trigger of situational interest similar to choice, on the reading comprehension of children at risk of ADHD ($N = 16$), compared with not at-risk children ($N = 16$, aged 7 to 11 years old). The findings of this thesis study are not in line with the findings of Beike and Zentall (2012). This might be due to methodological differences as the Beike and Zentall study (2012) recruited a relatively small sample size and also tested reading comprehension on shorter passages through a small number ($N = 5$) of questions, which raises concerns as to whether reading comprehension was assessed properly. Nevertheless, considering that non-diagnosed severely inattentive young people may struggle with working memory (Rogers et al., 2011), the use of shorter passages than the ones provided in this study may be more appropriate to test for potential choice effects. Finally, this study might have failed to report greater choice effects for children with severe inattention, due to the focus on a community sample of children. Choice effects may be greater for children with a clinical ADHD diagnosis, drawing on research showing more salient effects of motivation on this group (Beike & Zentall, 2012; Luman et al., 2005).

3.2.5 Conclusion

This study possesses several strengths including a repeated measures design that counterbalanced the story and condition order, a multi-method assessment of attention, and a diverse sample of children with different attentive profiles. This is the first study to explore empirically and report that choice is an important motivational practice that increases the reading comprehension of children with severe inattention and those with minimal inattention alike. Choice did not significantly increase enjoyment, although there was a trend with children achieving greater enjoyment in choice than no choice condition. Choice did not increase the reading comprehension and enjoyment of the severely inattentive children independently. These findings did not support previous studies that found more pronounced effects of motivation (e.g., rewards) on the behaviour of children with ADHD. These novel findings extend current knowledge about the importance of autonomy-supportive practices, such as story choice, in the classroom and also offer a starting point to further investigate choice effects with both community and clinical samples of children with ADHD-related characteristics.

In the light of Study 1 findings, Study 2 further investigated the effects of both intrinsic (choice) and extrinsic motivators (rewards) on children's reading outcomes. This study took a step further to test for choice and rewards effects on the reading comprehension and enjoyment of children with and without ADHD, with particular emphasis on the former group, employing a set of differentiated reading materials.

Chapter 4. Pilot and Main Study 2

The Role of Choice and Reward in a Community and Clinical Sample of Children with ADHD

Chapter 4 presents Study 2. The study addressed three aims. The first aim was to extend the findings of Study 1 and explore whether the key motivational constructs of *choice* (intrinsic motivator) and *reward* (extrinsic motivator) improve the reading comprehension and enjoyment of children aged 8 to 11 years old who attend mainstream primary schools. *Experimental Hypothesis 1* was that choice and reward would increase the reading comprehension and enjoyment of all children compared with no motivation. The second aim was to examine whether choice and reward enhance such reading outcomes for a community and a clinical sample of children with a clinical ADHD diagnosis. *Experimental Hypothesis 2* was that choice and reward would improve the reading comprehension and enjoyment of both groups, irrespective of ADHD, compared with no motivation. The third aim was to explore whether there would be any differences in the effects of choice and reward between the two groups, such that choice and reward effects would be more salient for the reading comprehension and enjoyment of children with ADHD compared with those without ADHD. *Experimental Hypothesis 3* was that children with ADHD would benefit more from choice and reward in reading comprehension and enjoyment than their non-ADHD peers.

The three hypotheses aimed to fill in the gap in the literature as to whether motivational practices improve the reading outcomes of children with and without ADHD, with greater emphasis placed on the former group. Theory and research with neurotypical children underline the positive effects of choice on affective (e.g., enjoyment) and cognitive engagement (e.g., performance) (Fridkin, 2018; Patall et al., 2014; Renninger & Hidi, 2016). However, intrinsic motivation, as promoted through choice, has been neglected consistently in ADHD literature.

Limited studies in ADHD provide further support for the positive effects of choice on task-related behaviour (e.g., on-task behaviour) and advocate the benefits of choice during learning (Dunlap et al., 1994; Powell & Nelson, 1997; Shogren et al., 2004). However, these choice studies are dated and have employed single case study designs that do not enable to draw safe conclusions regarding the role of choice in the learning/reading of children with ADHD. Most of these studies also tested the effects of choice on ADHD-related characteristics, such as inattention and/or hyperactivity/impulsivity, failing to test for any benefits of choice specific to learning and reading. Parents and educators may be more reluctant to apply autonomy-supportive practices, including choice, when expected to support the learning of children with ADHD. Due to the excessive workload, stress, and high responsibility for children's behaviour, teachers are more likely to use controlling practices (e.g., deny children opportunities for choice during learning) to address the behaviour and learning of children with ADHD (Ohan et al., 2011; Reeve, 2009). However, considering that children with diagnosed ADHD are more likely to show lower than average academic motivation (Smith & Langberg, 2018) and perceive their classrooms as more controlling than their non-ADHD peers (Rogers & Tannock, 2018), it is likely that these children are in greater need to experience autonomy in the classroom. Thus, autonomy-supportive practices including choice may generate interest, especially when teachers target the task motivation and engagement of children with ADHD.

This study also investigated the effects of tangible rewards during reading. In literature, rewards have been associated systematically with extrinsic motivation (Ryan et al., 2019). Contrary to intrinsic motivation that has been commonly related to increased reading in neurotypical children, the relationship between extrinsic motivation and reading is rather inconclusive (Cameron & Pierce, 1994; Deci et al., 2001; Murayama, 2018). Factors such as the type of reward, reward contingency, task initial interest as well as the learning/reading context (e.g., autonomy-supportive versus controlling), in which rewards are embedded, may explain the discrepancy in findings regarding reward effects (Cameron & Pierce, 1994; Deci et al., 1999; Hidi, 2016). Such inconsistencies point towards further exploration of the effects of rewards on children. Studies in ADHD investigated principally and offered evidence for the benefits of rewards on reducing ADHD-related characteristics (Luman et al., 2005); however, these studies did not explore motivational effects on the learning/reading of children with ADHD. Drawing parallels from research using rewards in children and adults with ADHD (Luman et al., 2005; Yu et al., 2018), these children are more likely to show greater sensitivity to rewards than those without ADHD, probably due to differences in the activity in the brain's reward circuitry mechanisms, specifically in the dopaminergic pathway (Volkow et al., 2011). To my knowledge, this is the first study that tested the effects of intrinsic and extrinsic motivators on the reading of a community and a clinical sample of children with ADHD. By acknowledging the multidimensional nature of motivational constructs and leveraging both intrinsic and extrinsic factors, educators and parents could support the reading of children with various cognitive profiles more effectively. While the present study recognises the reading challenges that many children with ADHD may experience, it takes a step further looking at ways to support their reading moving away from deficit models of research, which have been traditionally the focus of literature in ADHD.

This chapter presents the second/associated pilot study[34]. The second pilot study explored the reliability and difficulty level of the new researcher-designed reading materials with a community sample of children (aged 8 to 9 years old) to test for further use in the main study. Due to the change of reading materials (stories) in main Study 2, it was necessary to test their appropriateness with primary-aged children. Thus, initially, the chapter presents the pilot study. After this, it describes the methodology of the main study. Due to similarities with the

[34] Contrary to Study 1, the Pilot and Main Studies 2 are presented in the same chapter rather than as separate chapters. The Pilot Study 2 was relatively simple and brief, and thus it flowed more naturally to present this along with the Main Study 2.

main Study 1 (e.g., measures), similar information is not presented again to avoid repetition. Any methodological adjustments or additions are highlighted. In the *Results* section, the chapter investigates the associations between the ADHD-related measures (inattention, behavioural inhibition/impulsivity, hyperactivity, interference control) including rating scales and behavioural tasks (*Data-driven Aim 1*). It also tests for any differences in performance across these measures and baseline reading motivation between children with and without ADHD (*Data-driven Aim 2*). *Data-driven Hypothesis 1* was that convergent and divergent validity would not be always confirmed across the measures and *Data-driven Hypothesis 2* was that there would be differences between children with and without ADHD, such that children with ADHD would show greater inattention, hyperactivity/impulsivity, and lower inhibitory control and motivation than those without ADHD. Then, the chapter presents the results concerning the three experimental hypotheses. It discusses key findings, limitations, and implications for school and clinical practice, while others are explored broadly in the *General Discussion* chapter (Chapter 6).

4.1 Pilot Study

4.1.1 Method

4.1.1.1 Participants

An additional sample was sought for the pilot study. A community sample of 16 (7 boys, 9 girls) Year 4 children (8 to 9 years old) returned the parent/carer opt-in consent forms and participated in the study. A number of 10 to 30 participants (approximately 10% of the projected sample size) is regarded as satisfactory for a pilot study (Connelly, 2008). Children attended a four-form mainstream community primary school rated as ‘Good’ in the most recent Ofsted report. Children were not excluded based on additional criteria. Further personal information (e.g., birthdate, ethnicity) was not collected at this stage.

The study took place in March 2019. Information letters and opt-in consent forms were sent to parents/carers, via teachers, before the study. Some children, who did not return the signed parent form, continued with their regular school tasks following the teacher's suggestions. Other children, who did not return a signed consent, completed the reading activities to minimise feelings of exclusion; however, their data were not processed.

4.1.1.2 Measures

The New Group Reading Test (NGRT). All children completed the 2A form of the NGRT to assess baseline reading ability (Burge et al., 2010). This form includes two sections; a sentence completion section that assesses decoding with some element of comprehension and a passage comprehension section that measures a range of comprehension skills of increasing difficulty. The maximum score is 48. Raw scores on both sections were summed giving a total score for each child. Cronbach's alpha gave a value of .80 that indicates good-to-excellent reliability[35] (Koo & Li, 2016).

Stories, Reading Comprehension, and Scoring. Three stories, matched for word length and difficulty level, assessed reading comprehension to ensure further use in the main study. These stories were written by the researcher and further checks were made by supervisors to ensure a similar readability level. The main study design contained three conditions to assess the effects of choice and rewards (Choice, Reward, and No Motivation). Considering that all stories would be administered across one day, I deemed that these stories should be relatively short to minimise the work burden. Consequently, the two stories of Study 1 could not be further used, and new stories were developed and tested in the pilot study.

Initially, the three stories were tested through an online readability formula tool (readabilityformulas.com) that assigned the three stories at Grade Level 4/5, a reading age of

[35] Reliability values taken as: <.50 = poor; .50-.75 = moderate; .75-.90 = good; >.90 = excellent (Koo & Li, 2016).

8 to 9 years old and an 'easy to read/very easy to read' text difficulty level. Story A (Bank robbery/ Goodbye sweet dreams) comprised 216 words, Story B (The taxi driver / The holiday) 228 words, and Story C (A teacher's unusual day/ A series of unexpected events) 242 words. The three stories were similar in grammatical structure. Literal and inferential questions were developed using Key Stage 2 Statutory Assessment Tests (SATs) as a model. Story A had 15 questions (2 questions had two parts), Story B had 17 questions and Story C had 16 questions (1 question had two parts). Accordingly, the three stories had the same number of possible answers across multiple-choice and open-response questions. Questions were scored based on whether children had provided a correct answer. One point was awarded for each correct answer and where an answer was missing or was incorrect, no point was awarded. The maximum score was 17. The average reading time was 11 min for Story A, 13 min for Story B, and 11 min for Story C.

The 'Story Enjoyment' Question. Children answered a single question (yes or no format) indicating whether they enjoyed the story and shared at least one reason for their choice.

4.1.1.3 Design

A repeated measures design tested the reliability and difficulty level of the stories. Children completed the three reading tasks (stories and questions) and the enjoyment question about each story. Children also completed the NGRT as a useful check to assess the concurrent validity of the stories with a well-established measure of baseline reading ability. Three children participated in an interview to be used in Study 3 (see Chapter 5 for further details).

4.1.1.4 Procedure

Children and teachers were informed about the study aims. Children completed all reading tasks in their regular classroom across two days. On the first school visit, they worked on the NGRT during a morning session. On the second school visit, they completed two of the main reading tasks (stories and questions) in a morning session and the third reading task in an afternoon session. Children had as much time as they needed to complete the tasks. They also wrote down the time they had finished each reading task to measure the average reading time needed for each story. Upon the completion of reading, they completed the 'Story Enjoyment' question to indicate whether they enjoyed the story they had just read or not. Children received a certificate of participation and a small gift (a notebook and pen) for their involvement.

4.1.2 Results

The pilot study tested the internal consistency of the stories and the concurrent validity between the three stories and the NGRT. Internal consistency gave a Cronbach's value of .50 for Story A, a value of .78 for Story B, and a value of .69. Concurrent validity was explored by exploring the association between the three stories and the well-established NGRT. Table 4.1 shows the correlations between the three stories and the NGRT.

Table 4.1

Spearman's rho Correlations Between the Three Stories and NGRT in Study 2

	1	2	3
1. Story A			
2. Story B	$.55^{*}$		
3. Story C	.48	.27	
4. NGRT	$.69^{**}$	$.61^{*}$	$.64^{*}$

Note. $N = 16$. NGRT = New Group Reading Test (raw scores); Story A = Bank robbery; Story B = The taxi driver; Story C = A teacher's unusual day. * $p < .05$ ** $p < .01$ (two-tailed).

Considering that the sample size was not large enough ($N \leq 30$), a non-parametric Friedman test with reading comprehension scores (Story A, Story B, Story C) as the dependent variable tested for any differences in reading comprehension across the three stories. There was a significant difference in reading comprehension scores depending on the story type, χ^2 (2) = 17.40, p = < .001 (two-tailed), Kendall's W[36] = 0.54 (large). Post hoc analysis with Wilcoxon signed-rank tests was employed with a Bonferroni correction applied, resulting in a significance level set at $p < .017$. There was a significant difference in reading comprehension scores between Story A (M = 9, SD = 2.39) and Story B (M = 12.5, SD = 3.6), Z = -3.31, p = .001 (two-tailed), r[37] = 0.83 and a significant difference in scores between Story A and Story C (M = 11.25, SD = 3.34), Z = -2.65, p = .008 (two-tailed), r = 0.66. This finding indicated that Story A was significantly more difficult than Stories B and C. There was no significant difference between Story B and Story C, Z = -1.14, p = .256 (two-tailed), r = 0.29. Similarly, a non-parametric Friedman test with reading enjoyment scores (Story A, Story B, Story C) as the dependent variable tested for any differences in reading enjoyment across the three stories. There was no significant difference in reading enjoyment scores across the stories, χ^2 (2) = 2.18, p = .336 (two-tailed), Kendall's W = 0.07.

4.1.3 Interim Discussion

Overall, the three stories correlated well with the NGRT providing some evidence for convergent validity. Story B (The taxi driver) and Story C (A teacher's unusual day) showed good levels of reliability, however, Story A (Bank robbery) showed poor internal consistency and was perceived as more difficult. Children's reading comprehension scores differed significantly across the stories with children achieving greater scores (median) for Story B and Story C. Reading enjoyment scores did not differ significantly across the stories.

In the light of these results, further adjustments were made to the stories and questions.

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[36] Kendall's W (Coefficient of concordance) tested whether children performed the three reading tasks similarly, and thus they were in complete agreement. Kendall's W uses the Cohen's guidelines (1988) for effect sizes and these can be defined as small (0.01), medium (0.03) and large (0.05).

[37] Rosenthal's r statistic (Rosenthal, 1991) served as a measure of effect size for the non-parametric analyses; r values taken as: 0.10 – 0.06 = small; 0.06 – 0.14 = medium; > 0.14 = large.

The ‘Item Statistics’ and the ‘Inter-Correlation Matrix’ in SPSS also indicated which of the questions were simplistic or too challenging to answer. Based on these data, some questions were omitted, and others were simplified (e.g., some questions that had two parts were split into two single questions), especially in the case of Story A. Twelve questions, six literal and six inferential, assessed reading comprehension in the main study. Finally, it was difficult to measure reading enjoyment for each story based on a single question; however, children showed similar reading enjoyment levels across the stories. Children’s generic favorable comments for each story were used to write the story reviews in the main study.

The stories and questions were not further piloted to confirm whether the modifications worked. While acknowledging that this can be an important limitation, my decision not to test further the reading materials was primarily due to practical reasons. School recruitment proved relatively challenging, and therefore conducting another pilot study could have possibly delayed the implementation of the main study. As explained earlier, I followed a process to even out differences in the difficulty levels of the three stories. Finally, I ran non-parametric tests in the main study to test further for any differences in reading comprehension and enjoyment across the three stories to mitigate this limitation to a degree.

4.2 Main Study

4.2.1 Method

4.2.1.1 Participants

Using the G* Power 3.1 software, an a priori analysis showed that a minimum sample size of 28 children would allow checking for medium effects (η_p^2 = 0.06) and significant interactions between choice/reward (within-subjects factors) and ADHD status (between-subjects factor) at a power (alpha) of .05 (Faul et al., 2007). Information letters and opt-in consent forms were sent to parents/carers, either directly or via teachers (Appendix M).

Twenty-six children returned the opt-in consent forms. Twenty-four children finally participated in the study (*M* age = 9.33 years; *SD* = 0.79), after excluding two children who experienced emotional difficulties to a degree that these interfered with the testing procedure. The final sample included 12 children diagnosed with ADHD (4 girls, 8 boys) and 12 children without ADHD (4 girls, 8 boys) or any other diagnosis. All children attended a mainstream primary school in England. Children with co-occurring conditions were not excluded from the ADHD sample in this study. Given the under-diagnosis of ADHD in the UK (Russell et al., 2014) and the challenging aspect of child recruitment discussed later, I did not exclude any children in the presence of co-occurrence. This also offers a more accurate representation of ADHD, given its high co-occurrence with other conditions, such as autism (Astle & Fletcher-Watson, 2020).

Children attended Year 3, Year 4, Year 5, or Year 6 and were aged between 8 to 11 years old. Similar to Study 1, these age groups were selected as reading motivation and enjoyment are more likely to decline towards the end of the primary phase (Sainsbury & Schagen, 2004), and thus reading practices that promote motivation may be important predominantly for these children. Children with ADHD typically experience greater reading difficulties than children without ADHD (Miller et al., 2013). Therefore, the selection of older rather than younger children (Year 1 and Year 2) was strategic, as older children with ADHD were expected to have already developed a set of basic reading skills that would allow them to work on the assigned reading tasks. Children were not excluded based on additional criteria.

Children with ADHD had an independent formal diagnosis. Children with ADHD were sought initially, and the community sample was recruited using a non-probability 'snowball' technique commonly used in ADHD studies (Barkley & Fischer, 2011). Specifically, teachers nominated a child without ADHD, and any other diagnosis, of the same chronological age, gender, and similar reading ability to the child with ADHD for participation in the study. I tried to recruit participant pairs (a child with ADHD and a child without ADHD) from the same school. However, it was not possible to identify children without ADHD from the same school for four children with ADHD. As a result, four children without ADHD were recruited from different schools and matched based on similar characteristics (age, gender, and reading ability). Statistical analyses showed that the two groups were matched properly (did not differ) based on age $U = 67$, $Z = -0.29$, $p = .773$ (two-tailed), $r = 0.06$ and baseline reading ability $U = 61.5$, $Z = -0.61$, $p = .54$ (two-tailed), $r = 0.13$. As explained later, children's scores in the no motivation condition of the reading intervention served as an indicator of baseline reading ability, used to further confirm the equivalent reading level of the two groups. Children did not differ on receptive vocabulary (standardised vocabulary score), $U = 65.5$, $Z = -0.38$, $p = .707$ (two-tailed), $r = 0.08$. No child had an Education, Health and Care plan (EHC) or received Special Education Needs (SEN) support.

Children with ADHD were recruited directly through primary schools and indirectly via UK ADHD groups, charities and organisations using social media (Facebook, Twitter). Ten mainstream primary schools across England agreed to take part in the end. Due to practical difficulties related to cost and time, children outside England were not sought. Most children attended a community school ($N = 20$; ADHD = 20, Non-ADHD = 20) and four children attended a private school (ADHD = 2, Non-ADHD = 2). Community schools were rated as 'Good' or 'Outstanding' according to the most recent Ofsted report.

Teachers or parents provided information about child ethnicity, EHCP/SEN status (yes or no format), English as an Additional Language (EAL) (yes or no format), eligibility for free school meals (a proxy indicator of socioeconomic background; yes or no format) and pupil premium (a proxy indicator of socioeconomic background; yes or no format). Parents of children with ADHD offered information about medication usage (yes or no format) and co-occurring conditions. No significant differences[38] were reported in terms of free school meals χ^2 (1, N = 24) = 0.38, p = .537 (two-tailed), φ[39] = 0.13 between the two groups; children in the two groups were of similar socioeconomic background. There were significant differences in the EAL status between the two groups χ^2 (1, N = 24) = 4.8, p = .028 (two-tailed), φ = 0.45; children with ADHD (N = 12) did not have an EAL status, whereas four out of 12 children without ADHD had an EAL status. Table 4.2 presents the demographic characteristics of the final sample. This table also shows the different channels through which children were recruited to ensure greater transparency in recruitment methods, usually lacking in ADHD research.

[38] Similar non-significant results were also found for pupil premium.
[39] Phi values were interpreted as follows: 0.1 – 0.3 = small; 0.3 – 0.5 = medium; > 0.5 = large (Cohen, 1988).

Table 4.2

Demographic Characteristics of the Final Sample in Study 2

Baseline characteristic	Non-ADHD (N = 12) N	ADHD (N = 12) N
Gender		
Boys	8	8
Girls	4	4
Ethnic group		
White group	6	10
Asian group	4	0
Black group	1	1
Mixed group	1	1
Eligibility for free school meals (Yes: No)	1:11	2:10
Pupil premium (Yes: No)	1:11	2:10
English as an Additional Language (Yes: No)	4:8	0:12
Recruitment channels		
Social media (Facebook, Twitter)	0	8
Schools	12	3
ADHD conferences	0	1
Co-occurring conditions		
Developmental Co-ordination Disorder	0	2
Sensory Processing Disorder	0	3
Dyspraxia/Dysgraphia	0	1
Dyslexia (or dyslexic traits)	1[a]	2
Autistic traits/Autism	0	6
Anxiety	0	2
Oppositional Defiant Disorder	0	1
ADHD Medication		
Yes	0	7
No	12	5

Note. N = 24. Information was provided by teachers and/or parents. Children were grouped into ethnic groups according to the 2011 Census report (Office for National Statistics, 2012). Co-occurring conditions include both diagnosed and/or suspected conditions.

[a] This participant presented mild dyslexia traits but did not have a diagnosis of dyslexia at the time of testing.

4.2.1.2 Measures

Similar to Study 1, children completed the Adapted Version of the Motivation for Reading Questionnaire (MRQ), the Stroop Colour and Word Test, the Simon Task, and the Advanced Virtual Reality Tool for the Assessment of Attention (AULA). Parents and teachers completed the Conners 3 scales. This section offers brief coverage of these measures.

British Picture Vocabulary Scale- 3rd Edition (BPVS-III). The BPVS-III assesses receptive (hearing) vocabulary in children aged 3 to 16 years old (Dunn et al., 2009). This is a well-cited measure (Filippi et al., 2020) based on the Peabody Picture Vocabulary (Dunn & Dunn, 1997). Children with ADHD show typically weaker vocabulary (receptive or expressive) than those without ADHD (Martinussen & Mackenzie, 2015). Given the association between vocabulary and intelligence quotient (IQ) (Smith et al., 2005), scores on the BPVS-III could, possibly, serve as an indicator of general IQ. Research reports frequently a negative (generally modest) relationship between ADHD and IQ (Jepsen et al., 2009), with children with ADHD being more likely to have lower IQ than those without ADHD; however, differences between the two groups on IQ variables (e.g., verbal comprehension, perceptual reasoning) may not always be significant and vary based on the test and variables being measured (Areces et al., 2018). The BPVS-III has excellent reliability of .91 (Dockrell & Marshall, 2015).

The BPVS-III is an easily administered one-to-one test that lasts approximately 15 min. In this study, a computerised version was administered. Children were instructed that they would hear a word each time and they should respond by selecting a picture out of four options presented on the laptop screen to define the word meaning. All words were pronounced by a native speaker and recorded in advance to ensure that these were articulated clearly based on English standards. The test includes 14 sets of 12 items (words), each of increasing difficulty.

Before testing, it was necessary to find the set corresponding to the child's age and then begin the test with the first word in that set. If no more than one error was made, then this was the Basal set. If more than one error was made, then the Basal set was established by testing backwards through preceding tests until no more than one error was made for this set. After the Basal test had been established, children were tested forward by sets until eight or more items were wrong in a set of 12 items. This was the Ceiling set. Once a set had started, all 12 items were administered. Previously administered sets that were used to establish the Basal set were not tested again when checking for the Ceiling set. Children's responses and errors were recorded manually. A raw score was calculated for each child by recording the number of the Ceiling item (the last item in the Ceiling set) and subtracting from it the number of errors made by the child from the Basal set through the Ceiling set. Raw scores were converted to standardised scores (M = 100; SD = 15) by age (in years and months).

Adapted Version of the Motivation for Reading Questionnaire (MRQ). Similar to Study 1, an adapted version of the MRQ assessed baseline reading motivation (Wigield & Guthrie, 1997). This version was modified by Fridkin (2018) and included 38 items. Total scores were computed by using the sum of the items. Complete MRQ data following imputation (data not completed at random) were included. Cronbach's alpha gave a value of .89 showing good-to-excellent reliability.

Stroop Colour and Word Test. The paper-pencil version of the Stroop Colour and Word test assessed interference control (Golden version, 1978). The number of items that children read correctly in 45s was calculated for all three conditions (Word, Colour, Colour-Word). The Predicted Colour-Word (Pcw) score was then calculated using Golden's formula (see Section 3.1.2 for details on this formula). The interference score (I) is measured typically by subtracting the Pcw score by the actual number of items correctly named in the Colour-Word (CW) condition. A low Interference score indicates poor interference control (Scarpina

& Tagini, 2017). The number of errors that occurred in the CW condition also served as an index of interference control (McDowd et al., 1995). These were recorded manually.

Simon Task. A computerised version of the Simon Task (Simon & Wolf, 1963) designed by Naeem et al. (2018) was applied using E-Prime (version 2.0; Schneider et al., 2002; 2007) to measure interference control. The amount of Interference was assessed by subtracting mean reaction time (RT) in congruent trials by mean reaction time (RT) in incongruent trials. To measure Interference, difference scores in Accuracy were also calculated by subtracting mean Accuracy scores in congruent trials by mean Accuracy scores in incongruent trials. Large difference scores indicate weak interference control. Children with ADHD are more likely to differ from those without ADHD, with the former group achieving lower RTs and more errors in incongruent than congruent trials when compared with the latter group (Mullane et al., 2009).

AULA: Advanced Virtual Reality Tool for the Assessment of Attention. The AULA was administered (see Sections 3.1.1.2 and 3.2.1.2 for a detailed description of the tool) to ensure objective evaluations of inattention, behavioural inhibition/impulsive control, and hyperactivity (Díaz-Orueta et al., 2014). The use of general measures, including rating scales, and more specific measures, including AULA, could provide a better understanding of the cognitive profiles of children with and without ADHD (Areces et al., 2018). The AULA provides specific information across six conditions as it differentiates the measures of inattention and hyperactivity/impulsivity by sensory modality (visual versus auditory), presence of distractors (with or without distractors), and task paradigm (X versus No-X paradigm). Total raw scores[40] were extracted for Omission errors (inattention), Commission errors (behavioural inhibition/impulsive control), and Reaction Time Variability (RTV)

[40] RT to Commission errors (behavioural inhibition/impulsive control) and RTV to Commission errors (behavioural inhibition/impulsive control) were not used in this study, as, due to the number of variables, focus was given on the variables most commonly reported in ADHD research (Areces et al., 2018; Sims & Lonigan, 2012).

(inattention). Raw scores on Motor activity were also used given that children with ADHD had the combined type, thus experiencing both inattention and hyperactivity. Motor activity refers to the frequency and relevance of head movements and is a good indicator of hyperactivity. Motor activity in AULA refers to the total score of motor activity calculated in the presence or absence of distractors, both in the X and No-X paradigms. Motor activity scores in visual and auditory conditions are not assessed by AULA and thus were not included. Children with ADHD typically obtain greater scores on all AULA variables than children without ADHD, showing increased inattention, hyperactivity, and weak behavioural inhibition/impulsivity (Rodríguez et al., 2018).

Conners 3rd Edition-Parent (Conners 3-P) and Conners 3rd Edition-Teacher (Conners 3-T) Rating Scales (Short Version). Parents and teachers rated children's inattention and hyperactivity/impulsivity (Conners, 2008). Raw scores were converted to T scores based on age and gender. Cronbach's alpha gave a value of .97 for the Parent scale and a value of .96 for the Teacher scale. Cronbach's alpha gave a value of .95 for the Parent Inattention scale and a value of .95 for the Parent Hyperactivity scale. Cronbach's alpha had a value of .95 for the Teacher Inattention scale and a value of .93 for the Teacher Hyperactivity scale. T scores have a mean of 50 and a standard deviation of 10. T scores equal and/or above 65 show elevated inattention and hyperactivity/impulsivity (more concerns than are typically reported). Table 4.3 shows the descriptive statistics for background variables (e.g., baseline reading motivation), ADHD variables, and group differences across measures.

Table 4.3

Descriptive Statistics for Background Variables, ADHD Variables, and Differences Between Groups in Study 2

Variable	Non-ADHD (N = 12)			ADHD (N = 12)					
	M (*SD*) *Range*	*K*	*S*	*M* (SD) *Range*	*K*	*S*	*U*	*p*-value	*r*
Chronological age	9.27 (0.83) 8.3 – 11.17	1.06	0.91	9.38 (0.78) 8.03 – 10.87	0.08	0.33	67	0.773	-0.06
Receptive vocabulary BPVS-III	99.33 (15.84) 70 - 122	0.13	-0.85	103 (15.21) 77 - 125	-0.63	-0.45	65.5	0.707	-0.08
Baseline reading ability Reading scores_ No motivation	8.5 (2.75) 4 - 12	-1.49	-0.38	8.17 (2.33) 4 – 11	-0.58	-0.71	61.5	0.54	0.13
Baseline reading motivation MRQ	110.32 (19.14) 85 - 140	-1.18	0.24	104.67 (19.63) 63 - 133	0.53	-0.52	63	0.60	-0.11
Conners 3 Parent report									
Inattention	55 (10.85) 43 – 76	-0.44	0.77	86.08 (5.63) 73 - 90	1.24	-1.41	1	**≤ .001****	-0.84
Hyperactivity	55.83 (13.53) 41 - 79	-0.9	0.8	85.42 (5.37) 77 - 90	-1.76	-0.51	2	**≤ .001****	-0.83
Conners 3 Teacher report									
Inattention	51.75 (8.04) 41 – 66	-0.76	1	68.92 (12) 41 - 90	2.37	-0.65	15	**≤ .001****	-0.67
Hyperactivity	51 (8.19) 42 – 68	0.17	1.13	78.42 (9.74) 56 - 90	1.43	-0.85	3	**≤ .001****	-0.82
AULA									
Inattention_ Omissions	34.25 (32.54) 0 - 92	-1.1	0.68	42.25 (29.45) 9 – 109	0.96	1.03	56.5	0.370	-0.18
Inattention_ RTV	395.77 (73.23) 255.81 – 514.49	-0.14	-0.29	430.03 (108.33) 282.90 – 671.68	0.98	1.03	62	0.564	-0.12
Behavioural inhibition_ Commissions	19.17 (8.53) 8 – 39	1.15	1.04	24.58 (9.83) 12 - 49	2.71	1.36	47	0.148	-0.30
Hyperactivity_ Motor activity	1.52 (1.34) 0.17 – 4	0.01	1.09	2.53 (1.67) 0.64 – 5.42	-0.67	0.6	44	0.106	-0.33
Stroop Test Interference	1.7 (5.32) -5.45 – 11.15	-0.59	0.7	1.63 (4.33) -7.79 – 6.17	0.36	-0.91	66	0.729	-0.07
Simon Task									
Interference (Accuracy difference)	-0.06 (0.09) -0.22 – 0.11	0.3	-0.21	-0.15 (0.18) -0.61- 0.05	2.79	-1.54	52	0.241	-0.24
Interference (RT difference)	27.53 (65.85) -75.22 – 126.72	-1.02	0.33	-2.21 (92.81) -174.17 – 93.66	-0.95	-0.78	66	0.729	-0.07

Note. M = Mean; SD = Standard deviation; K = Kurtosis; S = Skewness; BPVS-III = British Picture Vocabulary Scale (3rd Edition, raw scores converted to standardised scores by age); Baseline reading ability = Reading scores (raw scores) in the No motivation (Control) condition were treated as indicators of baseline reading ability; MRQ = Motivation for Reading Questionnaire (raw scores); Conners 3 Parent and Teacher raw scores were converted to T scores based on the child's age and gender; AULA = Advanced Virtual Reality Tool for the Assessment of Attention (raw scores for all variables); Omissions = Omission errors; Commissions = Commission errors; RTV = Reaction Time Variability; Stroop Interference = The Predicted Colour-Word raw score was subtracted by the actual number of items correctly named in the Colour-Word condition. A low Interference score indicated weak interference control; Simon Interference = Mean Accuracy and RT raw scores in congruent trials were subtracted by mean Accuracy and RT scores in incongruent trials respectively. Large difference scores indicated weak interference control. The two groups were matched based on age, gender, and baseline reading ability. Significant results are marked in bold. * $p < .01$ ** $p < .001$ (two-tailed).

Observation Checklist. Off-task behaviour was rated, while children were working on the reading tasks. Off-task behaviour offers an additional combined measure of inattention and hyperactivity/impulsivity. Off-task behaviour was measured after having initially tested four children (two pairs). During the testing of these children, slight differences in off-task behaviour were observed, informally, across the three conditions. Thus, a simple observation checklist was selected to record the frequency of off-task behaviours for the remaining children ($N = 20$). Off-task behaviour included active off-task behaviour (e.g., talking to the other child, standing up) and passive behaviour (e.g., looking consistently somewhere else other than the reading task, daydreaming) (Lauth et al., 2006). A total score of off-task behaviour was calculated for each child across all three conditions (Choice, Reward, and No Motivation).

Using an observation checklist examined whether children with and without ADHD would differ in behaviour across the three conditions, such that children, with particular focus on children with ADHD, would show less off-task behaviour when motivation was offered (Choice, Reward) compared with No Motivation. The few existing studies with children with and without ADHD show that autonomy-supportive (choice) and consequence-based (reward) interventions may help reduce off-task behaviour to a degree (Gaastra et al., 2016; Lauth et al., 2006; Zentall, 1980). Tables 4.4 and 4.5 show children's scores by group on the key developmental and ADHD variables. Table 4.6 shows descriptive statistics and differences between the two groups across the three conditions on the observation scale.

Table 4.4

Individual Scores of Children on Developmental and ADHD Variables in Study 2 (Except for AULA)

	Group	Gender	Age	Receptive vocabulary (BPVS)	Motivation (MRQ)	Parent Inattention (Conners 3)	Parent Hyperactivity (Conners 3)	Teacher Inattention (Conners 3)	Teacher Hyperactivity (Conners 3)	Interference (Simon Accuracy)	Interference (Simon RT)	Interference (Stroop)
Pair 1	Non-ADHD	M	8.37	111	85	48	41	49	47	-0.05	126.72	-3.37
	ADHD	M	8.03	77	130	89	90	82	90	-0.17	14.78	1.17
Pair 2	Non-ADHD	M	8.43	70	118	44	76	55	61	-0.06	23.56	-5.45
	ADHD	M	8.62	114	113	73	90	66	72	-0.61	-174.17	6.17
Pair 3	Non-ADHD	M	8.65	114	140	52	46	42	42	0	114.94	-1.11
	ADHD	M	8.88	117	117	90	83	75	83	-0.27	-120.94	-7.79
Pair 4	Non-ADHD	F	8.30	72	135	62	44	61	47	0	46.89	0.39
	ADHD	F	9.02	79	63	90	90	68	77	-0.33	-109.72	-1.83
Pair 5	Non-ADHD	M	8.88	122	113	61	60	66	62	0	-8.66	9.61
	ADHD	M	9.12	125	102	90	77	66	80	0.05	93.66	3.84
Pair 6	Non-ADHD	M	9.20	102	135	47	49	52	68	-0.17	-31.39	-2.93
	ADHD	M	9.12	118	120	90	90	66	80	-0.17	-74.22	2.90
Pair 7	Non-ADHD	M	9.62	86	86	52	43	54	48	-0.05	22.39	.61
	ADHD	M	9.20	91	90	90	80	75	77	-0.11	6.77	-1.47
Pair 8	Non-ADHD	F	9.53	106	102	59	74	41	47	-0.05	-75.22	11.15
	ADHD	F	9.52	103	133	87	90	41	90	0	69.23	2.41
Pair 9	Non-ADHD	M	9.35	103	110	43	49	47	48	-0.05	-14.11	8.11
	ADHD	M	9.92	102	102	79	79	72	90	-0.05	53.28	6.10

Table 4.4 (continued)

	Group	Gender	Age	Receptive vocabulary (BPVS)	Motivation (MRQ)	Parent Inattention (Conners 3)	Parent Hyperactivity (Conners 3)	Teacher Inattention (Conners 3)	Teacher Hyperactivity (Conners 3)	Interference (Simon Accuracy)	Interference (Simon RT)	Interference (Stroop)
Pair 10	Non-ADHD	M	10.02	104	113	76	79	58	47	-0.22	57.55	-1.10
	ADHD	M	9.91	112	98	82	79	65	71	-0.11	69.28	6.02
Pair 11	Non-ADHD	F	9.77	98	92	71	56	55	52	-0.17	-5.83	1.64
	ADHD	F	10.38	97	101	83	90	61	75	-0.05	83.95	-2.70
Pair 12	Non-ADHD	F	11.17	104	95	45	53	41	43	0.11	118.33	2.80
	ADHD	F	10.87	101	87	90	87	90	56	0	61.56	4.76

Note. ADHD (N = 12), Non-ADHD (N = 12), M = Male, F = Female. The two groups were matched based on chronological age, gender, and baseline reading ability. BPVS-III = British Picture Vocabulary Scale (3rd Edition, raw scores were converted to standardised scores by age); MRQ = Motivation for Reading Questionnaire (raw scores); Conners 3 Parent and Teacher raw scores were converted to T scores based on age and gender; Stroop Interference = The Predicted Colour-Word raw score was subtracted by the actual number of items correctly named in the Colour-Word condition. A low Interference score indicated poor interference control; Simon Interference = Mean Accuracy and RT raw scores in congruent trials were subtracted by mean Accuracy and RT scores in incongruent trials respectively. Large difference scores indicated weak interference control.

Table 4.5

Individual Scores of Children on the AULA Variables in Study 2

	Group	Gender	Age	Inattention (Omissions)	Behavioural inhibition (Commissions)	Inattention (RTV)	Hyperactivity (Motor activity)
Pair 1	Non-ADHD	M	8.37	74	39	433.84	2.40
	ADHD	M	8.03	64	17	329.12	2.73
Pair 2	Non-ADHD	M	8.43	59	25	471.51	4
	ADHD	M	8.62	40	32	545.59	3.40
Pair 3	Non-ADHD	M	8.65	76	17	424.93	3.97
	ADHD	M	8.88	59	26	385.40	2.72
Pair 4	Non-ADHD	F	8.30	92	13	514.49	1.26
	ADHD	F	9.02	109	49	671.68	5.26
Pair 5	Non-ADHD	M	8.88	4	20	349.64	0.37
	ADHD	M	9.12	12	24	346.04	0.68
Pair 6	Non-ADHD	M	9.20	19	27	368.57	2.18
	ADHD	M	9.12	9	21	377.45	0.64
Pair 7	Non-ADHD	M	9.62	30	18	411.27	1.08
	ADHD	M	9.20	18	19	282.90	0.67
Pair 8	Non-ADHD	F	9.53	7	17	361.38	0.38
	ADHD	F	9.52	34	12	429.48	1.60
Pair 9	Non-ADHD	M	9.35	0	23	255.81	0.47
	ADHD	M	9.92	72	23	396.82	3.76

Table 4.5 (continued)

	Group	Gender	Age	Inattention (Omissions)	Behavioural inhibition (Commissions)	Inattention (RTV)	Hyperactivity (Motor activity)
Pair 10	Non-ADHD	M	10.02	17	10	383.99	0.87
	ADHD	M	9.91	40	32	427.19	1.81
Pair 11	Non-ADHD	F	9.77	30	8	466.58	1.04
	ADHD	F	10.38	34	25	542.13	5.42
Pair 12	Non-ADHD	F	11.17	3	13	307.28	0.17
	ADHD	F	10.87	16	15	426.51	1.70

Note. ADHD (N = 12), Non-ADHD (N = 12), M = Male, F = Female. The two groups were matched based on chronological age, gender, and baseline reading ability. AULA = Advanced Virtual Reality Tool for the Assessment of Attention; Omissions = Omission errors; Commissions = Commission errors; RTV = Reaction Time Variability. Total raw scores are presented for all variables.

Table 4.6

Descriptive Statistics Across the Three Conditions Using Off-task Behaviour Observation Data in Study 2

	Non-ADHD (N = 10)			ADHD (N = 10)		
	M (SD)	K	S	M (SD)	K	S
Choice	.10 (.32)	10	3.16	.40 (.70)	-1.36	1.33
Reward	.10 (.32)	10	3.16	.30 (.48)	2.05	1.66
No Motivation	.20 (.42)	1.41	1.78	1.40 (1.71)	-1.36	0.71

Note. N = 20. Observation Off-task Behaviour data were not collected for four children. The table shows raw scores of off-task behaviour across the three conditions of the reading intervention.

Stories, Reading Comprehension Questions, and Scoring. Three short stories, written and matched for word length and difficulty level, assessed reading comprehension. Following the pilot study results, story adjustments were made to ensure that these were age-appropriate and had parity in difficulty level. Following adjustments, Story A (Bank robbery/Goodbye sweet dreams) included 221 words, Story B (The taxi driver/The holiday) comprised 229 words and Story C (A teacher's unusual day/A series of unexpected events) included 229 words. The stories were relatively short to avoid adding extra cognitive workload, especially to children with ADHD (Brock & Knapp, 1996). Mean reading times were 10.42 min for Story A, 9.92 min for Story B, and 9.63 min for Story C. No significant differences in reading time were reported across the three stories, $\chi^2(2) = 5.17$, $p = .075$ (two-tailed), Kendall's W = 0.11.

Twelve questions, six literal and six inferential, for each story assessed reading comprehension. The three stories included a variety of multiple-choice and open-response questions. One point was awarded for each correct answer and where the answer was missing or was incorrect, no point was awarded. The maximum score was 12. Total raw scores were used in analyses. Internal consistency gave a Cronbach's value of .67 for Story A, a value of .64 for Story B, and a value of .74 for Story C. This level of internal consistency was moderate-to-good (Koo & Li, 2016). Spearman's rho correlations showed a large significant (positive) correlation (two-tailed) between Story A and Story C, $r(24) = .64$, $p = .001$. No significant correlations were found between Story A and Story B, $r(24) = .33$, $p = .118$ as well as between Story B and Story C, $r(24) = .34$, $p = .099$. Concurrent validity with a standardised reading assessment (e.g. NGRT) was not tested, as in the pilot study, due to time constraints and the number of study materials. However, children's reading scores in the No Motivation (Control) condition were used as an indicator of baseline reading ability.

Titles, Summaries, and Child Reviews. In the Choice condition, six titles, six story summaries, and six short story reviews were written (two versions for each of the three stories). The titles and story summaries were generic and did not reveal much information about the story plot. The reviews gave generic positive comments for each story without sharing any key information (see Appendix N for the final version of the stories, questions, and additional reading materials). The reviews were developed based on children's story comments in the pilot study. Summaries and reviews were similar in terms of word length and structure. By offering children the opportunity to read comments made by other children, the aim was to increase feelings of task relatedness and potentially maximise choice effects. Children are more likely to attend to and invest themselves in reading when offered a meaningful choice; that is choice that enables them to exercise autonomy and considered choosing (not blind choice) over different options (Katz & Assor, 2007).

The '*Story Enjoyment/Interest*' Scale. Following the completion of the reading comprehension tasks for all three conditions, children completed a 13-item Likert scale rating the story they had just read. This was the same scale used in Study 1. Total raw scores were used in analyses. Cronbach's alpha gave a value of .80, indicating good reliability. Concurrent validity was assessed via calculating the association between the MRQ and the 'Story Enjoyment/Interest' scale in the No Motivation (Control) condition. Statistics showed a moderate (Spearman's rho) correlation between the MRQ and the 'Story Enjoyment/Interest' scale, $r(24) = .54$, $p = .006$ (Cohen, 1988), suggesting the concurrent validity of the measure. Spearman's rho correlations showed a large significant correlation between the enjoyment scales for Story B and Story C, $r(24) = .51$, $p = .011$. No significant correlations were found between the scales for Story A and Story B $r(24) = .15$, $p = .484$ as well as between Story A and Story C, $r(24) = -.13$, $p = .546$.

Reward List. In the Reward condition, children received a list of six rewards. The reward list included mini cube puzzles, animal pencils, superhero bookmarks, small notebooks, emoji stamps, and cartoon stickers. Before the reading comprehension task, they could choose two small rewards with the condition that they would make a considerable effort during the reading task (‘If you try hard and do your best, you will receive the reward of your choice’). When rewards are perceived as demonstrations of appreciation for children’s effort and hard work (informational), rather than as the only reason for participating in a task (controlling) they are more likely to enhance self-competence, and subsequently cognitive (reading comprehension) and affective (reading enjoyment) performance (Hidi, 2000). Contrary to most previous studies, in which participants were offered predefined rewards (Carlson et al., 2000; Luman et al., 2009), in this study rewards were administered in a more autonomy-supportive style as children chose their reward. Rewards may have greater cognitive and affective benefits when these represent effort-driven and autonomy-supportive events. To maximise reward effects, children were informed that they would receive their rewards after the completion of the reading comprehension task. Rewards are expected to have larger effects for children with ADHD when offered immediately after task performance, possibly due to the steeper delay-of-reinforcement gradient of children with ADHD (Marx et al., 2018).

4.2.1.3 Design

A repeated measures design examined differences in reading comprehension and reading enjoyment during a Choice (intrinsic motivator: experimental), a Reward (extrinsic motivator: experimental), and a No Motivation (no choice/reward: control) condition. Reading comprehension scores and enjoyment scores were the dependent variables. A mixed design with Condition (Choice, Reward, and No Motivation) as the within-subjects variable and Group Membership (ADHD, Non-ADHD) as the between-subjects variable explored differences in reading comprehension and enjoyment by Condition and Group, such that the reading comprehension and enjoyment of children with ADHD would be more positively affected by motivation (choice and/or reward) compared with no motivation than children without ADHD.

The Choice and No Motivation conditions were counterbalanced such that half children experienced the Choice condition first and the No Motivation condition after and the other half vice versa. Children were randomly assigned to one out of these two conditions. The Reward condition was always presented in the end. The Reward condition was administered after children had already experienced the other two conditions, as the presentation of reward in the first condition and removal of this in the following ones could affect negatively reading comprehension and enjoyment (Hidi, 2016). Due to the focus of the study, I was particularly interested in manipulating the positive effects of reward, as an extrinsic motivator, on reading.

A crossover design was applied, and children experienced all three conditions by the end of the intervention. Each pair of children read the same stories and experienced the same conditions at the same time. Different stories (Story A, Story B, and Story C) were administered across the three conditions. The story type and condition order were counterbalanced across the different pairs. All six story versions (two for each of the three stories) were rotated and administered across the three conditions (see Table 4.7) to ensure with greater certainty that any differences in reading comprehension and enjoyment across the conditions would be due to motivation (Choice, Reward) rather than due to the story characteristics.

Table 4.7

Example of Condition and Story Administration in Study 2

Pair	Stories across conditions		
Pair 1	The taxi driver (Story B, version 1) No Motivation (control)	Bank robbery/ Goodbye sweet dreams (Story A, two versions) Choice (experimental)	A teacher's unusual day (Story C, version 1) Reward (experimental)
Pair 2	A teacher's unusual day/ A series of unexpected events (Story C, two versions) Choice (experimental)	Bank robbery (Story A, version 1) No Motivation (control)	The taxi driver (Story B, version 1) Reward (experimental)
Pair 3	A series of unexpected events/ A teacher's unusual day (Story C, two versions) No motivation (control)	The taxi driver/ A holiday (Story B, version 1) Choice (experimental)	Goodbye sweet dreams (Story A, version 2) Reward (experimental)

Note. All six versions, two for each of the three stories, were rotated across all conditions (Choice, Reward, and No Motivation). The condition order was counterbalanced for the Choice and No Motivation Conditions. The Reward condition was always presented in the end.

4.2.1.4 Procedure

The study began in October 2019 and lasted until May 2021. Children were informed about the study aims and shared questions before testing. Children in pairs, a child with ADHD and a child without ADHD, completed the reading tasks in a quiet schoolroom. There was only a child who was tested at their home. Children worked in pairs, rather than separately, to minimise the exam-oriented character of the procedure and the overall time of testing following teachers' suggestions. Three children completed the reading tasks individually due to home testing or due to difficulties in identifying another child for participant matching.

All children completed the reading intervention in a morning session. Children were randomly assigned either to the Choice or No Motivation condition. In the Choice (experimental) condition, each child received two A4 envelopes. Each envelope included a story. The story title, summary, and reviews were stapled to the front of the envelope. Children had a perceived choice between one out of two stories; that is, the two stories were identical, but the titles, story summaries, and child reviews were different. Two versions were designed for each of the three stories (six in total). The number of stories was limited to two as the limitless choice could prove complex and eventually demotivating (Clark & Phythian-Sence, 2008), particularly for children with ADHD. Children had 5 min to read through the stapled material and make judgments about the given stories. Once children had made their decision, they placed the rejected story on the floor and opened the envelope with their chosen story. Inside the envelope, there was a full version of the story and a set of comprehension questions. Children read the story and answered the questions. They were reminded that they should work individually and could refer to the story while answering the questions.

In the No Motivation (control) condition, children were assigned one of the three stories and no motivation was offered. Children read the story and answered the questions. The procedure was identical to that of the Choice condition, except for the story selection. In the Reward (experimental) condition, children were assigned one of the three stories. Before reading, children were informed that they would receive a reward if they were being observed to work hard during reading. Children checked a reward list and selected two out of the six small rewards, which they would receive immediately after their work. Children chose their rewards first and then completed their reading task. Overall, they had as much time as they needed to complete the three reading tasks. All children finished each reading task within 20 min. During the three reading tasks, children's frequency of off-task behaviours was recorded via an observation checklist. Following the completion of each reading task across all three conditions, children were read aloud the 'Story Enjoyment/Interest' scale items and rated the story they had just read.

After the reading intervention, children completed the MRQ. They were read aloud the questionnaire items and recorded their answers. Where children were tested in pairs, they completed the reading tasks, the 'Story Enjoyment/Interest' scales, and the MRQ approximately within an hour. Following teachers' recommendations to minimise the testing time in school due to the COVID-19 outbreak and school timetable, four children completed the MRQ on a different day, with their teacher reading aloud the MRQ items. The teacher received explicit instructions for the MRQ administration and testing ran smoothly.

After the administration of the three reading tasks and the MRQ, children completed the rest of the tasks (BPVS-III, Simon, Stroop, and AULA) individually during a morning or afternoon session. Overall, testing lasted approximately two hours for each child and took place within the same day ($N = 20$) or two different days ($N = 4$) with breaks (e.g., school break, lunch break, 2 min break) in between. In addition to these measures, teachers and parents completed the Conners 3 Parent and Teacher rating scales respectively before and during the study. Due to the school workload and the pandemic, some parents ($N = 2$) and teachers ($N = 5$) were offered extra time to return the rating scales after the study.

4.2.2 Ethics

Ethical issues were considered throughout the study. This has been covered by the UCL Data Protection Registration and received a reference number Z6364106/2019/02/130 under the category of social research. The Department of Psychology and Human Development at UCL, Institute of Education has also granted ethical approval. Information letters and opt-in consent forms were sent to schools and parents/carers. Participants had the right to withdraw from the study at any stage; however, no requests for withdrawal were received after involvement in the study. Parents/carers of children with ADHD should ensure that their child does not take any ADHD medication at least 24 hours before the study, if applicable. Six parents expressed their concerns as to whether their child would be able to cope with the school routine, if not medicated. To address this issue, it was agreed to visit the school on a Monday morning, so that children would not have to stay medication-free for two consecutive school days.

Children were informed about the study aims and had the opportunity to ask questions before and after the study. I made an effort to test children in pairs during the reading activities to minimise child stress and the exam-oriented character of the procedure. Child verbal consent was sought before individual testing. Some time was given to build rapport with children and help them become more comfortable in the presence of an external school visitor. All children received a certificate of participation as a thank-you for their contribution. Parents of children with ADHD have received (or will receive), a brief report of their children's overall performance. This study did not aim to provide any clinical diagnosis and, therefore parents/carers of children without ADHD did not receive a similar report to avoid any undue concerns. All parents have been entered in a prize draw for 2x£25 and 2x£50 Amazon Vouchers. Full reports of the main findings have been or will be sent to participating schools. Copies of future publications will also be emailed to schools.

Due to the COVID-19 outbreak, testing was disrupted in March 2020 and began again in October 2020 (also disrupted between December and March 2021 due to another national lockdown), only to finish in May 2021. Before resuming fieldwork, a risk assessment for school and home testing was secured by UCL to ensure the health and safety of the people involved in the study. Some of the control measures included the disinfecting of the study equipment, the use of hand sanitiser before and after testing as well as the use of face masks and plastic gloves throughout testing. Schools, parents/carers, and children received an additional copy of these precautionary measures. Before testing, these additional measures were explained to children. In addition to the 24 children included in this study, 11 more parents of children with ADHD expressed an interest to participate in the first place; however, they had to withdraw from participation before the beginning of the study. Some reasons for not participating in the study involved i) the child's difficulty to follow their daily routine in the absence of medication ii) the child was struggling in school at the time of testing iii) schools were not willing to get involved iv) the parents' fear of virus transmission due to COVID-19 v) the child was attending a special needs school.

Data were initially stored in my personal encrypted computer and then transferred to UCL computers. Individual ID numbers were given to each child and anonymity was kept strictly. Data have been reported in research anonymously, ensuring that no sensitive information is included, and no participant is identifiable. School names or names of the school personnel have been kept confidential and no personal information has been or will be reported in papers, seminars, and conferences. Data were not transferred outside the European Economic Area (EEA). Personal (paper) data will be processed so long as it is required for the study and then destroyed. De-identified data will be perpetually available in the UCL Data Repository following publications.

4.2.3 Results

4.2.3.1 Data Screening and Analysis Plan

Data were analysed using the IBM SPSS Statistics 25 package. No missing data were reported for the key variables of interest (reading scores, ADHD measures). EDA showed that results were not always normally distributed. The Shapiro-Wilk Test showed that data were not normally distributed for the reading comprehension scores in the Reward and No Motivation condition, although no outliers, serious skewness, and kurtosis were detected (skewness was between -2 to +2 and kurtosis is between -7 to +7, Byrne [2010]). Due to the small sample size

($N = 24$), normality could not be assumed for the two key variables ($N \leq 30$), and thus non-parametric tests (e.g., Mann Whitney U test, Friedman test) and mixed ANOVA tests, using the Greenhouse-Geisser correction, were performed to test the aims and hypotheses for reading comprehension. Regarding reading enjoyment, reading enjoyment scores across all three conditions met the assumptions of normality based on the Shapiro-Wilk Test. No outliers were observed and both skewness and kurtosis ranged within normal rates. As a result, parametric tests were conducted (e.g., repeated measures ANOVA tests, paired sample t-tests) to test hypotheses with greater power (assumption of sphericity was met for reading enjoyment). Rosenthal's *r* statistic[41] (Rosenthal, 1991) was applied as a measure of effect size for the non-parametric analyses (e.g., Mann Whitney U tests) and partial-eta squared η_p^2 was used to report effect size in ANOVA analyses, as most commonly used.

To address *Data-driven Aim 1*, I conducted Spearman's Rho correlations to test the *Data-driven Hypothesis 1* that the convergent and divergent validity would not always be confirmed across the ADHD measures. Spearman's Rho correlations further explored the associations between the ADHD variables (inattention, behavioural inhibition/impulsivity, hyperactivity, and interference control), baseline reading motivation, and reading ability. Similar to Study 1, exploration of these associations was not a primary aim, but rather emerged as a significant issue during data analysis with important implications for ADHD assessment and diagnosis. Although children's assignation to groups (ADHD, Non-ADHD) was made based on formal diagnosis, parents/carers and teachers completed the Conners 3 scale to further

[41] Rosenthal's *r* statistic (Rosenthal, 1991) was applied as a measure of effect size for the non-parametric analyses. Effect size using the Rosenthal's *r* statistic is interpreted based on the Cohen's guidelines (1988). Therefore, effect size is small if $\eta_p^2 = 0.01$ (Rosenthal's $r = 0.10$), effect size is medium if $\eta_p^2 = 0.06$ (Rosenthal's $r = 0.30$) and effect size is large if $\eta_p^2 = 0.14$ (Rosenthal's $r = 0.50$). As mentioned in Chapter 3, Cohen's d values are also reported in brackets, only for the parametric and non-parametric analyses testing Experimental Hypothesis 1 in Studies 1 (Chapter 3) and 2 (Chapter 4). Cohen's d values are indicative of the magnitude of effects and allow better comparisons of findings across studies in the General Discussion chapter (Chapter 6). These values are interpreted as follows: 0.2 – 0.5 = small; 0.5 – 0.8 = medium; > 0.8 = large (Cohen, 1988).

confirm that the two groups differed significantly on the inattention and hyperactivity/impulsivity measures.

Regarding *Data-driven Aim 2*, a series of Mann-Whitney U Tests tested for any differences between children with and without ADHD across the ADHD variables (inattention, behavioural inhibition/impulsivity, hyperactivity, interference control), as measured by the Simon Task, Stroop Test, Conners 3 Rating Scales, and AULA as well as baseline reading motivation, assessed via the MRQ. *Data-driven Hypothesis 2* was that the two groups would differ across the ADHD and MRQ measures. Exploration of these differences was also not a primary aim of the study; however, this was considered as an important emerging issue.

Regarding the testing of the experimental aims and hypotheses for reading comprehension, a Friedman test (non-parametric alternative to parametric repeated measures ANOVA test) addressed *Aim 1* with Condition (Choice, Reward, No Motivation) as the three-level within-subjects variable to determine whether motivation could benefit all young readers. For reading enjoyment, a repeated measures ANOVA with Condition (Choice, Reward, and No Motivation) as the three-level within-subjects variable tested for any differences in reading enjoyment scores across the three conditions. *Experimental Hypothesis 1* was that Choice and Reward would increase the reading comprehension and enjoyment of all children compared with no motivation.

To address *Aims 2* and *3*, a mixed 2x3 ANOVA[42] with Group Membership (ADHD, Non-ADHD) as the two-level between-subjects variable and Condition as the three-level within-subjects variable (Choice, Reward, No Motivation) examined i) whether choice and reward could enhance the reading comprehension and enjoyment of both groups (Group membership was included in the analyses this time) and ii) whether the effects of choice and rewards would be more pronounced for the reading comprehension and enjoyment of children

[42] Mixed ANOVA tests using the Greenhouse-Geisser correction were applied due to the absence of an equivalent non-parametric test in SPSS.

with ADHD compared with those without ADHD. *Experimental Hypothesis 2* was that choice and reward would improve the reading comprehension of both groups, irrespective of group membership than no motivation. *Experimental Hypothesis 3* was that children with ADHD would benefit more from choice and reward in reading comprehension and enjoyment compared with those without ADHD.

Using the Greenhouse-Geisser correction, two mixed (3x3 or 3x2) ANOVA tests with Condition as the three-level within-subjects variable (Choice, Reward, No Motivation) and Story type (three-level) or Choice order (two-level) as the between-subjects variable tested whether Story type and/or Choice order affected reading comprehension and enjoyment scores and checked for possible interactions between Condition and Story type and/or Choice order. Using the Greenhouse-Geisser correction, a 3x2 repeated measures ANOVA with Condition (Choice, Reward, No Motivation) as the three-level within-subjects variable and Group membership (ADHD, Non-ADHD) as the two-level between-subjects variable tested any differences in off-task behaviour between the two groups across the three conditions.

4.2.3.2 Testing of Data-driven and Experimental Hypotheses

Data-driven Hypothesis 1: Convergent and divergent validity will not always be confirmed across the ADHD-related measures.

The convergent (agreement) and divergent (disagreement) validity between the behavioural tasks and rating scales of ADHD-related characteristics (Inattention, Behavioural inhibition, Hyperactivity, Interference control) was explored before testing the experimental hypotheses. This is an important aspect of the study with implications for assessment and diagnosis. Overall, correlations[43] were found primarily between constructs (e.g., inattention and hyperactivity) within the same measure (e.g., Parent rating scale), rather than between measures

[43] According to Cohen's guidelines (1988), correlation coefficient values are determined as small (.10), medium (.30) and large (.50).

(e.g., Parent rating scale and AULA) within constructs. There were limited or no associations across the assessment measures, with a few of these reaching a moderate level (e.g., Parent-rated Hyperactivity and Simon Interference, Hyperactivity [Motor] in AULA, and Stroop Interference).

Spearman's rho correlations underlined the discrepancies between the rating scales and behavioural tasks. Parent-rated Inattention showed a large positive correlation with Teacher-rated Inattention, indicating the convergent validity of the two Conners 3 rating scales, $r(24) = .75$, $p < .001$. However, there was also a large positive correlation between Parent-rated Inattention and Parent-rated Hyperactivity, $r(24) = .76$, $p < .001$ and a large positive correlation between Parent-rated Inattention and Teacher-rated Hyperactivity, $r(24) = .70$, $p < .001$. These findings fail to distinguish between the inattention and hyperactivity/impulsivity scales. Parent-rated Hyperactivity also showed a medium positive correlation with Interference control (Accuracy difference scores) in the Simon Task $r(24) = -.42$, $p = .043$, indicating that children rated as hyperactive by parents were more likely to display weak interference control. Similarly, a large negative correlation was found between Hyperactivity, as measured via Motor activity, in AULA and Stroop Interference. Drawing on this finding, children who displayed increased motor activity were more likely to exercise poor interference control. In the Simon Task, Interference control, as measured via Accuracy difference scores, showed a large positive correlation with Interference control, as measured via RT difference scores, $r(24) = .65$, $p = .001$, confirming that both variables assess interference.

Regarding inattention, a large positive correlation was found within the AULA between Omission errors and RTV, $r(24) = .66$, $p < .001$, which underlines the convergent validity of the measure to assess inattention. Nevertheless, Omission errors also correlated strongly, positively with Motor activity, $r(24) = .82$, $p < .001$ as well as with Stroop Interference $r(24) = -.53$, $p = .008$ (negative correlation), which highlights the difficulty of AULA to discriminate between inattention and hyperactivity (within the same measure). It was also difficult to distinguish between inattention measured by AULA and Interference control in the Simon Task (across measures).

In terms of hyperactivity, Motor activity had a large positive correlation with RTV, $r(24) = .67$, $p < .001$, a finding that, again, does not provide evidence that the two variables measure different ADHD constructs as expected. Most consistently with expectations, Motor activity had a large positive correlation with Commission errors, $r(24) = .48$, $p = .017$, showing that children with increased head movements were more likely to exercise poor behavioural inhibition by responding to AULA stimuli while they should not. Across measures, consistent with expectations, a large negative correlation was found between Motor activity and Stroop Interference, $r(24) = -.52$, $p = .009$. Motor activity, Commission errors, and Stroop Interference measure relatively different ADHD constructs, and such findings do not offer strong evidence for the divergent validity of the variables. Overall, results provided some evidence for the convergent validity of variables measuring the same construct within the same measure (e.g., Parent-rated Inattention and Teacher-rated Inattention), however, associations between variables measuring different ADHD constructs (e.g., Omission errors and Motor activity) were also found at the same time. In general, weak or no associations were found between variables measuring the same construct across different measures. Table 4.8 shows Spearman's rho correlations among the variables of interest.

Table 4.8

Spearman's rho Correlations Among Variables in Study 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Receptive vocabulary_ BPVS														
2. Baseline reading_ No Motivation	.16													
3. Baseline motivation_ MRQ	.15	-.19												
4. Inattention_ Parent report	.09	-.18	-.14											
5. Hyperactivity_ Parent report	.	-.05	.03	**.76****										
6. Inattention_ Teacher report	-.08	-.36	-.14	**.75****	**.57****									
7. Hyperactivity_ Teacher report	.	-.17	.11	**.70****	**.74****	**.61****								
8. Inattention (Omissions)_ AULA	-.36	**-.61****	.11	.12	.06	.2	.16							
9. Behavioural inhibition (Commissions)_ AULA	.17	.01	-.17	.04	.13	.23	.31	.3						
10. Inattention (RTV)_ AULA	-.28	-.35	-.11	.06	.17	.01	-.01	**.66****	.24					
11. Hyperactivity (Motor)_ AULA	-.34	-.38	.09	.13	.3	.25	.29	**.82****	**.48***	**.67****				
12. Interference_ Stroop	.38	.29	-.06	-.01	.07	-.01	.	**-.53****	-.22	-.31	**-.52****			
13. Interference (Accuracy)_ Simon	.11	.11	-.01	-.25	**-.42***	-.35	-.32	-.26	-.38	-.22	-.34	.29		
14. Interference (RT)_ Simon	.04	.03	-.1	-.11	-.23	-.25	-.25	.08	-.23	.01	.05	-.1	**.65****	

Note. N = 24. BPVS-III = British Picture Vocabulary Scale (3rd Edition); Baseline reading ability = Reading scores (raw scores) in the No Motivation (control) condition were treated as indicators of baseline reading ability; MRQ = Motivation for Reading Questionnaire (raw scores); AULA = Advanced Virtual Reality Tool for the Assessment of Attention (raw scores for all variables); Omissions = Omission errors; Commissions = Commission errors; RTV = Reaction Time Variability; Stroop Interference = The Predicted Colour-Word raw score was subtracted by the actual number of items correctly named in the Colour-Word condition (low interference score showed poor interference control); Simon Interference = mean Accuracy and RT raw scores in congruent trials were subtracted by mean Accuracy and RT scores in incongruent trials respectively (large difference scores indicated weak interference control). Significant correlations are presented in bold. * $p < .05$ ** $p < .01$ (two-tailed).

Associations Between the ADHD-related variables, Receptive vocabulary, Baseline Reading Ability and Motivation

A large negative correlation was found between Omission errors and Baseline Reading Ability, $r(24) = -.61$, $p = .001$. This showed that children with greater inattention, as assessed via AULA, were more likely to struggle with reading, scoring lower on the reading task in the No Motivation condition. No associations were found between baseline reading ability, baseline reading motivation, and receptive vocabulary as well as between baseline reading motivation, receptive vocabulary, and ADHD measures (both rating scales and behavioural tasks).

Data-driven Hypothesis 2: There will be differences between children with and without ADHD, such that children with ADHD would show greater inattention, hyperactivity/impulsivity, and lower inhibitory control and motivation than children without ADHD.

Based on the Conners 3 thresholds for T scores (Conners, 2008), the parent and teacher scores for children with ADHD showed elevated inattention and hyperactivity/impulsivity ($T \geq 65$), while these scores fell within the typical range (40 to 59) for children without ADHD. Drawing on the statistics of the Iriarte et al. (2016) study with a community sample of 502 children aged 8 to 11 years old ($N = 9.49$), children's scores for Omission errors were $M = 22.79$, $SD = 25.2$, for Commission errors were $M = 15.70$, $SD = 17.87$, for RTV were $M = 435.59$, $SD = 1256.83$, and for Motor activity, $M = 0.59$, $SD = 0.53$. In the present study, scores for Omission errors, Commission errors, RTV, and Motor activity were above the average (except for RTV) for both children with (Omission errors, $M = 42.25$, $SD = 29.45$; Commission errors, $M = 24.58$, $SD = 9.83$; RTV, $M = 430.03$, $SD = 108.33$; Motor activity, $M = 2.53$, $SD = 1.67$) and without ADHD (Omission errors, $M = 34.25$, $SD = 32.54$; Commission errors, $M =$

19.17, *SD* = 8.53; RTV, *M* = 395.77, *SD* = 73.23; Motor activity, *M* = 1.52; *SD* = 1.34), although scores were higher in the case of children with ADHD as expected.

Mann Whitney U Tests indicated the existence of significant differences between the two groups (see Table 4.3), only for the Conners 3 sub-scales. For the Parent scale, significant differences were reported for Parent-rated Inattention, $U = 1$, $p < .001$, $r = 0.84$ with children with ADHD being rated as more inattentive by parents, *M* = 86.08, *SD* = 5.63 than those without ADHD, *M* = 55, *SD* = 10.85. The two groups differed in Parent-rated Hyperactivity, $U = 2$, $p < .001$, $r = 0.83$, with children with ADHD being rated as more hyperactive by parents, *M* = 85.42, *SD* = 5.37 than those without ADHD, *M* = 55.83, *SD* = 13.53.

Regarding the Teacher scale, the two groups differed on Teacher-rated Inattention, $U = 15$, $p < .001$, $r = 0.67$ with children with ADHD being rated as more inattentive by their teachers, *M* = 68.92, *SD* = 12, than children without ADHD, *M* = 51.75, *SD* = 8.04. Children with ADHD were also perceived as more hyperactive by their teachers, *M* = 78.42, *SD* = 9.74 than children without ADHD, *M* = 51, *SD* = 8.19, $U = 3$, $p < .001$, $r = 0.82$. Following Bonferroni adjustments for multiple comparisons (.05/4 = .01) within the Conners 3 measure, differences between groups remained significant. In the presence of statistically significant differences between the two groups across the Conners 3 sub-scales, discriminant analyses were not applied to define the specificity and sensitivity levels of these variables in identifying children in each group (Areces et al., 2018), because of the small sample size and issues with multicollinearity resulting from the high correlations between Parent-rated Inattention, Parent-rated Hyperactivity, Teacher-rated Inattention, and Teacher-rated Hyperactivity.

The behavioural tasks (Simon, Stroop, and AULA) failed to discriminate between the two groups. As seen in Table 4.3, regarding the Simon Task the two groups did not differ in Interference, as shown by Accuracy and RT difference scores. Regarding the Stroop Test, the two groups did not differ in Interference. Similarly, no significance difference in Colour-Word errors was reported between the two groups, $U = 41.5$, $Z = -1.82$, $p = .068$ (two-tailed), $r = 0.37$. Regarding the AULA, no significant group differences were found in Inattention, assessed by Omission errors and RTV, Behavioural inhibition, measured via Commission errors, and Hyperactivity, measured via Motor activity.

Experimental Hypothesis 1: Choice and reward will increase the reading comprehension and enjoyment of all children compared with no motivation.

A Friedman test with Condition (Choice, Reward, No Motivation) as the three-level within-subjects variable investigated whether there are any significant differences in reading comprehension scores due to motivational choice and/or reward compared with no motivation. There was no statistically significant difference in reading comprehension scores, $\chi^2(2) = 4.45$, $p = .108$ (two-tailed), Kendall's W = 0.09 between the Choice ($M = 8.75$, $SD = 2.13$), Reward ($M = 9.25$, $SD = 2.33$) and No Motivation conditions ($M = 8.33$, $SD = 2.50$). A Wilcoxon Signed Ranks Test further checked[44] whether reading comprehension scores would differ across the three sets of conditions (Reward/Choice, No Motivation/Choice, and No Motivation/Reward). No significant differences in reading comprehension scores were found between the Reward and Choice conditions, $Z = -1.13$, $p = .260$ (two-tailed), $r = 0.23$ ($d = 0.2$) as well as between the No Motivation and Choice conditions, $Z = -.84$, $p = .40$ (two-tailed), $r = 0.17$ ($d = 0.18$). However, a statistically significant difference was found between the No Motivation and Reward conditions, $Z = -2.27$, $p = .023$ (two-tailed), $r = 0.46$ ($d = 0.4$), such that children scored higher on the reading comprehension task when offered extrinsic motivation, via reward, than no motivation.

A repeated measures ANOVA with Condition (Choice, Reward, No Motivation) as the three-level within-subjects variable explored whether reading enjoyment scores differed across

[44] Despite the lack of significant differences across the three conditions, I followed up with a non-parametric Wilcoxon Signed Ranks Test to check for comparisons across pairs of conditions, as originally planned.

the three conditions. There was a main effect of Condition, $F(2,46) = 3.9$, $p = .027$ (two-tailed), $\eta_p^2 = 0.15$. Children achieved greater scores in the Reward ($M = 40.25$, $SD = 7.15$) condition, followed by the Choice ($M = 39.67$, $SD = 6.23$) and No Motivation ($M = 35.63$, $SD = 7.25$) conditions. After Bonferroni adjustments, pairwise comparisons showed no significant differences across the three conditions. No significant difference was found in the reading enjoyment scores between the Choice and Reward conditions ($p = 1$, $d < .001$). Reading enjoyment scores also did not differ significantly between the Choice and No Motivation condition ($p = .065$, $d = 0.6$) or between the Reward and No Motivation condition ($p = .098$, $d = 0.64$); however, a non-significant trend (significant at the level of a one-tailed hypothesis) was found ($p < .1$) with children enjoying their reading better when offered either type of motivation compared with no motivation. Order of Story and Condition (the Reward condition was always presented last and, thus, not included in these analyses) did not affect reading comprehension and enjoyment scores (see Appendix O).

Experimental Hypothesis 2: Choice and reward will improve the reading comprehension and enjoyment of both groups, irrespective of ADHD, compared with no motivation.

Experimental Hypothesis 3: Children with diagnosed ADHD will benefit more from choice and reward in terms of reading comprehension and enjoyment rather than their non-ADHD peers.

Regarding reading comprehension (dependent variable), a mixed 3x2 ANOVA with Condition (Choice, Reward, No Motivation) as the three-level within-subjects variable and Group membership (ADHD, Non-ADHD) as the two-level between-subjects variable explored *Hypotheses 2* and *3*. Using the Greenhouse-Geisser correction, there was no main effect of Condition, $F(2, 44) = 2.12$, $p = .144$ (two-tailed), $\eta_p^2 = 0.09$, although both groups scored higher on the reading comprehension tasks in the Choice and Reward than the No Motivation conditions (see Table 4.9). There was no main effect of Group membership, $F(1, 22) = 0.12$, p

= .736, η_p^2 = 0.01. There was no significant interaction between Condition and Group membership, $F(2, 44) = 0.86$, $p = .364$, $\eta_p^2 = 0.04$. Therefore, the reading comprehension scores of children with ADHD were not more affected by either type of motivation compared with no motivation than those without ADHD.

Table 4.9

Descriptive Statistics for Reading Comprehension and Enjoyment by Group and Condition

Variable	Non-ADHD (*N* = 12)			ADHD (*N* = 12)		
	M (*SD*) *Range*	*K*	*S*	*M* (SD) *Range*	*K*	*S*
Reading intervention						
Reading_ Choice	8.58 (2.43) 4 - 11	-0.6	-0.69	8.92 (1.88) 5 - 12	0.5	-0.64
Reading_ Reward	8.83 (2.48) 4 – 12	-0.11	-0.8	9.67 (2.19) 5 - 12	0.26	-1.18
Reading_ No Motivation	8.5 (2.75) 4 - 12	-1.49	-0.38	8.17 (2.33) 4 - 11	-0.58	-0.71
Reading enjoyment_ Choice	42.42 (4.76) 37 - 52	-0.22	0.94	36.92 (6.49) 28 - 46	-1.15	0.15
Reading enjoyment_ Reward	41.17 (6.94) 28 - 52	-0.15	-0.21	39.33 (7.53) 26 - 51	-0.68	-0.3
Reading enjoyment_ No Motivation	38.42 (6.67) 27 - 50	-0.11	-0.11	32.83 (6.97) 16 - 42	2.23	-1.09

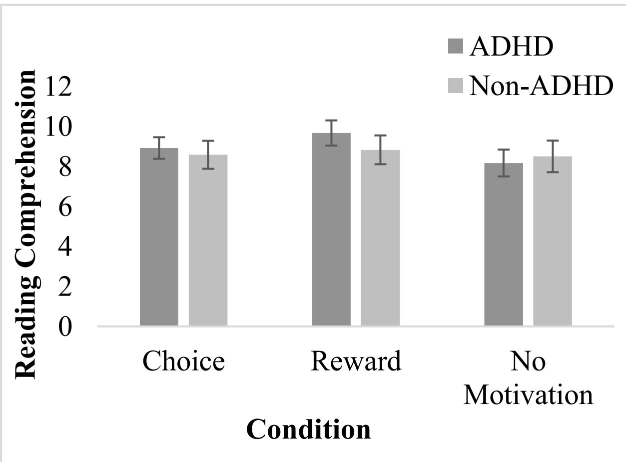
Note. *M* = Mean; *SD* = Standard deviation; *K* = Kurtosis; *S* = Skewness; Raw scores are presented for reading comprehension and enjoyment. All children read a different story in each condition (Choice, Reward, and No Motivation) and completed the 'Story Enjoyment/Interest' scale upon the completion of the reading task.

In terms of reading enjoyment, a second mixed 3x2 ANOVA was employed with Condition (Choice, Reward, No Motivation) as the three-level within-subjects variable and Group membership (ADHD, Non-ADHD) as the two-level between-subjects variable. There was a main effect of Condition, $F(2, 44) = 3.84$, $p = .029$ (two-tailed), $\eta_p^2 = 0.15$ (large). There was a main effect of Group membership, $F(1, 22) = 6.41$, $p = .019$, $\eta_p^2 = 0.23$ (large). Children with ADHD scored lower across all three conditions than those without ADHD (see Table 4.9 and Figure 4.1). Following Bonferroni adjustments, pairwise comparisons showed no significant differences between the Choice and Reward conditions ($p = 1$), between the Choice and No Motivation conditions (p = .075), and between the Reward and No Motivation conditions (p = .101), although these p-values became significant at the level of a one-tailed hypothesis (p = .04 for Choice/No Motivation and p = .05 for Reward/No Motivation respectively). Differences were not significant, however, descriptive statistics showed that both groups scored higher on reading enjoyment in the Choice and Reward compared with the No Motivation conditions (see Table 4.9). There was no interaction between Condition and Group membership, $F(2,44) = 0.7$, $p = .505$, $\eta_p^2 = 0.03$, indicating that the reading enjoyment of children with ADHD was not more positively affected by motivation compared with no motivation than that of children without ADHD.

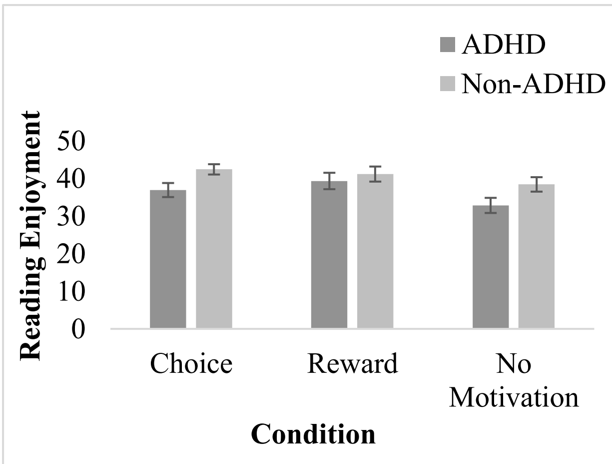
Figure 4.1

Reading Comprehension (A) and Enjoyment Scores (B) by Group and Condition in Study 2

A)



B)



Note. ADHD (N = 12), Non-ADHD (N = 12). No significant differences were found in reading comprehension and enjoyment between the two groups across the three conditions. Error bars represent standard errors.

Off-task Behaviour Observation Data

A mixed 3x2 ANOVA with Condition (Choice, Reward, and No Motivation) as the three-level within-subjects variable and Group membership (ADHD, Non-ADHD) as the two-level between-subjects variable tested for any differences in off-task behaviour between the two groups across the three conditions.

Using the Greenhouse-Geisser correction (assumption of sphericity was violated), there was a main effect of Condition, $F(2,36) = 5.76$, $p = .017$ (two-tailed), $\eta_p^2 = 0.24$ (large). There was no main effect of Group membership, $F(1,18) = 3.87$, $p = .065$ (two-tailed), $\eta_p^2 = 0.18$. A significant interaction was found between Condition and Group membership, $F(2,36) = 3.94$, $p = .048$ (two-tailed), $\eta_p^2 = 0.18$ (large). Following Bonferroni corrections, pairwise comparisons showed no significant differences in off-task behaviour between the two groups ($p = .065$). Nevertheless, there were significant differences in the total off-task behaviour of children across the conditions. Specifically, a significant difference was found between the No Motivation and Choice condition ($p = .044$), such that children, overall, showed greater off-task behaviour in the absence of motivation ($M = .80$, $SD = 1.36$) compared with choice ($M = .25$, $SD = .55$). No significant differences in off-task behaviour were found between the No Motivation and Reward ($M = .20$, $SD = .41$) conditions ($p = .076$) as well as between the Choice and Reward conditions ($p = 1$), although descriptive statistics showed that children displayed lower off-task behaviour, as indicated by lower mean scores, in the Choice and Reward conditions compared with the No Motivation condition (see Table 4.6).

4.2.4 Discussion

4.2.4.1 Associations of Measures and Differences Between Groups

Associations between the ADHD measures, baseline reading ability, and baseline reading motivation were explored before the testing of experimental hypotheses. Examination of these analyses proved to be an issue of major significance, considering its potential implications for the assessment of ADHD-related characteristics. Associations between inattention and hyperactivity/impulsivity variables were found within the same measure (e.g., AULA variables, Conners 3 rating scales), nevertheless, associations between constructs across measures were limited. The greatest association across measures was observed between hyperactivity (motor activity) in AULA and Stroop interference, $r(24) = -.52$, $p = .009$. These findings are in line with previous research that reveals consistent discrepancies among behavioural tasks and rating scales of ADHD-related characteristics.

Drawing on the most noteworthy findings, there were large associations between parent and teacher scales for both inattention and hyperactivity. Literature suggests that parent-teacher agreement on ADHD scales is more likely to increase with age (Narad et al., 2015), which may explain such high levels of inter-rater agreement in this study. Children who were rated as inattentive by parents and teachers were also more likely to be rated as hyperactive by parents. There is a likelihood that parents and teachers may find it difficult to distinguish between inattention and hyperactivity/impulsivity (Sims & Lonigan, 2012), rating children as both inattentive and hyperactive. The use of parent and teacher scales has also received some criticism, due to potential rater bias. In addition to this, half of the children had a diagnosis of ADHD, which was known to parents and teachers. This could have affected their ratings and, consequently, led to an increased parent-teacher agreement.

Regarding the AULA measure, a certain level of convergent validity was established between omission errors (inattention) and RTV (inattention); however, a large association was also found between omission errors and motor activity (hyperactivity) as well as between RTV and motor activity. Such findings fail to provide evidence for the divergent validity of these AULA variables in assessing inattention and hyperactivity, although they are in line, to an extent, with previous findings showing weak positive associations between the AULA variables expected to measure different constructs, such as commission errors and RTV (Rodríguez et al., 2018). In the present study, large associations were also found between motor activity and Stroop interference, $r(24) = -.52$, $p = .009$, as well as between motor activity and commission errors, $r(24) = .48$, $p = .017$, although they measure slightly different ADHD constructs. A possible explanation for such associations may be that all these variables assess the child's ability to exercise a level of inhibition by reducing head movements, restricting their tendency to respond to irrelevant stimuli, and suppressing the processing of irrelevant stimuli to focus on relevant stimuli being presented at the same time. Divergent validity was confirmed between omission errors and commission errors (hyperactivity) to a degree, in line with previous research reporting a lack of an association between omission and commission errors in AULA (Rodríguez et al., 2018). High associations between the inattention, behavioural inhibition, and hyperactivity variables in AULA as well as between the parent and teacher inattention and hyperactivity/impulsivity scales could be partially explained by the fact that the clinical sample had a diagnosis of combined ADHD, presenting difficulties with both inattention and hyperactivity/impulsivity.

The high internal consistency of inattention and hyperactivity/impulsivity items as reported in parent/teacher scales, as well as the strong associations between inattention and hyperactivity/impulsivity in rating scales and AULA, may also underline that these are distinguishable, but highly correlated dimensions (Sokolova et al., 2016; Willcutt et al., 2012). To explain this association, some studies suggest that inattention and hyperactivity/impulsivity have a common underpinning and interact synergistically to contribute to the manifestation of ADHD (Sonuga-Barke, 2005; Toplak et al., 2009). A bi-factor model for ADHD offers a useful framework to understand this overlap and distinction between inattention and hyperactivity/impulsivity (Martel et al., 2010). In brief, the bi-factor model for ADHD, which finds some support with young people, posits that there is a general ADHD factor that accounts for covariation among all ADHD- related characteristics with two specific factors of inattention and hyperactivity/impulsivity that explain variance and covariance independently, beyond that explained by the general factor (Dumenci et al., 2004; Toplak et al., 2012). This model further argues for an inter-person heterogeneity with some children displaying both inattention and hyperactivity/impulsivity, while others presenting a different profile such as greater inattention rather than hyperactivity and vice versa. Certain studies suggest that the association between inattention and hyperactivity/impulsivity is due to the causal relationship between the two constructs with inattention being a driving factor for hyperactivity/impulsivity (Sokolova et al., 2016). Findings that show the high association between inattention and hyperactivity/impulsivity have significant clinical implications. They stress the need to embrace holistic models that consider the contributions of both inattention and hyperactivity/impulsivity to the manifestation of ADHD, rather than overemphasising strict dichotomisations between current ADHD subtypes.

Significant differences between groups were reported for the Conners 3 parent and teachers scales, for both inattention and hyperactivity/impulsivity. These findings offer further empirical support for the discriminative validity of the ADHD scales (Izzo et al., 2019) and their diagnostic value towards distinguishing between clinical and community samples. Nevertheless, as mentioned earlier, rating scales alone may have not served as an objective measure of ADHD-related characteristics, given that raters were aware of children's diagnosis. Interestingly, no significant differences were found between the two groups in the AULA variables (omission errors, RTV, commission errors, motor activity), the Simon (interference measured via accuracy and RT difference scores), or the Stroop tasks (interference). Regarding AULA, failure to identify significant differences between the two groups contradicts previous research. In particular, Areces et al. (2018) found that children with ADHD ($N = 50$) displayed more omission and commission errors as well as a greater motor activity than the control group ($N = 38$). In the Iriarte et al. (2016) study with a community sample of children ($N = 1{,}272$), omission errors were identified as one of the most important AULA predictors (along with reaction time[45]) of group associations (14 groups classified by age and gender, seven for each gender group) and explained better group differences. Failure to distinguish successfully between the two groups in the present study may be, partially, due to the small sample size that did not enable detection of significant differences, especially considering that mean scores on the AULA variables were towards the expected direction, with children with ADHD displaying poorer performance (greater omission errors, commission errors, motor activity, and RTV) than children without ADHD. This also applies to the rest of the behavioural tasks (Simon and Stroop).

It has also been argued that behavioural tasks may not always distinguish effectively between the two groups, contrary to the rating scales. Most previous studies reported small or medium effect sizes for behavioural tasks, showing their potential difficulty in differentiating between the two groups (Marshall et al., 2019). In this study, effect sizes for behavioural tasks ranged from small to medium (r ranged between 0.18 and 0.33), whereas these were large for rating scales (r ranged between 0.67 and 0.84). The modest effect sizes in behavioural tasks may indicate that many children with ADHD score within the typical performance when tested on a single specific measure, having the ability to sustain their attention for brief periods and only a few of them may struggle significantly more than their non-ADHD peers (Kofler et al., 2014; Marshall et al., 2019; Nigg et al., 2005). Another possible explanation for not detecting group differences across the AULA variables could be related to age. Due to notable age differences across the sample, there is also a likelihood that age differences could have masked any group differences in performance on the behavioural tasks. For example, previous research found that the severity of inattentive and/or hyperactive-impulsive behaviours is more likely to

[45] Reaction time was not included in the Study 2 design; however, no significant differences were found on this variable between the two groups.

decrease with age, as indicated by children's improved performance on behavioural tasks over time (Coghill et al., 2014).

Associations between Stroop and Simon interference, hyperactivity (motor activity in AULA) and parent-rated hyperactivity (Conners 3) were limited. No significant differences were found between the two groups in interference control. Evidence regarding the relationship between ADHD and executive function (EF) processes, such as interference control, is relatively mixed. Some theory and research underline that children with ADHD (particularly those with the combined ADHD type) are more likely to struggle with inhibition-related processes including interference (Barkley, 1997; Biederman et al., 2004) than those without ADHD. However, difficulties with EF are neither necessary nor sufficient to predict group membership (Geurts et al., 2005; Nigg et al., 2002; Willcutt et al., 2005). Given the small sample size as well as the different manifestations of ADHD and the multi-dimensionality of inhibition as a construct, it is difficult to generalise these findings to the entire ADHD population. Furthermore, due to the focus of the study on reading motivation, further EF measures (e.g., behavioural tasks, rating scales) were not included. Considering the associations within measures, but across constructs and the limited or no association across measures within constructs reported here, these findings raise questions over the utility of behavioural tasks in the assessment of ADHD. Such discrepancies may highlight the necessity to develop more ecologically valid measures of ADHD-related characteristics that capture the everyday strengths and challenges of children with ADHD. Besides, omission errors (inattention) in AULA were the only ADHD variable in the present study that was associated with baseline reading ability (reading scores in the no motivation condition). These findings also raise the question as to how rating scales relate to objective measures, which are designed to measure ADHD-related characteristics minimising the risk of subjective bias (Sims & Lonigan, 2012).

Inattention, as measured by AULA Omission errors, was the only ADHD variable that was strongly negatively associated with baseline reading ability, $r(24) = -.61$, $p = .001$, possibly highlighting the greater role of inattention, compared with hyperactivity, in (poor) reading (Rabiner et al., 2000). No associations were found between baseline reading ability and baseline reading motivation as well as between baseline reading motivation and ADHD variables. As suggested in Study 1, although the MRQ is a reliable measure (a = .89) that has been used systematically with children, children and especially those with ADHD may find it difficult to reflect on past reading behaviour (more discussion on this in Chapter 6). In addition to this, lack of reporting an association between reading comprehension and motivation may be partially due to other factors (e.g., decline in reading motivation with age [Sainsbury & Schagen, 2004]) explained in greater detail in Chapter 3. Children's reading scores in the no motivation condition were used as indicators of baseline reading ability in the absence of a standardised reading test. Children in the two groups did not differ on their reading scores in the no motivation condition, validating the approach to seek teachers' opinions to match participants based on their reading level before recruitment. Nevertheless, standardised reading assessments offer more valid data on the strengths and difficulties of children in different areas (e.g., vocabulary, grammatical knowledge, and inference-making assessed in the NGRT) and help understand better the relationship between ADHD-related characteristics and reading.

No (negative) associations were found between baseline reading motivation and any of the ADHD variables and also no significant differences between the two groups on the MRQ. Mean scores on reading motivation were relatively lower for children with ADHD, but not significantly different. This is not in line with previous theory and research suggesting that children with ADHD are more likely to display poor (academic) motivation than children without ADHD (Sonuga-Barke, 2005; Smith & Langberg, 2018; Smith et al., 2019). In a systematic review of 18 studies, Smith and Langberg (2018) explored the relationship between motivation and ADHD in young people up to the age of 18. Nine studies that used teacher ratings, parent ratings, and observations with children found that those with ADHD displayed significantly lower academic motivation than those without ADHD (Carlson et al., 2002; Colomer et al., 2017; Gut et al., 2012). Contrariwise, seven studies that used self-reports with children, including the MRQ, did not report such significant differences between the two groups (Birchwood & Daley, 2010; Carlson et al., 2000; Dunn & Shapiro, 1999; Lee & Zentall, 2012; Martin, 2014; McInerney & Kerns, 2003). Only two studies that used self-reports of motivation with children found significant differences between the two groups (Olivier & Steenkamp, 2004; Zentall & Beike, 2012). Drawing on these conflicting findings, there is a likelihood that the relationship between academic motivation and ADHD may not always be clear, in part due to the type of the motivation assessment. Use of teacher and/or parent reports alone may not necessarily offer valid information, as adult raters do not have direct access to children's reading motivation, and may rely primarily on child reading behaviour, which is related more to reading ability rather than reading motivation. Combining different measures of motivation (e.g., teacher ratings, parent ratings, child ratings, observations) may offer a more holistic understanding of child reading motivation. Longitudinal research (Lee & Zentall, 2017) also reported that children with and without ADHD show similar rates of intrinsic reading motivation in primary school. Nevertheless, children with ADHD show a more significant decrease in reading motivation, relative to their non-ADHD peers, from primary to secondary school. These longitudinal findings stress the importance of developmental trajectories when investigating the relationship between reading motivation and ADHD (Smith & Langberg, 2018).

4.2.4.2 Testing of Experimental Hypotheses and Implications

This study recruited 24 children aged 8 to 11 years old, 12 children with and 12 children without ADHD, matched on chronological age, gender, and reading ability. All children attended mainstream primary schools in England. The hypotheses were that i) all children would show greater reading comprehension and enjoyment when offered perceived story choice and/or reward compared with no motivation; ii) story choice, as an intrinsic motivator, and/or reward, as an extrinsic motivator would increase the reading comprehension and enjoyment of both groups, irrespective of the presence of an ADHD diagnosis; and iii) the effects of story choice and/or reward would be significantly stronger for the reading comprehension and enjoyment of children with ADHD than those without ADHD. Children participated in a reading intervention with three conditions, a choice in which they selected one out of three stories, a reward in which they chose the reward offered upon the completion of the given reading task, and a no motivation condition, in which they were assigned a reading task (story) and no motivation was offered. Children completed measures of baseline motivation (MRQ) and receptive vocabulary (BPVS-III). They completed a virtual reality task (AULA) and measures of interference control (Simon, Stroop). Children's off-task behaviour was also rated across the three reading tasks. Teachers and parents rated children's inattention and hyperactivity/impulsivity (Conners 3).

Testing of *Experimental Hypothesis 1* showed that children did not achieve greater reading comprehension scores when checking the effects of condition (Choice, Reward, No Motivation) on reading comprehension. Nevertheless, a further analysis that compared children's reading comprehension scores across pairs of conditions showed that they achieved significantly higher reading comprehension scores when offered a reward compared with no motivation. There was a main effect of condition on reading enjoyment, with children achieving greater reading enjoyment scores in the reward condition, followed by the choice and then the no motivation condition. After Bonferroni corrections, pairwise comparisons showed no significant differences in reading enjoyment between pairs of conditions. Nevertheless, considering the small sample size there was a non-significant strong trend ($p <$

.1), with children enjoying their reading more when offered story choice (p = .065) and reward (p = .098) compared with no motivation. Taking into account that I was interested in testing the relationship in one direction (whether choice and/or reward increase reading enjoyment), results reached statistical significance for a one-tailed hypothesis (p-values for two-tailed tests divided in half), relevant for the testing of Experimental Hypothesis 1. Reading comprehension and enjoyment scores were not affected by story and condition order.

The reported non-significant findings of choice on reading comprehension and enjoyment are not in agreement with previous studies that found significant positive effects of choice on affective (e.g., interest) and cognitive engagement (e.g., task performance) (Flowerday et al., 2004; Fridkin, 2018; Patall, 2013; Wigfield & Guthrie, 1997). Children's opportunity to exercise ownership and self-determination during their reading did not increase significantly reading comprehension and enjoyment in this study, as hypothesised. This finding could be attributed partially to the small sample size, as explained earlier. Condition effects and pairwise comparisons could likely turn to significant with a larger sample size, as suggested by power analysis ($N \geq 28$). This can also be assumed drawing on children's mean scores for both reading comprehension and enjoyment, with all children achieving greater scores in the choice and reward conditions, than the no motivation condition as well as based on the effect sizes that ranged from small-to-moderate for reading comprehension (r between 0.17 and 0.46) and were relatively large for reading enjoyment (η_p^2 = 0.15). Nevertheless, exploration of mean scores across the three conditions in the absence of significant differences requires extra caution, as it could lead erroneously to over-interpretation of current findings. It is also likely that self-reports do not offer a valid measure of situational interest and enjoyment. Situational interest, as triggered by story choice, reflects the first phase of interest development, and thus children may not have yet developed the metacognitive ability to reflect on their enjoyment/interest levels at such an early stage (Hidi & Renninger, 2006).

Motivational theories and research (Deci & Ryan, 1985; Fridkin, 2018; McGeown et al., 2012; Wigfield & Guthrie, 1997) offer strong support for the positive impact of intrinsic motivators, such as choice, on reading outcomes including intrinsic motivation, reading amount, and reading comprehension (Becker et al., 2010; Schaffner et al., 2013). Current literature advocates primarily the negative effects of extrinsic motivators, including rewards, on subsequent motivation and cognitive performance, when rewards are no longer offered, (Deci et al., 1999), although findings have been relatively inconsistent. Interestingly, in the present study children achieved significantly higher reading comprehension scores in the reward than the no motivation condition. Greater total (not significant) mean scores in reading enjoyment were also reported for the reward than the choice and no motivation condition. No significant differences were reported in the reading comprehension and enjoyment scores between the choice and reward conditions.

Rewards have been regularly described as controlling events that facilitate an external perceived locus of causality (a child's perceptions of success and/or failure are attributed to external factors) and, thus, thwart intrinsic motivation for reading and subsequent cognitive performance (Deci & Ryan, 1985). In this study, choice did not increase reading comprehension or enjoyment more than reward, and, similarly, reward did not decrease either reading comprehension or enjoyment. Completion-contingent and performance-contingent rewards have been found to decrease intrinsic motivation and task performance (Deci et al., 1999). Nevertheless, in this study children were advised that they would receive a reward if they had been observed to work hard with their reading task. In this scenario, rewards were likely perceived by children as demonstrations of appreciation for personal effort and investment, and therefore served as boosters of perceived competence, reflected on comprehension and enjoyment scores (Hidi, 2000). Similarly, rewards were presented in a more autonomy-supportive rather than controlling style, as children had the opportunity to choose among a selection of rewards based on their preferences.

It is also relatively difficult to draw safe conclusions about the effects of rewards on reading comprehension and enjoyment due to other methodological limitations. For instance, the reward condition was not counterbalanced, as this was always presented in the end to maximise reward effects. This decision was strategic, driven by empirical evidence showing that withdrawal of a reward, once this was presented in the first place, could reduce motivation (enjoyment here) and performance (Hidi, 2016). The decision to administer the reward condition in the end also proved sensible, as some children with ADHD, got over-excited following testing. Therefore, using a different sequence of conditions may have interfered with the smooth completion of the remaining reading tasks. Future research should further investigate the effects of rewards on motivation and reading performance while controlling for the type of reward (verbal or tangible), reward expectancy (whether reward is expected or not), and reward contingency (whether reward is provided for completing a task or contingent on performance). Controlling for these factors could shed further light on the potential factors that may moderate reward effects on children's reading outcomes (Cameron & Pierce, 1994).

Experimental Hypotheses 2 and *3* were not confirmed. These hypotheses explored the potential reading benefits of extrinsic and intrinsic motivation for both children with and without ADHD, with greater emphasis on the reading of those with ADHD, due to the limited evidence-based reading practices supporting these children and to theoretical understandings of the particular relationship between ADHD and motivation. Testing of *Experimental Hypothesis 2* showed that both groups did not achieve greater reading comprehension in the choice and/or reward conditions in comparison with the no motivation condition. In terms of reading enjoyment, there was a main effect of condition. Descriptive statistics showed that both groups scored higher on reading enjoyment in the choice and reward conditions compared with the no motivation condition. Pairwise comparisons, however, did not identify any significant differences across the pairs of conditions. In this case, it could be argued that results became significant at the level of a one-tailed test, relevant for the testing of Experimental Hypothesis 2 (whether choice and reward increase reading enjoyment), with children scoring higher on reading enjoyment in the choice (p = .075, two-tailed) and reward (p = .101, two-tailed) than the no motivation condition. Testing of *Experimental Hypothesis 3* showed that choice and reward did not have a greater effect on the reading comprehension and enjoyment of children with ADHD than children without ADHD, as shown by the lack of interaction between choice+/reward and group membership.

These findings do not extend motivational theories in ADHD such as Delay-aversion and Optimal stimulation theories (Sonuga-Barke, 2005; Zentall, 1975) that underline the benefits of motivation on improving inattention, hyperactivity/impulsivity, and interference control (e.g., assessed through Go/No-Go tasks), to confirm similar gains for reading. Also, they do not offer support for the more salient effects of motivation on the reading comprehension and enjoyment of children with ADHD (Marx et al., 2018). Nevertheless, there is some research reporting limited support for the non-significant effects of reading motivation, particularly for children with ADHD. After controlling for initial reading differences, Zentall and Lee (2012) found significant effects of motivation (positive feedback) on the reading fluency and comprehension of children (aged 7 to 11 years old) with reading disability (RD) alone and combined ADHD and RD, but no significant gains for children with ADHD alone. The mean reading scores of the ADHD group were higher in the presence of motivation compared with no motivation.

Findings from the Zentall and Lee (2012) study and the current thesis study may underline the great heterogeneity of the ADHD population and the potential differential gains that motivational interventions could have for children with ADHD, depending on the presence or absence of RD. The present study did not include a separate group with combined ADHD and RD. Given the high co-occurrence between ADHD and RD (Sexton et al., 2012), future studies should aim to include multiple comparison groups (e.g., ADHD+RD) for more critical insight into the role of motivation in the reading of children with ADHD. Further extending on this point, in the present study, children with and without ADHD were matched by teachers based on baseline reading ability, so if children with ADHD had a low standard of reading, this would be matched with the reading of those without ADHD. Considering this, if motivation (choice and reward) is particularly important for those with a lower standard of reading, any effects of motivation seen in children with ADHD would also be seen in those without ADHD. Future research could further explore the effects of motivation using a clinical group of children with ADHD, a group of children without ADHD matched with the ADHD group on baseline reading, and a group of children without ADHD, performing within the typical range of reading.

Initially, the use of short passages was considered sensible to avoid adding extra cognitive workload, especially to those with ADHD. Nevertheless, drawing on the propositions of Zentall and Lee (2012), the use of short passages could be a compensatory strength for children with ADHD, making it difficult to identify additional stronger gains of motivation (choice and/or reward) for reading comprehension and enjoyment. It seems that story choice and reward may be of little additional value for children with ADHD in the case where reading materials are relatively brief. My findings may also not be in line with previous research, partially due to the focus on reading. Reading practices supporting motivation in children with ADHD have been neglected systematically. Reading represents a relatively cognitively demanding activity, and thus it may have been difficult to identify significant motivational effects, especially given the small sample size and the situational manipulation of choice. It remains to be seen whether situational factors including choice, vivid descriptions, surprising information, and novelty could contribute consistently to greater gains for the reading of children with ADHD, relative to children without ADHD (Beike & Zentall, 2012).

An observation checklist was applied drawing on preliminary findings showing that child off-task behaviour may vary depending on whether the learning environment is autonomy-supportive or not (Lauth et al., 2006; Zentall, 1980). Analyses showed that there were no significant differences in observed off-task behaviour between the two groups across the three conditions. However, overall, children were observed as showing significantly lower off-task behaviour in the choice than the no motivation condition. No other differences in overall off-task behaviour were found across conditions. Considering that significant interactions were not found between group membership and condition in the main analyses for reading comprehension and enjoyment, there might be an element of subjective bias in the observation method, due to the absence of a second observer in the room. For instance, I may have recorded, subconsciously, more frequent incidents of inattention and hyperactivity/impulsivity (off-task behaviour) for all children in the no motivation than the choice (and reward) condition. In addition to this, I had full knowledge of the child's group membership (ADHD, Non-ADHD) during the performance of the reading tasks, and this could have affected recordings of children's behaviour.

Finally, another important methodological limitation is that the three stories of the intervention were piloted initially with 8 to 9-year-old children. Following amendments made to the stories and questions based on the pilot study results, a second pilot study did not further test the appropriateness of reading materials with children aged 8 to 11 years old as recruited in the main study. A second pilot study was not conducted due to time constraints and practical difficulties related to school access. This study's findings should also be treated with caution given the good, but not excellent internal consistency of the three stories (a = .67 for Story A, a = .64 for Story B, a = .74 for Story C). Children achieved greater reading comprehension scores for Story C compared with the other two stories and greater enjoyment scores for Story A, compared with the rest of the stories. Nevertheless, differences across stories were not significant. A cross-over design controlled for the effects of story type to address this issue in the main study, however, it is difficult to preclude the possibility that story type could have obscured choice and reward effects.

4.2.5 Conclusion

This is the first study to manipulate experimentally both intrinsic and extrinsic motivation, to inform research and school practice around the role of motivation in the reading outcomes, especially of children with ADHD. This study possesses several strengths. It included both a community and clinical sample of children with ADHD, this tested hypotheses during a repeated measures design that counterbalanced the story and condition order, and this also used a multi-method assessment of ADHD-related characteristics. Findings point towards some of the benefits of motivators on reading comprehension and enjoyment (e.g., positive reward effects on reading comprehension) trying to fill in the gap in ADHD literature; however, the great majority of results were not statistically significant. Such inconsistencies stress the need for further examining the effects of choice and reward with large samples, including further comparison groups (ADHD + RD), to inform current reading policy and practice in schools.

In the light of this unclear quantitative evidence, seeking the personal accounts of children with and without ADHD could prove of considerable value. To understand the role of intrinsic and extrinsic motivation during reading, it is also important to elicit children's perspectives. Children engage in reading activities daily at school and home, and thus they should be involved more actively in dialogues around a topic such as motivation that can have a direct impact on their learning. Qualitative research could further elucidate whether, how and under what conditions interest and motivation (intrinsic and extrinsic) affect reading, whether interest and motivation can support attention during reading as well as whether children with and without ADHD discuss the role of motivators during reading in different ways. The following chapter presents the final study of the thesis that explored the reading experiences of children with and without ADHD in relation to interest, motivation, and attention.

Chapter 5. Pilot and Main Study 3

Children's Perspectives on the Role of Interest and Motivation in Reading

So far, Study 1 (Chapter 3) showed that story choice, as an intrinsic motivator, contributed to an increase in the reading comprehension, but not reading enjoyment (there was a strong non-significant trend though) of a community sample of children with minimal and severe inattention (and other ADHD-related characteristics). In Study 2 (Chapter 4), children with and without ADHD showed greater gains in reading comprehension and enjoyment when offered story choice or reward compared with no motivation. Nevertheless, Study 2 findings were mostly non-significant, in part due to the small sample size. Current knowledge as to whether reading motivation is meaningful in the reading of children with and without ADHD is considerably restricted given the methodologies applied in reading motivation research to date. Chapter 5 presents the final qualitative study (Study 3) of the thesis. The first aim was to explore the perspectives of children with and without ADHD aged 8 to 11 years old about their reading experiences and the role of motivation (intrinsic and extrinsic) and interest in their reading. The second aim was to examine whether there are any qualitative differences in the motivational profiles and reading experiences of the two groups.

The first-person accounts of children have not been sought actively and consulted in studies that explore children's learning (Hargreaves, 2017), such as the relationship between interest, motivation, and reading. There is some literature investigating the views of neurotypical children around interest, reading motivation, and reading for pleasure (Edmunds & Bauserman, 2006; Fridkin 2018; Strommen & Mates, 2004), but not the views of children with ADHD. A common argument for the limited child accounts in the literature of motivation is that children may not always offer valid data, as they have not yet fully developed their knowledge to reflect accurately on the relatively abstract constructs of interest, motivation, and attention (Piaget, 1971). Although there is some basis for this proposition, there are a few studies that have underlined the importance of children's self-reports and subjective accounts in gaining a thorough understanding of their learning/reading experiences.

In a qualitative study with 91 children aged 9 to 10 years old, Edmunds and Bauserman (2006) found that reading-related factors such as personal interests, choice, characteristics of books (e.g., illustrations) as well as sources including family, teachers, and peers influenced children's motivation to read. Similarly, quantitative research found both cross-sectional and longitudinal associations between these factors, increased reading achievement and reading for pleasure (Clark & Rumbold, 2006; Wigfield et al., 2016). In a study using self-reports with 117 children aged 6 to 11 years old, Rogers and Tannock (2018) found that children with severe teacher-rated ADHD-related characteristics perceived their classrooms as more controlling, experienced greater feelings of incompetence, and reported more negative relationships with their teachers than those with such minimal characteristics.

During semi-structured interviews with 39 adolescents aged 9 to 16 years old, Morsink et al. (2017) found that major themes related to everyday motivation such as achieving a sense of togetherness, feeling competent, valuing social reinforcement, and feeling free and independent were valued as equally important by children with and without ADHD. The two groups differed in some specifics, with children with ADHD showing a greater aversion towards boring and lengthy tasks and also an aversion towards the slow passing of time, mentioning being less attracted by familiar and predictable tasks and providing less elaborate descriptions of togetherness (belonging to a group). These findings are in line with previous quantitative findings which highlighted that motivation is equally important for children with and without ADHD, although the former group may be in greater need of motivation (Smith & Langberg, 2018). The very limited, but promising, evidence shows that children with and without ADHD do not necessarily lack the ability to reflect on reading motivation and overall reading experiences, and thus their perspectives should be further embedded into reading research.

Failure to include children's voices in discussions around their reading poses several limitations. First, studies traditionally apply questionnaires of reading motivation developed by researchers (usually neurotypical adults) that have investigated principally the reading profiles of neurotypical children (Cox & Guthrie, 2001; Lee & Zentall, 2012). For example, the empirically validated Motivation for Reading Questionnaire (MRQ, Wigfield & Guthrie, 1997) has been developed based on interviews and observations with children attending mainstream primary schools. However, it is unclear whether testing also included children with neurodevelopmental conditions such as children with ADHD. In addition to this, qualitative measures of reading motivation could offer insight into the conditions under which young readers, and particularly readers with ADHD, may show enhanced or reduced motivation. Interest and motivation do not represent static constructs that exist independent of context, but they can rather develop and flourish, for example, in autonomy-supportive and rewarding learning environments (Renninger & Hidi, 2016). Thus, classifying children with ADHD as having poorer than average reading motivation, may not reflect fully the motivational profiles of these children. The proposed study aims to address this gap by eliciting the views and perspectives of primary-aged children about their motivation and reading experiences.

First, Chapter 5 presents the pilot interview study. Due to similarities with Study 2, some information will not be repeated in this chapter and the reader will be referred to the relevant sections. Then, the chapter describes the main study aiming to provide sufficient information to ensure the clarity and transparency in methods and meet the criteria of good-quality qualitative research. After this, it presents and discusses the interview results drawing on literature. It addresses key limitations and theoretical/educational implications, while others are discussed more broadly in the *General Discussion* chapter (Chapter 6).

5.1 Pilot Study

5.1.1 Method

5.1.1.1 Participants

Three children without ADHD (two girls and a boy) aged 8 to 9 years old participated in a brief interview and discussed their learning experiences about interest, motivation, and attention. Children attended the same classroom of a four-form community mainstream primary school, rated as ‘Good’ in the most recent Ofsted report. The classroom teacher nominated three children of different reading ability. Background information (e.g., birthdate, ethnicity, reading ability) was not collected.

5.1.1.2 Measures

Semi-structured Interviews. Children were interviewed individually using face-to-face audio-recorded semi-structured interviews. In the absence of qualitative research exploring the relationship between reading motivation, interest, and attention, the interview questions, in the pilot and main study, were generated based on questionnaires such as the MRQ (Wigfield & Guthrie, 1997), the Motivation to Read Profile (MRP; Gambrell et al., 1996; Malloy et al., 2013), the ‘Story Enjoyment/Interest’ scale used in Studies 1 and 2 as well as the Conners 3 self-report (Conners, 2008). Questions were generated drawing on qualitative and quantitative research showing the importance of motivation for children with and without ADHD (Fridkin, 2018; Morsink et al., 2017; Wigfield et al., 2016).

The interview schedule included a warm-up question and five main questions about intrinsic motivation, attention, and learning (e.g., Are there any things that make it difficult for you to pay attention in the classroom? /As a Year 4 student, what do you think that good teachers can do to help children pay attention in the classroom?). Prompt questions were also used to encourage children to expand on their ideas (e.g., What do you mean by saying this? Can you tell me a bit more about this? / Why do you think so?). The average length of the three interviews ranged between 8 and 10 min. At this stage, the interview schedule included questions about learning in broad terms rather than questions specific to reading. Transcript analyses and informal observations during the interviews informed decisions around the selection of questions specific to reading in the main study.

5.1.1.3 Procedure

The study took place in March 2019. Information letters and opt-in consent forms were sent, via teachers, to parents/carers before the study. Children were interviewed individually in a quiet schoolroom. They were informed about the study aims and offered verbal assent. The interviews took place during afternoon sessions within a school day. Children received a certificate of participation and a gift (a notebook and pen) for their involvement.

5.1.2 General Findings and Lessons Learnt During the Pilot Study

Interviews were transcribed verbatim. The primary thesis supervisor and I searched for child statements that focused on the relationship between interest, motivation, and reading/learning more broadly. I looked at interview transcripts in relation to the study aims and did not apply any particular method of analysis (thematic analysis) due to the small sample size.

Children discussed the role of motivation and interest and their relationship to learning: ‘It’s a bit boring to focus on listening to the teacher, so they [other children] can’t focus properly’; ‘When it’s things I do like in subjects I would always be focused, but if it’s boring and the teacher talks too much about it, I wouldn’t really pay attention’. When children were asked about what teachers could do to help them pay attention in the classroom a child mentioned the role of intrinsic motivation: ‘They [teachers] can make it [lesson] more exciting’. Two children also referred to the importance of extrinsic motivators such as rewards and punishment: ‘Children can have a five-minute break’; ‘Teachers can move them [children] or maybe move the other children that distract them’. Based on the pilot interviews, I decided to make further adjustments to the interview questions so that these are specific to reading. Also, I added five more questions about extrinsic motivation.

In the pilot study, I evaluated my interview techniques and practiced how to be more reflective and flexible when interviewing children. It was necessary to shift my focus towards a more child-centred approach to understand children's ideas. For instance, I practiced how to make more frequent use of prompt questions when something was not clear, how to rephrase questions to encourage child talk as well as how to steer the discussion back to the topic, in case children started talking about stuff not relevant to reading and school life.

5.2 Main Study

5.2.1 Method

5.2.1.1 Participants

The children interviewed in this study were the same group of children tested in Study 2. In total, 12 non-ADHD children (4 girls, 8 boys) and 12 children with a diagnosis of ADHD, aged 8 to 11 years old, participated in the study (*M* age = 9.33 years; *SD* = 0.79). All children attended mainstream primary schools in England. The two groups were matched on gender, chronological age, and baseline reading ability. Children did not differ on receptive vocabulary (standardised vocabulary score; an indicator of general IQ) and socioeconomic status (e.g., eligibility for free school meals, pupil premium). Children did not receive an Education, Health and Care plan (EHC) or Special Education Needs (SEN) support. There were significant differences in English as an Additional Language (EAL) between the two groups χ^2 (1, $N = 24$) = 4.8, p = .028 (two-tailed), φ = 0.45; children with ADHD (N = 12) did not have an EAL status, whereas four out of 12 children without ADHD had an EAL status. Some children with ADHD had co-occurring conditions (see Section 4.2.1.1 for details on participant characteristics and recruitment). Table 5.1 shows children's background information.

Table 5.1

Children's Background Information in Study 3

	Group	Gender	Age	Receptive vocabulary (BPVS)	Motivation (MRQ)	Reading ability (No Motivation)
Pair 1	Non-ADHD	M	8.37	111	85	7
	ADHD	M	8.03	77	130	4
Pair 2	Non-ADHD	M	8.43	70	118	6
	ADHD	M	8.62	114	113	5
Pair 3	Non-ADHD	M	8.65	114	140	6
	ADHD	M	8.88	117	117	5
Pair 4	Non-ADHD	F	8.30	72	135	4
	ADHD	F	9.02	79	63	8
Pair 5	Non-ADHD	M	8.88	122	113	9
	ADHD	M	9.12	125	102	8
Pair 6	Non-ADHD	M	9.20	102	135	11
	ADHD	M	9.12	118	120	10
Pair 7	Non-ADHD	M	9.62	86	86	10
	ADHD	M	9.20	91	90	9
Pair 8	Non-ADHD	F	9.53	106	102	12
	ADHD	F	9.52	103	133	9
Pair 9	Non-ADHD	M	9.35	103	110	11
	ADHD	M	9.92	102	102	9
Pair 10	Non-ADHD	M	10.02	104	113	11
	ADHD	M	9.91	112	98	11
Pair 11	Non-ADHD	F	9.77	98	92	5
	ADHD	F	10.38	97	101	11
Pair 12	Non-ADHD	F	11.17	104	95	10
	ADHD	F	10.87	101	87	9

Note. ADHD (N = 12), Non-ADHD (N = 12), M = Male, F = Female. The two groups were matched based on chronological age, gender, and baseline reading ability. BPVS-III = British Picture Vocabulary Scale (3rd Edition), raw scores were converted to standardised scores by chronological age (M = 100; SD = 15); MRQ = Motivation for Reading Questionnaire (raw scores); Reading scores in the No Motivation condition served as an indicator of baseline reading ability (maximum score was 12).

5.2.1.2 Measures

Semi-structured Interviews. Children were interviewed individually using face-to-face audio-recorded semi-structured interviews. The interview design was flexible to maximise the opportunity to probe relevant aspects of interest and reading motivation, rather than fixed, where the aim is to provide representative descriptions. Initially, the interview schedule of the main study included nine open-ended questions that explored children's reading experiences in relation to interest, motivation, and attention. After the first two interviews and following discussions with the primary supervisor, six questions remained the same, two questions were modified, one question was deleted, two main questions, and six sub-questions were also added (nine questions in total). The new questions and sub-questions explored what kind of books children read, how they find out about the books they read as well as children's feelings when reading an easy or difficult book in relation to attention. These questions were tested with three pairs of children (six children in total) from the final sample size. Following these six interviews, one more question with three sub-questions and three more sub-questions for three other questions were added to examine the role of rewards in reading. Inclusion of interview questions targeting both intrinsic and extrinsic motivation could help explore more exhaustively the contribution of different motivators to reading and shed further light on the inconclusive Study 2 quantitative findings around story choice and reward.

The final interview schedule included 10 main open-ended questions that explored children's reading experiences in relation to interest, intrinsic motivation (choice), extrinsic motivation (rewards), and attention. The interviews focused particularly on children's perceptions of their reading, children's thoughts about the elements that make books interesting/boring and easy/difficult to read/pay attention as well as children's ideas about the role of choice and rewards during reading and the teaching practices needed to support attention and reading in the classroom. Sixteen more children (eight children with and eight children without ADHD) were interviewed on the final set of 10 questions.

Adding new questions as the interview study progressed may have led to offering some children more opportunities to discuss certain aspects of reading motivation compared to others. Nevertheless, this was a necessary step considering that the interview process is dynamic and can be shaped by the interviewees' views. Due to the limited qualitative research with children, it was also essential to reflect on the interview schedule throughout the study and make any necessary changes. Adjusting the questions after the first eight interviews based on children's ideas and literature allowed to develop a more focused and refined interview schedule that secured a richer story of the role of motivation in reading (McGrath et al., 2019).

Interview techniques including the use of probe questions (e.g., 'Can you tell me more about this?'), imaginary scenarios ('Imagine that you read a mystery book, will you find it easier or more difficult to pay attention?') and summary statements ('Do you mean that you make pictures in your mind while reading this book?') were used to ensure that children understood the questions and I understood their ideas. A critical incident technique was used occasionally (Flanagan, 1954), in which children reflected on specific and concrete examples related to their reading ('Can you think of one or two things that teachers can do to make reading interesting?', see Williamson et al., 2009 for an example application of the technique). Table 5.2 presents the final version of the interview schedule.

Table 5.2

Final Interview Schedule Including Main Questions and Sub-questions in Study 3

Main questions	Sub-questions
One of the activities that children do in the classroom and outside school is reading. Do you like reading? Do you feel that you are a good reader? What kind of books do you like reading?	What do you like best about reading? Why don't you like reading?
How do you find about the books you want to read?	Who picks the books that you read? Do you prefer choosing the books or having someone else choose the books for you? At school, do you usually choose the books, or do you have someone else choose the books for you?
Do you have an all-time favourite book?	Was it easy or difficult for you to read your favourite book?
If a book is interesting, do you find it easy or more difficult to read?	If a book is not interesting, can you still read this or do you find this difficult to read? Do you ever feel that you lose track of time when a book is interesting?
Are there any books that you find easy and difficult to read?	How do you feel, when you read a difficult book? Do you find it easy or difficult to pay attention? How do you feel, when you read an easy book? Do you find it easy or difficult to pay attention? At school, do you often find that you get books that are difficult or easy to read? How do you feel about this?
I would like you to have a look at this picture. Some children say that they cannot always pay attention when they read a book in the classroom. Do you ever feel this way?	If children say that the reason, they cannot always pay attention is their classmates who keep on distracting them, then the question would be 'If your classmates read an interesting book, do you think that they will continue distracting you or not?'
As a student, what do you think that good teachers can do to help children pay attention during reading?	If children find it difficult to answer, then 'Do you think that children can better pay attention, when teachers make reading more enjoyable, or it does not make any difference? If it does, then 'What does enjoyable reading mean to you?
At school, do you ever get a reward, such as stickers or certificates, during reading?	What rewards do you usually get? How do you feel? Do you feel that you want to try harder with your reading when you know that you will get a reward, or it does not make any difference? Do you think that teachers who give rewards to children can help them become better readers?

5.2.1.3 Analytic Approach and Positionality

Interviews were transcribed verbatim and analysed using NVivo 12, following the six phases of the Thematic Analysis (TA) outlined by Braun and Clarke (2006; 2019). *Thematic Analysis* is a widely used qualitative analytic method of identifying, analysing, interpreting, and reporting patterns (themes) of shared meaning across the data set (Braun & Clarke, 2006; 2017; 2019). The six phases of TA include i) familiarisation with the data ii) generation of initial codes iii) searching for themes iv) reviewing themes v) defining and naming themes and vi) producing the report.

I examined all the data together, due to codes and themes being shared across the two groups and re-coded, where necessary. TA was reflexive, as I moved backwards and forwards between the data and analysis to ensure a more reflective and thoughtful engagement with the data. I carried out an initial thematic analysis with my primary supervisor conducting a thematic analysis on 20% of interviews. During online meetings, we discussed whether the themes and sub-themes reflected shared meaning within the data set to ensure that important patterns were not overlooked and to address any inconsistencies. This approach better aligns with the premises of a reflexive TA. Nevertheless, it is difficult to preclude the possibility that researchers with a more positivist and neo-positivist epistemology (e.g., those supporting inter-rater reliability) may potentially find this approach as limiting in terms of scientific rigour. To provide a more rigorous, transparent, and trustworthy TA, I followed the trustworthiness criteria introduced by Lincoln and Guba (1990, see Appendix P).

I applied an inductive (bottom-up or data-driven) approach looking to generate themes based on the data, rather than following a pre-existing coding framework (top-down or deductive approach). Given that the study aims, and interview questions were developed following familiarisation with existing literature with both neurotypical and ADHD populations, the challenge was not to generate themes based on pre-defined coding frameworks in reading motivation research. To minimise the effect of previous knowledge on data interpretation (Tufford & Newman, 2012), I kept a diary to record any pre-conceptions (bracketing) and also discussed any issues related to potential bias with my supervisor. Data were analysed at the semantic (or explicit) level initially, generating themes based on similar phrases and concepts. Records of all raw data were archived to provide an audit trail against which data analysis and interpretations were tested (Nowell et al., 2017). The themes were not considered final until the entire data set had been read through. Keyness of themes was established, based on whether this theme captured an important aspect of reading (Braun & Clarke, 2006). The prevalence of themes was determined at the level of the data item (e.g., Did a particular theme appear anywhere in each interview?).

Reflexive TA requires transparency regarding the researchers' theoretical assumptions and philosophical beliefs (Braun & Clarke, 2019; Nowell et al., 2017; O'Brien et al., 2014). Themes were created within a 'contextualist' framework of critical realism (Willig, 1999). In critical realism, reality comprises three levels, namely, the empirical, the actual, and the real (Fletcher, 2017). Critical realism enables the exploration of children's subjective reading experiences related to interest and motivation (the empirical level). It also allows investigating any differences in the role of motivation in reading between children with and without ADHD, probably as the outcome of differences in the brain's reward circuit mechanisms (the actual level) and examining some of the underlying mechanisms that may affect reading motivation, including the classroom environment (the real level).

In line with Braun and Clarke's approach (2019), I determined the sample size reflecting on factors such as i) *the breadth and focus of research questions*-questions were open-ended and relatively broad to explore the under-researched reading and motivational experiences of children ii) *the diversity of the sample* - the sample included children aged 8 to 11 years old, with and without ADHD, who attended mainstream primary schools, and thus it was relatively diverse for this qualitative study iii) *the methods and modes of data collection employed*- both quantitative (Studies 1 and 2) and qualitative (Study 3) approaches explored the role of motivation in reading and iv) *the pragmatic constraints of the study*- these were evaluated particularly in terms of access to primary schools and identification of children with ADHD.

Finally, it is important to address my positionality as this could influence the ways I am interpreting children's accounts (England, 1994). I am a psychology researcher, and thus I will explore the reading experiences of children from an outsider's perspective. Also, I consider myself as a person without ADHD, and therefore the interpretations and conclusions I will provide may differ from people with ADHD. I have developed an interest in research with children with ADHD-related characteristics through previous experiences as a primary teacher and researcher in the areas of reading and reading motivation. My research is inspired by the neurodiversity movement (Singer, 1999), which embraces a positive approach towards neurodevelopmental conditions and views ADHD as a neurological difference, rather than as a set of deficits rooted in disease-based models (Armstrong, 2011). Recognition of these personal positions does not entail that this study lacks in veracity. Such an acknowledgment rather underlines the need to reflect continuously on personal perspectives and ideologies.

5.2.1.4 Procedure

The study began in October 2019 and lasted until May 2021 along with Study 2. Information letters and opt-in consent forms were sent to parents/carers, either directly or via teachers, before the study (see Appendix M). Ethical approval for school/home testing and a risk assessment related to COVID-19 were secured. Twenty-three children were interviewed individually in a quiet school room and one child was interviewed in their home. The study aims were discussed with children. Children offered verbal assent and were informed that they could withdraw at any stage if they wished. No requests for withdrawal were received. In line with the updated UCL Ethics procedures around COVID-19, children and I discussed the protective measures taken during testing, where applicable. The interviews took place during morning or afternoon sessions within a day. All children received a certificate of participation and parents have been entered in a prize draw for 2x£25 and 2x£50 Amazon Vouchers as a thank-you for their involvement.

5.2.2 Ethics

Most ethical issues are covered in detail in Section 4.2.2 of Chapter 4. Regarding the ethical issues specific to Study 3, it was necessary to add new questions as the interview study progressed for a better understanding of children's reading motivation as mentioned earlier. Therefore, it is likely that some children in the later phase of data collection had more opportunities to discuss certain aspects of motivation (e.g., rewards), compared with the others in the earlier phase. Another related issue is that I considerably improved my interview and answer elicitation skills from the beginning until the end of the study, and so there is a likelihood that interviews with children were richer in content and more meaningful as the interviews progressed. Children who were medicated and were advised to stay medication-free at least 24 hours before the study, were given a short break to take their medication before the interviews and after their parents' permission to avoid interfering further with children's daily medication routine. Finally, Study 3 interviews took place after children had already been tested on the rest of the measures (e.g., MRQ, BPVS-III) to help build rapport and trust with them. Overall, no serious ethical issues (e.g., requests for withdrawal) were reported.

5.2.3 Results

Interviews varied in length (range = 9.27 – 20.36 min), but mean interview times did not differ between children with (16.12 min) and without ADHD (14.78 min), p = .360, d =

0.38. All quotations[46] are identified by group membership and numbers to secure the anonymity of children. The codes 'ADHD' and 'NONADHD' refer to children with and without ADHD respectively.

I identified three main themes with their sub-themes related to reading and a general theme related to children's school life (see Figure 5.1). The three themes and key sub-themes (added in brackets) include 'Motivations to engage in reading' (positive wellbeing, preference towards challenging books, rewards, interest, escape reality, and educational benefits), 'Basic needs satisfaction' (competence, relatedness, and autonomy), and 'Classroom context' (noise and structure). The fourth general theme is named as 'Togetherness in school'. Themes and sub-themes were common across the two groups. A few group differences were seen as explained later in relation to the sub-themes of relatedness, supported autonomy, and perceived value of rewards.

[46] Grammar and syntax errors in quotations were corrected, ensuring that the meaning and the child character of these remain the same.

Figure 5.1

Concept map with Themes and Sub-themes in Study 3

Note. Themes are shown in rectangles and highlighted in bold, sub-themes in ovals. Themes were mostly similar in children with and without ADHD. The sub-themes discussed more elaborately by children with ADHD are presented in bold outline.

Motivations to Engage in Reading

In terms of what motivates children to engage in reading, some children talked about the contribution of reading to *positive wellbeing*: 'Reading is a nice peaceful thing to do' (NONADHD5); 'Funny books make me laugh and feel happy when I am sad' (NONADHD10); 'I use reading to have fun' (ADHD8); 'If I have a good book, I get attached to it. It entertains me when I'm bored' (NONADHD12).

Some children underlined the value of reading to *escape reality* and 'travel to a new world': 'My favourite things about books are that they can take you off to a new world' (ADHD5); 'I love reading because you find out more stuff about people, and then you have a new world' (ADHD1). This particular sub-theme may relate more strongly to fiction rather than non-fiction books, as mentioned by another child: 'I like fictional books because they take you off to a different world. Normal non-fiction keeps you in the same world' (NONADHD10). An equally prevalent response expressed by children was a *preference towards challenging books*, which are neither too easy nor too difficult to read: 'I like challenging books. I don't like the ones that are too hard to read, but I like to find the balance. I won't just read easy books' (ADHD6); 'I wouldn't like it if it was just a small book, because I like books to challenge myself' (ADHD8). Nevertheless, a few children showed a strong aversion towards extremely challenging books: 'I don't like it when there are too many people. It can get confusing' (ADHD10); 'If there are lots and lots of characters, then I would get confused (NONADHD8). Others shared thoughts about the *educational benefits* of reading such as the fact that this can *improve vocabulary* and help *gain knowledge*: 'Books improve my reading'; (ADHD7); 'Reading gives you more knowledge and then you can be better at reading and understanding words' (NONADHD3); 'It's (reading) really interesting and you get to learn so many things' (NONADHD4); 'When I read difficult books, I can find more stuff about the world' (ADHD1).

Interest was found to play a key role during reading when children were asked about its contribution. Interesting books have catchy covers and titles, pictures, funny characters and plot as well as unexpected turns: 'The way I find if a book is interesting, is the cover. A good title and the pictures also make it good' (NONADHD6); 'I like these books because they are full of funny jokes and stories' (NONADHD3); 'The characters are funny, and I like them' (NONADHD6); 'There are often plot twists and that's the bit I like about it (the book)' (ADHD3). Contrariwise, boring books have boring characters, plot, language, they are repetitive and predictable: 'The most boring thing about books I'm not interested in, is the characters, the setting and the story' (NONADHD6); 'The same repeated thing over and over again can make books boring' (NONADHD10).

Children highlighted the contribution of interest to both *affective* (e.g., enjoyment, liking) and *cognitive engagement* (e.g., task performance). In terms of affective engagement, several children engaged in reading out of *personal interest*: 'The books I read are quite interesting' (ADHD7); 'I like adventure books because they are just too interesting to read' (NONADHD4). Children expressed their preference towards certain *text types and genres*. The great majority of them enjoyed reading narrative over non-fiction books. In terms of narrative books, most children preferred adventure books, followed by fantasy/make-believe, mystery/horror books, and fairytales. In terms of non-fiction books, informational texts about the natural and social world were less popular among children: 'I have this really good book that is full of adventure' (ADHD2); 'I like fantasy, make-believe books. Most children in my class like fantasy, like vampire diaries' (ADHD10); 'I like airplane books' (ADHD9); 'I like mysteries, I always want to know more, and to see what happens next' (ADHD8); 'I like fairytales' (NONADHD4). In these accounts, children talked particularly about personal interest and/or interest related to book characteristics (e.g., topic interest). Children also showed an affective response towards *book illustrations* that supported interest and reading engagement. Book illustrations can help *make pictures in mind*, a reading strategy that was described as ‘creative’ and similar to ‘watching a movie’ in a few cases: ‘When you read this book, you get lots of pictures in your mind. It is quite creative as well’ (NONADHD7); ‘It’s like a show that is made of characters. I want to watch it, but I want to read it as well’ (NONADHD9). In other cases, children stressed how teachers can help make reading more interesting, for example, by *acting out*: ‘Teachers can use facial expressions and funny language’ (ADHD1); ‘Teachers can act out scenes from the books’ (NONADHD10); ‘I like it when my teacher uses different voices to make reading funny’ (ADHD11). Overall, children discussed that they engage in reading out of personal interest/enjoyment (*involvement)*, to escape reality and for their wellbeing (*importance/value*) as well as for educational reasons (*curiosity/desire to learn*) and preference for challenging books (*seeking challenge*), aspects which are associated more strongly with intrinsic motivation (e.g., engagement in reading for the sake of reading).

Several children explained that interesting books motivate cognitive engagement and skilled reading, whereas boring books are more likely to disengage them from this: ‘When I get hooked on a book, I can’t stop reading. The more I read of it, the easier it gets to read’ (ADHD5); ‘I normally enjoy the book that I pick. It sucks you in the book and if you close the book, you are still focusing on this and you want to read more’ (NONADHD5); ‘Whenever I read a boring book, then I find this annoying, and I don’t want to read it anymore. I have to change it’ (ADHD1). The great majority of children found it difficult to read boring books and only a few of them could still read such books, with difficulty and less willingness: ‘I find this (boring book) more difficult to read because normally I don’t want to. I can read it, but I don’t find it interesting’ (NONADHD6); I don’t read this (boring book) that quickly, but I can still read this’ (NONADHD10); ‘I find it amotivating and I don’t like it, but I would read it. I find it quite hard to read boring books’ (ADHD5).

When children were asked about the relationship between interest and attention, all children explained that interest (e.g., topic interest) improves c*oncentration* and minimises distractibility during reading: ‘It is easier to pay attention. I think I get attracted to the book and it makes me interested’ (NONADHD8); ‘If it’s (the book) interesting, I want to know what’s happening. If it’s dull and boring, I start thinking about other stuff’ (NONADHD12); ‘If it’s a boring book, then my eyes would be looking at other books. If it’s an interesting book, I don’t think about other books or anything else’ (ADHD10); ‘If a book is not interesting, then I get bored. It becomes hard and it stops me from focusing. Then, I go to do something else’ (ADHD9).

Most children mentioned that they *lose track of time* during the reading of an interesting book when asked about this phenomenon: ‘I’m too busy with getting caught up in all the adventures and what’s happening that I don’t really see the time. I think it has to do with the fact that when it’s an interesting book, you just can’t help but read it’ (ADHD2); ‘I just like reading it and I won’t look at my watch for a long time’ (ADHD6); ‘I’m so into the book that I completely lose knowledge of what is going on around me and what time it is’ (NONADHD10); ‘I always lose track of time when I read an interesting book. I think it’s because this book took my soul, and I am reading everything. When I flip the pages, it feels like I’m not flipping the pages. It feels like I’m on the same page, but I’m not’ (ADHD11); ‘I zone out and I can always read an interesting book. Sometimes, I might zone out a couple of seconds just reading the book’ (ADHD5). There were only three children without ADHD that mentioned not losing track of time when reading an interesting book.

A few children mentioned that whether an interesting book would be relatively easy to read or not, depends on the *vocabulary*, *reading level*, or *size of the book*. Some children found interesting books relatively easy to read, primarily because the vocabulary was perceived as more accessible: ‘My favourite book was easy to read because it doesn’t have big words. It doesn't have words that are hard' (ADHD4); 'Some interesting books are hard to read because they have many pages. It will take lots of time (to read)' (NONADHD6); 'I would find an interesting book easy and difficult because I know how to spell some words, but not others' (NONADHD11); 'If an interesting book is way up my (reading) range, I would find it extremely hard, and I don't think I could read it' (ADHD5). Drawing on these child accounts, interest was not perceived as the only factor affecting readability, but other factors, including vocabulary, were also important. Interesting books could still discourage some children from reading if they are too difficult to read.

Children were also asked about the role of *rewards* as extrinsic motivators during reading. All children explained that their schools have a reward system such as stickers, certificates, bookmarks, badges, books as well as extra playtime, lunchtime, and pupil choice. Almost all of them confirmed that they had received a reward for their reading in the past. The two sub-themes identified about rewards were *perceived value* and *factors affecting rewards*. *Perceived value* was defined in terms of both interest/enjoyment value, which refers to the enjoyment children experience when receiving a reward, and utility value refers to whether or not children perceived rewards as important and useful during reading (Wigfield & Cambria, 2010). Regarding the *perceived value* of rewards, children had relatively mixed feelings. Some children mentioned that they enjoyed receiving a reward for their reading: 'Getting a reward makes me feel happy' (ADHD5); 'It makes me feel happy and excited' (NONADHD4). Others mentioned that receiving a reward would make them feel proud of themselves because this serves as an indicator of hard work and progress: 'It's nice to get a reward for all the reading I've done' (ADHD2); 'Certificate is a good thing to have. It is a card that says kind things, but it's more than kind things. It means I'm good at reading' (NONADHD2); 'It's like proof that you worked hard' (NONADHD9). Nevertheless, others expressed the view that they enjoy reading 'for the sake of reading' and they do not feel that rewards are necessary to get involved in this. Children with ADHD were more likely to acknowledge that they are intrinsically motivated to engage in reading, irrespective of the presence of a reward, compared with their non-ADHD peers: ‘It’s reading, you don’t need a reward’ (ADHD12); ‘It doesn’t make any difference (getting a reward). I just read for fun’ (ADHD10); ‘I don’t mind (getting a reward), probably because I’m just interested in reading’ (NONADHD11); ‘I like reading. Certificates are just papers. There is nothing special about them’ (ADHD4).

A child explained their high interest in reading, regardless of receiving a reward below:

‘It is quite nice to get a certificate and it’s nice to get things like that, but I’d rather read for the sake of reading, rather than just read for the achievement or the toys. I don’t do it for the reward. I know a couple of children do it in our class’ (ADHD5).

A few children also talked about certain *factors affecting rewards*. These factors referred to the *meaningfulness of rewards*, *age effects*, and levels of *book interest*: ‘If it’s just a sticker, no one would like it’ (ADHD12); ‘Rewards could help only some children. I know some people in my class that if they get a reward such as a pencil for their reading, they won’t like it’ (NONADHD10); ‘If it’s just a sticker, then I’m not that motivated’ (ADHD5); ‘Younger ones are more excited about rewards than older ones’ (ADHD12); ‘If it’s a book they (children) want to read, they don’t need a reward. If it’s a book they don’t like to read, they should get a reward for trying’ (ADHD11); ‘Say that someone says ‘Oh, if you read this book, I’ll give you money’; but what happens if I don’t want to read this book?’ (ADHD6).

Basic Needs Satisfaction

Another central theme identified during the interviews was *basic needs satisfaction*. Specifically, children acknowledged the importance of *autonomy*, *relatedness,* and *competence* during reading. The role of autonomy was explored primarily in terms of choosing a book to read. To make a more relevant book choice, most children would look at the book summary ('blurb'), the cover, and the title. Most importantly, children expressed the need to *feel free and independent* during reading and perceived having an option to 'be in control' over their books as positive: 'I choose my books, it makes me feel excited' (NONADHD11); 'I prefer choosing the books, I like options' (ADHD11). Autonomy was also related to topic preference. Several children mentioned that exercising choice over their reading materials can help them identify books based on their interests (e.g., preferred genre type). Similarly, children mentioned that they prefer choosing, because other people may not select an interesting book or a book appropriate for their reading level: 'I like choosing because others might pick a book that I don't like, they might pick a horror book (ADHD9); 'If someone else chooses the books, they might get my range wrong, they might go under or over' (ADHD5).

Some children expressed negative feelings and low interest due to the lack of opportunities to experience a sense of freedom as readers. A few children made use of strong statements ('I'm forced to read'), highlighting the frustration and aversion experienced in the absence of choice during reading: 'I like reading when I'm not forced to read' (ADHD9); 'When you are forced to read a book, you are bored to it' (NONADHD11); 'I am happy that I get to choose the book. If the teacher just gave me a book, then I wouldn't feel that comfortable with it' (ADHD2); 'I don't like horror books. If someone picks a horror book and they tell me to read it, I'm not going to read it. But, if I choose it out myself, I know what's genre I like, so I can choose the book I want' (NONADHD9); 'If it's a book that I don't like and someone gives me no other choice, but to read it, I'll still carry on reading it. Then, I'll get to the end quick, so I don't have to read it anymore' (NONADHD11). From the children's perspective, such statements may suggest that lack of choice during reading turns some children to disengage from this or engage in superficial, rather than deep level, reading, usually necessary for the reading activities in the classroom.

Some children also expressed a preference towards *supported autonomy*. Supported autonomy was described by children as a desire to have others, such as parents and friends, support them during book choice. Supported autonomy was not expressed in comparison to or as a preference over child autonomy mentioned above, but rather as another practice that children preferred in their quest for books to read. The sub-theme of supported autonomy was identified in both groups; however, this was discussed more elaborately by children with ADHD. For instance, children with ADHD were more open and shared a more positive affective response, when their parents or friends would support them with the process of book selection: 'I like my mum and dad picking the books because then there's more adventure in the book. Because that way I don't know which book they've got and what's happening in the book' (ADHD2); 'I choose books. However, sometimes my friends would say that a book is good, and other times my friend who reads the same (book) series may recommend the next one (book in the series)' (ADHD5); 'Sometimes other people choose for me because I want to find something new that I like, then I end up liking it' (NONADHD11). However, even in the case of supported autonomy, children stressed the need for others to choose books based on children's reading preferences: 'If they like fantasy a lot, I would have someone else choose the books for me' (ADHD10); 'I like when my mum chooses the books for me because she knows my taste in books, she knows the books I am reading' (ADHD6).

A child with ADHD explained in greater detail how important it is that others choose books for children based on their reading interests.

'I normally like choosing the books, but if somebody else gives me an option, I wouldn't say that I want to choose it. If they want to choose a book for me and they asked me what type of books I like, then I would tell them adventure, mysteries, and fantasy. If you tell somebody else the types of books you like and give them an option, then you have a better chance of finding whether you like this book' (ADHD8).

Several children stressed the need for *teacher autonomy support* through practices that promote child autonomy in the classroom: 'Teachers should listen to children's ideas for what books they should get. They can pick any books somebody requests for' (NONADHD3); 'Teachers should let children choose what books they want to read, an adventure story, a mystery book, or something completely different. Children can choose and maybe vote if they want an adventure or a mystery story' (NONADHD10); 'I think that instead of all of us reading one certain book, there should be a survey on what the book should be. Then, people that have chosen adventure and mystery should go into one group and children that like magic in another group' (NONADHD8).

Relatedness was another sub-theme generated as part of the *basic needs satisfaction* theme. Relatedness was described by children as 'help' offered by teachers or parents during reading as well as positive feelings experienced by children when reading to others (e.g., parents, siblings) or when having other people read to them. Similar to supported autonomy, this need for *teacher-child relatedness* and *family-child relatedness* was expressed to a greater degree by children with ADHD: 'Sometimes the teacher can read with them (children) and help them get the words correct' (ADHD7); 'Teachers should help children with reading if something doesn't make sense' (NONDADHD6); 'I love reading, especially when my mum and dad read to me. I think I like it more when other people read to me, but I do like it when I read to other people' (ADHD8); 'Sometimes I wait for my mum to come and I read on her bed' (ADHD4); 'I like reading to my brother, I like reading to others because it doesn't matter what voice you do, it doesn't matter if you get a word wrong. You can always go back and correct it; it is very calm' (ADHD11).

Competence was another key sub-theme. This was defined in terms of children's feelings or perceptions of themselves as readers in general named as *perceived competence* and their perceptions specific to vocabulary knowledge named as *vocabulary competence*.

Regarding perceived competence, most children had relatively positive feelings or perceptions of their competence as readers: ‘I think I am good at reading. I am very good at reading in my head, but not when I read out loud’ (ADHD10); ‘I feel that I am good, but I want to improve my reading as much as I can’ (ADHD5); ‘I feel that I am a good reader. I read the books that I like very quickly’ (NONADHD10). However, two children had mixed or negative feelings about their reading competence: ‘I don’t know (if I’m a good reader), probably in the middle’ (NONADHD2); ‘I don’t feel I’m a good reader. I can’t read any words pretty much’ (ADHD12). Also, some children perceived themselves as competent readers or not based on how their parents and teachers view them as readers, which indicates that feedback from others could affect children’s perceptions of themselves as readers: ‘I think I’m a good reader because my parents always say to me that I am a good reader (ADHD2); ‘I feel that I’m a good reader. My teacher and my friend say it because every time that I read a book, I always get dramatic. Sometimes my teacher likes it, when I do (read) it while pretending different voices and characters’ (NONADHD11).

Regarding *vocabulary competence*, a recurring point made by children was that good knowledge of vocabulary played a key role as to whether they would feel competent to read a book: ‘In this book, all the words are big and made-up. It is hard to read’ (NONADHD7); ‘I found this book easier to read because I knew some of the words’ (ADHD7). Two children expressed feelings of relative anxiety and annoyance when reading material with difficult vocabulary: ‘It was easy to read this book, it doesn’t have long words’ (ADHD9); ‘There is one book, where my belly is teasing. The words are all crunch, and I can’t read them’ (ADHD7); It’s the vocabulary. I get annoyed because I don’t know the word. I just get annoyed’ (ADHD6). Taking into account these statements, getting the vocabulary right was considered as a key competence-enhancing factor for children.

Classroom Context

A major thread identified during the interviews of both groups referred to the *classroom context*. *Noise* in the classroom, such as child talk, was found as the most consistently referenced environmental factor affecting children's attention and engagement levels during reading: 'Everyone's talking, and I can't concentrate. It is quite hard' (ADHD7); 'Everybody in my classroom is always screaming and shouting. Most people usually do things that other people don't want to happen' (ADHD2); 'It's quite noisy in our class, and most of us like a quiet class, where we can read our books' (ADHD10); 'If someone talks, you can't concentrate' (NONADHD2); 'I get distracted when people are walking in the classroom. There is also a kid that has autism, and he is walking around in the classroom' (ADHD4); 'Most people around me talk and read loudly' (NONADHD4). Similarly, some children stressed the need for teachers to establish *structure* through giving consequences to secure that everyone attends to and engages in reading: 'Teachers should give children a consequence or move them in different tables' (NONADHD7); 'They can separate children who talk' (NONADHD2); 'Teachers can say to children that they can't go outside during the playground if they don't read the book. That's what our teacher does' (NONADHD4). Considering these comments, applying disciplinary practices, such as separating children who sit on the same table or denying playtime, were seen as useful practices to address classroom noise.

Togetherness in School

Children shared thoughts and feelings about their school life. Most importantly, some of them stressed the need for *togetherness in school*. Togetherness in school was not included under the sub-theme of *relatedness*, presented earlier, because the former was discussed more broadly by children and not specific to reading like the latter. Togetherness in school reflects children's need for belongingness in school and a need to feel accepted and valued by others, including peers and teachers. No qualitative differences were manifest between the two groups.

Specifically, a few children shared strong negative feelings about the fact that, sometimes, they felt lonely or got bullied by their classmates in school: 'I don't like it when I get left out in some school games. It makes me feel sad, when others leave me out' (ADHD7); 'What I don't like about school life is that sometimes you can get bullied. This makes me feel sad, anxious, and stressed' (ADHD1); 'The thing that I don't like about school is that there are lots of people who are always mean to me. This makes me feel sad, angry, and annoyed' (NONADHD2); 'I don't like it when a lot of my friends get lonely and feel left out at playing games' (NONADHD8). Contrariwise, close and trusting relationships with children and teachers were identified as a key factor for a positive school experience: 'What I like about school is that, sometimes, other children let me play with them' (ADHD7); 'One thing that I like about school is that I get to see some of my friends' (ADHD5); 'What I like about school is that the teachers are kind to us' (NONADHD2).

The great majority of children with ADHD did not share any experiences of discrimination in school due to their diagnosis. Nevertheless, a child discussed extensively the stigma experienced in school due to their ADHD and highlighted the importance of breaking stereotypes around neurodevelopmental conditions:

'What I like about school is that you have lots of friends and lots of people who support you. Something I don't like about school is that sometimes children, including me, would find things unfair if they have differences. Me and [a friend's name] have ADHD. Some people think that you should get treated differently because of that, which is unfair. Obviously, that's part of what we're trying to change in the world, not just in school. Everyone should be happy, and nobody should be treated differently, just because they have an illness sort of' (ADHD8).

5.2.4 Discussion

Using semi-structured interviews, this study explored the reading experiences of children with and without ADHD in relation to reading motivation (intrinsic and extrinsic), interest, and attention. This study also compared directly the two groups to identify any potential qualitative differences in their reading experiences and motivational profiles. Three major themes related to reading were identified including motivations to engage in reading, basic needs satisfaction, and classroom context. A fourth prominent theme focusing on togetherness in school in broad terms, rather than specific to reading was also generated. In general, it was remarkable to see how similar were the themes identified in the interviews of the two groups. This is in line with previous qualitative and quantitative studies (Morsink et al., 2017; Morsink et al., 2021), which found that young people (aged 8 to 16 years old) with and without ADHD value similarly motivational factors such as autonomy, relatedness, interest, and togetherness. In terms of the qualitative group differences in this study, children with ADHD offered more elaborate descriptions of the supported autonomy, relatedness, and perceived (reward) value sub-themes than their non-ADHD peers.

Children in both groups discussed a range of motivators that drive them to engage in reading including escaping reality, experiencing positive feelings and emotions, entertaining themselves, gaining educational benefits such as vocabulary and knowledge, and challenging themselves. Similar sub-themes were also identified in previous qualitative and quantitative research (Clark & Rumbold, 2006; McGeown et al., 2020). In terms of the educational benefits of reading, previous qualitative research (Clark & Foster, 2005) also reported that children view reading as a useful activity to develop reading-related skills such as vocabulary. Children's reference to the educational benefits of reading in the present study revealed that several children may hold intrinsic/utility values for reading towards the end of the primary phase. Nevertheless, in some cases, there was an impression that children would speak about the contributions of reading, for example to vocabulary acquisition, not necessarily reflecting their views, but rather commenting on what they learn about the importance of vocabulary and reading in the classroom. Considering that the national curriculum places vocabulary at the heart of reading instruction (Department of Education [DfE], 2013), teachers are more likely to tailor their practices towards increasing vocabulary, as reflected, to an extent, on children's views. It could also be argued that children acknowledged in their comments the importance of skill and will during reading. In line with the literature, lifelong reading requires a combination of will and skill and, as a result, children should be driven by an intrinsic desire to read (Baker & Wigfield, 1999; Ryan & Deci, 2000; Wigfield et al., 2016) and possess a rich vocabulary base (Cain & Oakhill, 2014).

Children discussed both the affective (e.g., enjoyment) and cognitive (e.g., enhanced reading performance) benefits of interest for reading. This finding is in line with theory and research underlining that interest has an affective component, which is typically positive, and a cognitive component that refers to the perceptual processes involved in reading (Hidi & Renninger, 2006; Renninger & Hidi, 2016). In terms of affective engagement, children engaged in reading out of personal interest. Children showed diversity in their reading preferences, however, most of them preferred narrative over non-fiction texts, in line with previous reading research (Clark & Teravainen-Goff, 2020). Given that half of the children were interviewed in the new COVID-19 reality and drawing on recent research (Clark & Picton, 2020) showing that most primary-aged children turned to narrative books including adventure, fantasy, and make-believe, during the lockdown, in part to alleviate stress, children's reading preferences could have been influenced to a degree by contextual factors.

Children also expressed a preference for books with illustrations. Visual imagery may contribute to a positive reading experience and increase story understanding in this age group (Strouse et al., 2018). Similar to personal interest, children talked about the strategy of 'acting out' during reading that teachers employ to make reading more interesting, which may relate more to situational interest. As discussed in Chapter 1, situational interest can be triggered by contextual factors (Hidi & Renninger, 2006) and teaching practices, such as teachers acting out when reading a story in the classroom. The fact that children discussed a range of reading genres, stresses the need to equip classroom and school libraries with a variety of high-quality books of different reading genres and text types. Nevertheless, it might not be always feasible for teachers to offer interesting reading material in the classroom. Thus, teaching practices such as acting out and story choice, as explained later, may offer another practical avenue for teachers to trigger a positive reading experience, even in the absence of genuine personal interest.

In terms of the cognitive aspect of interest, children explained that reading an interesting book motivates skilled and deep-level reading. Thus, interest could impact reading behaviour (Hidi, 2001), which, in turn, should lead to children getting through the 'reading miles', acknowledged as a route to reading fluency and comprehension. Further to this, children shared that they felt more attentive when reading an interesting book, whereas their inattention and distractibility levels increased when reading a boring book. Therefore, interest could elicit an automatic change in attention and perseverance, which could influence positively, in turn, reading performance and overall reading (Hidi & Renninger, 2006; Renninger & Hidi, 2016). In the context of reading, this means that once a reading activity becomes interesting, it may not require conscious processing, but the child may rather allocate effortlessly their attention to engage in this. Contrariwise, children may show less engagement and cognitive effort when encountering boring tasks (Renninger & Hidi, 2016). Therefore, educators who support interest in the classroom may help readers attend to and engage in reading.

When asked about the phenomenon of 'losing track of time' during engagement with an interesting book, the great majority of children, except for three of them, would explain that this is a relatively common experience with interesting books. This experience of being 'hooked' and 'caught up' in reading resembles the experience of cognitive flow, a concept introduced by Csikszentmihalyi (1975; 1990). Cognitive flow refers to the cognitive state of deep concentration when engaging with interesting reading, with limited or no consciousness of the around world. The necessary components of the cognitive flow experience are interest and enjoyment (Bakker, 2008; Csikszentmihalyi, 1990). In ADHD literature, a relatively similar phenomenon that has been overlooked is hyperfocus, which refers to a state, in which the person is entirely immersed and deeply focused on a task, because they perceive this as interesting to a degree that is temporarily difficult for them to pay attention into other aspects of their environment (Ashinoff & Abu-Akel, 2021). Despite the limited research investigating these experiences, drawing on the children's accounts in this study, engagement with interesting reading material could increase concentration, contributing to increased reading comprehension and enjoyment. It is important to highlight, however, that due to the complexity of this relatively sub-conscious phenomenon, some children may not have had full awareness of this, and therefore their responses may not reflect fully their real experiences of reading an interesting book. Further research could elucidate whether the experience of 'zoning out' is more common in children with ADHD compared to their non-ADHD peers, as proposed by previous research (Ashinoff & Abu-Akel, 2021).

All children mentioned that their schools have a reward system. The use of rewards serves as a key school practice to motivate positive behaviour and learning (DfE, 2015). When children were asked about the role and value of rewards during reading, feelings were relatively mixed. This inconsistency in children's views around the role of rewards also reflects the inconsistency of findings in quantitative research around the positive or negative effects of rewards (Cameron & Pierce, 1994; Deci et al., 1999). Research with neurotypical children reports more frequently the negative effects of rewards on reading outcomes, nevertheless, factors related to the type and presentation of rewards could moderate the strength of these negative effects (Hidi, 2016). In the current study, children also acknowledged that positive reward effects may differ based on age, task meaningfulness, and book interest. Although findings around age effects on reward sensitivity are inconclusive (Scheres et al., 2006), there is some preliminary research showing that reward effects may be positive particularly during uninteresting tasks (Cameron & Pierce, 1994; Murayama & Kuhbandner, 2011).

In this study, some children in both groups enjoyed receiving a reward, probably because this communicates positive beliefs about children's effort, perseverance, improvement, and competence during reading (Hidi, 2000). Morsink et al. (2021) also found that young people with and without ADHD aged 8 to 16 years old perceived rewarded task elements (e.g., gifts, points given) as equally motivating during learning. In the present study, children, and particularly those with ADHD, reported being more motivated to read 'for the sake of reading' rather than for a reward. This qualitative finding contradicts previous quantitative findings reporting that children with ADHD demonstrate typically lower academic (intrinsic) motivation than their non-ADHD peers (Luman et al., 2005; Smith et al., 2019). This finding is likely related to the child characteristics of the Study 3 sample, considering that children with and without ADHD in this study were equally motivated readers based on their interviews and scores on the MRQ (no significant differences between the two groups). As discussed later, factors such as parental involvement could explain to an extent why children with ADHD reported to be more intrinsically motivated, to a degree, than their non-ADHD peers.

Regarding basic needs satisfaction, children expressed a need for autonomy, relatedness, and competence during reading. No qualitative differences were found between the two groups, except for the sub-themes of supported autonomy and relatedness, which were discussed more elaborately by children with ADHD. In terms of autonomy, all children shared a need to exercise a level of control over their reading material, irrespective of ADHD. Based on children's perspectives, book choice was motivating itself ('I choose my own, it makes me feel excited'), but there were also cases in which book choice was discussed in relation to previous reading interests (‘I like choosing myself because others might pick a horror book’). These qualitative accounts are valuable because they posit that autonomy-support, as offered via story choice, is good, but also teachers should aim to explain the connections (relevance) between the reading material and children’s personal goals while being considerate of children’s reading preferences (Assor et al., 2002). This finding is in line with the qualitative findings of Morsink et al. (2017) who also found that young people with and without ADHD, aged 9 to 16 years old, expressed similarly a need for autonomy during everyday situations and learning. Contrary to the questionnaire study of Rogers and Tannock (2018), children with ADHD in the current thesis study did not express a greater need for autonomy-supportive classroom environments than their non-ADHD peers. A possible explanation for this is that children in the present study were asked about story choice specifically and not as to whether they perceived their classroom environments as autonomy-supportive in general or not.

The sub-theme of autonomy could be viewed within the empirically validated framework of Self-determination theory (SDT; Deci & Ryan, 1985), which views choice as a key motivational practice that promotes readers’ autonomy, reading motivation, and, subsequently, reading for pleasure, and reading comprehension (Wigfield et al., 2016). Contrariwise, drawing on children’s perspectives, controlling practices, such as ‘forcing’ children to engage in reading, could thwart intrinsic motivation and lead some of them to develop negative reading attitudes and maladaptive reading behaviours (e.g., avoidance style), associated with reading underachievement (Lee & Zentall, 2017; Niemec & Ryan, 2009). Children with ADHD discussed, at the same time, their need for supported autonomy more elaborately than those without ADHD. Children with ADHD expressed a greater need to have their parents, teachers, and friends as facilitators when choosing a book. The unlimited choice is likely burdensome and potentially demotivating (Clark & Phythian-Sence, 2008) for these children, as this process requires a level of self-regulation that some children with ADHD may struggle with. In the classroom, children with ADHD may benefit more from teachers who offer autonomy support and structure (e.g., offer guidance with respect to children's interests during book selection) during reading. Teacher-autonomy support and structure may be seen at odds with each other at first glance. Nevertheless, the teacher-provided structure could support young readers, including children with ADHD, to experience a greater sense of perceived control over school outcomes instead of helplessness and low perceived competence (Jang et al., 2010; Reeve & Jang, 2006). Future research should investigate the potential benefits of supported autonomy for children with and without ADHD, during interventions in which teachers are trained on how to use structure (e.g., communicate expectations, offer feedback) in more autonomy-supportive ways (e.g., seek child input, provide a rationale for decisions) (Cheon et al., 2020).

Children also stressed the importance of feeling competent during reading. As acknowledged by a few of them, the feedback that they receive from significant others, such as parents and teachers, about their reading skills could affect perceptions of reading competence (McGrath & Repetti, 2000). Similarly, good vocabulary knowledge was considered as a key factor of whether children would feel competent or not during reading. Linking this with the sub-theme of supported autonomy, autonomy as promoted via book choice may be valuable; however, ensuring that this is within the child's competence is also necessary. Previous research with adults shows that opportunities to exercise choice may decrease the motivation and cognitive performance of people who feel that they lack competence and expertise in a task (Patall et al., 2014). In the context of child reading, children may feel that choice is not always sufficient to secure a positive reading experience. Therefore, parents and teachers should offer choice over reading materials that tap into children's vocabulary and overall reading level.

Furthermore, several children expressed a need for relatedness with teachers and parents during reading. Children with ADHD shared to a greater degree than their non-ADHD peers positive feelings when reading to significant others (e.g. parents) and/or when having other people read to them. For children with ADHD, reading for prolonged periods may be challenging, and thus reading with parents and teachers could be particularly motivating and calming. Limited research on joint parent-child reading shows that children with ADHD recalled stories of similar length as those recalled by their non-ADHD peers and displayed more positive affect during parent-child reading (Leonard et al., 2009). Parent-child and teacher-child reading could prove valuable for all children, and especially for children with ADHD, as parents and teachers employ scaffolding techniques building on children's reading level and guiding children, via questions, to move beyond their reading level (Vygotsky, 1978). Considering that children with ADHD reported engaging in reading more for the sake of reading rather than for a reward and discussed reading-related activities with their parents, there is a likelihood that the parents of children with ADHD were more involved in their reading than the parents of those without ADHD. Parental involvement was not assessed in this study, however supportive parental involvement is associated with greater reading motivation and academic achievement (e.g., standardised reading tests) than controlling (e.g., 'I punish my child when they do poorly at school') parental involvement (Clark & Hawkins, 2010; Rogers et al., 2009). From a clinical practice perspective, this finding stresses the need to involve parents more actively in the co-design and delivery of reading interventions to support children's reading at school and home.

Many children reported greater distraction and irritation due to classroom noise as primary-aged children in previous research (Massonnié et al., 2020). Classroom noise may be overwhelming for young children, who have not yet developed sufficient attentional resources and executive functioning skills, such as interference, to shift their attention, when necessary, and integrate distractions in the learning process (Massonnié et al., 2019). Noise and movement in the classroom may be particularly distracting and a barrier for the learning of children with ADHD (Connolly et al., 2019; Richardson et al., 2015), although no differences were found in terms of perceptions of classroom noise between the two groups in the current study. To minimise classroom noise, a few children of this study suggested that teachers build structure in the classroom through offering consequences to 'noisy' children, such as reduced playtime and splitting children into different tables. In general, structure refers to the communication of the clear expectations and responsibilities of children and teachers to secure a positive classroom environment (Sierens et al., 2008). In the educational system of the UK, sanctions such as moving seats, loss of break time, and removal of privileges are common practices for managing behaviour (DfE, 2016; Skipp & Hopwood, 2017). Thus, it is difficult to disentangle whether children mentioned these practices because they found these genuinely helpful towards reducing distractibility in the classroom, or because these were the practices preferred most by their teachers (You can't go outside during the playground, if you don't read the book. That's what our teacher does'). Use of reasonable negative consequences may be inevitable in the classroom. Nevertheless, teachers should aim towards applying proactive and more positive practices to classroom management, such as co-deciding expectations around classroom behaviour and classroom routine (e.g., ways in which to line up, interact with others, read a book) with children and offering feedback on how children can exercise control over their learning in more constructive ways (Richardson et al., 2015; Sierens et al., 2008).

Togetherness in school was a central theme discussed by children in broader terms when asked about their school life, and not specifically to reading. No qualitative differences were found in this theme across the two groups. Positive relationships between children and their classmates/teachers are a key aspect of the school climate, which refers to the social characteristics of school (Maxwell et al., 2017; Thapa et al., 2013). In the context of reading, the reading achievement of primary-aged children, especially struggling readers, has been associated with the average amount of the reading skills displayed by the peers they report talking to or seeking help from in recent research (Kim et al., 2017). Therefore, the social benefits of positive peer relationships can be reflected in children's reading outcomes. Although the small sample size does not enable to draw safe conclusions in terms of the existence of stigma around ADHD in the recruiting schools (there was only a child with ADHD discussing stigma in school), previous studies have shown that some educators may hold negative expectations and emotions about children with ADHD and limited confidence in their ability to teach these children (Ohan et al., 2011), which result most commonly from a limited understanding of the condition and practices to support these learners (Arcia et al., 2000).

Overall, the interview questions were informed by existing motivational theories, including the Four-Phase Model of Interest Development (Hidi & Renninger, 2006), the Engagement Model of Reading Development (Wigfield & Guthrie, 1997), SDT (Deci & Ryan, 1985), Delay aversion theory (Sonuga-Barke, 2005) and Optimal stimulation theory (Zentall, 1975). Some of the interview questions focused specifically on interest and rewards, given the thesis focus. This could be seen as a limitation because it is likely that other key reading motivators could have been missed from this discussion. Nevertheless, the use of more specific, rather than too broad, questions with children proved sensible to address the thesis aims, considering the relatively abstract nature of the motivation, interest, and attention concepts. Finally, it is worth noting that children expressed their views in polite, sensible, and constructive ways, which indicates that they can offer valuable input to conversations around the improvement of reading practices in the classroom.

5.2.5 Conclusion

This study is the first that sought the accounts of children with and without ADHD to investigate the relationships between interest, motivation, and attention as well as explore any differences in the reading experiences and motivations between the two groups. Both groups were driven by similar motivators during reading, with children with ADHD reporting to benefit more from supported autonomy, relatedness, and intrinsic rather than extrinsic motivation (e.g., rewards). Overall, reading practices supporting motivation at a whole class, rather than individual level, may prove equally effective for children with different cognitive profiles.

Regarding the key educational implications, teachers and schools should:

i) secure a variety of high-quality reading materials to tap into the reading preferences, reading levels, and vocabulary knowledge of different readers

ii) employ practices that support child interest and teacher-child relationships, such as 'acting out' book scenes during reading and teacher-child joint reading, if valuable

iii) use rewards, when needed with some readers, but aim towards promoting intrinsic motivation and interest in the classroom, as these are more highly valued by the great majority of young readers in this study

iv) use autonomy-supportive practices including book choice, whole-classroom surveys, and votes to involve children more actively in autonomous and meaningful reading

v) establish discipline and structure to maximise child engagement levels

vi) build a supportive and positive school environment, in which children feel accepted and valued

The following chapter is the *General Discussion* chapter that offers an overview of the thesis, discussing its main findings, contributions to research and school/clinical practice, limitations, and future directions.

Chapter 6. General Discussion

This thesis explored the role of intrinsic (choice) and extrinsic (reward) motivators in the reading outcomes of children with ADHD-related characteristics, attending mainstream primary schools in England. Theory and research underline the benefits of choice as a central intrinsic motivator for the reading (e.g., reading performance, enjoyment) of primary-aged neurotypical children (Assor et al., 2002; Cordova & Lepper, 1996; Fridkin, 2018). Nevertheless, findings around the positive effects of choice are inconclusive, depending on how choice is presented (meaningful or not) and manipulated (controlling for prior interest and story knowledge or not) (Fridkin, 2018; Katz & Assor, 2007). The potential benefits of choice for children with non-diagnosed ADHD-related characteristics, and particularly inattention have been overlooked systematically, raising the important question as to how educators can support these readers. Also, research with children with diagnosed ADHD offers some empirical support for the benefits of choice, especially in terms of behaviour (Dunlap et al., 1994; Powell & Nelson, 1997); however, these studies are scarce, dated, and have employed single case study designs that do not enable understanding choice effects on learning, especially reading.

In the case of rewards, previous literature with neurotypical children has argued primarily for their negative effects, as extrinsic motivators, on intrinsic motivation and reading (Deci et al., 1999; Schaffner et al., 2013). Luman et al. (2005; 2010) reported predominantly the positive effects of rewards (especially monetary rewards) on adaptive behaviour and cognitive performance in both children with and without ADHD, with these effects being more salient for those with ADHD. In the light of this inconclusive evidence, the three thesis studies aimed to address the gap in the literature around the role of choice and reward in the reading of both community and clinical samples of children with ADHD-related characteristics (inattention, hyperactivity/impulsivity, interference).

Using a repeated measures cross-over design, *Study 1* (Chapter 3) examined whether i) perceived story choice improves children's reading comprehension and enjoyment ii) perceived story choice increases the reading comprehension and enjoyment of children with minimal and severe inattention (and other ADHD-related characteristics including hyperactivity/impulsivity and interference) iii) perceived story choice increases especially the reading comprehension and enjoyment of children with severe inattention (and other ADHD-related characteristics) than those with minimal inattention. A community sample of children aged 8 to 9 years old (N = 108) participated in a reading intervention with two conditions; a choice, in which they selected one of two stories (perceived story choice), and a no choice, in which they were given a story after counterbalancing condition and story order. Following the reading comprehension task, children completed a scale measuring story enjoyment/interest. Children also completed measures of baseline reading ability (NGRT) and reading motivation (MRQ).

Using a repeated measures cross-over design, *Study 2* (Chapter 4) extended the findings of Study 1 to investigate whether i) choice and reward increase reading comprehension and enjoyment ii) choice and reward increase the reading comprehension and enjoyment of both children with and without diagnosed ADHD iii) choice and reward improve especially the reading comprehension and enjoyment of children with diagnosed ADHD than those without ADHD. Children with (N = 12) and without (N = 12) a diagnosis of ADHD aged 8 to 11 years old participated in a reading intervention with three conditions; a choice in which they selected one out of three stories (perceived story choice), a reward, in which they chose two small rewards offered upon the completion of the reading task (story and questions) and a no motivation condition, in which children read a given reading task with no special motivator. The rest of the procedures were similar to Study 1, except for the fact that children of this study completed measures of baseline reading motivation (MRQ), but not reading ability (e.g., NGRT), and a measure of receptive vocabulary (BPVS-III). In Studies 1 and 2, all children performed a set of behavioural tasks including the Simon Task (interference control), the Stroop Test (interference control), and the AULA (inattention, behavioural inhibition, hyperactivity). Parents and teachers rated children's inattention and hyperactivity/impulsivity using the Conners 3 scales. Due to a multi-method measurement of ADHD-related characteristics (behavioural tasks, a virtual reality measure, and rating scales) in Studies 1 and 2, it was necessary to examine the associations between these measures checking for their convergent and divergent validity as well as for any differences between children with and without ADHD across the measures. Such analyses informed later the testing of the experimental hypotheses related to choice and reward. Using the same sample from Study 2, the qualitative *Study 3* (Chapter 5) sought the perspectives of children with and without ADHD aged 8 to 11 years old to i) understand the role of motivation (intrinsic and extrinsic) in reading ii) check for any qualitative differences in the reading motivations and experiences between the two groups. Themes and sub-themes from children's interviews were generated using thematic analysis.

This final chapter, first, presents a summary of the key thesis findings. Second, it discusses these findings and their theoretical implications to the field. Then, it describes the main thesis limitations. Finally, it considers the implications of the thesis findings to school and clinical practice as well as future directions.

6.1 Summary, Discussion of Main Findings and Theoretical Implications

6.1.1 Summary of Main Findings

The thesis findings indicate, to a greater or lesser degree, the benefits of choice and reward for the reading comprehension and enjoyment equally of children with minimal and severe ADHD-related characteristics and/or diagnosed ADHD. Study 1 findings showed that all children benefited from perceived story choice, as reflected on their higher reading comprehension scores in the choice, compared with the no choice condition. Children with minimal and severe inattention achieved greater reading comprehension. In terms of reading enjoyment, the findings were relatively inconsistent. Children reported higher reading enjoyment in the choice, compared with the no choice condition; however, enjoyment scores did not always differ significantly across the two conditions. Using whole-sample and trichotomisation method analyses, choice did not increase the reading comprehension and enjoyment of severely inattentive children more than it did for children with minimal inattention, as shown by the lack of interaction between choice and inattention. Despite the focus on inattention as explained in Chapter 3, the rest of the ADHD variables (hyperactivity/impulsivity, interference) were also included in analyses, with results being similar (mainly significant for reading comprehension and non-significant for reading enjoyment) as those reported for inattention.

Study 2 findings were in the same direction as in Study 1, but rather inconclusive, pointing towards some of the positive effects of choice and reward on the reading comprehension and enjoyment of both groups. In terms of reading comprehension, children scored significantly better in the reward than the no motivation condition (p = .023) indicating the moderate benefits (d = 0.4) that rewards can bring compared to no motivation. No other significant differences were reported between conditions. In terms of reading enjoyment, there was a main effect of condition (p = .027); however, no significant differences were found in reading enjoyment across the three conditions. There was a non-significant trend (significant p-value at the level of one-tailed hypothesis) with children achieving greater reading enjoyment, as shown by their mean scores, in the choice (p = .065, d = 0.6, two-tailed) and reward conditions (p = .098, d = 0.64, two-tailed), than the no motivation condition. Similar to Study 1, children with ADHD did not show greater gains in reading comprehension and enjoyment than their non-ADHD peers, due to choice and/or reward compared with no motivation.

In Study 3, three themes specific to reading, including children's reading motivations (positive wellbeing, educational benefits, escapism, interest, rewards, and preference for challenging books), basic needs satisfaction (autonomy, competence, relatedness), and classroom context (classroom noise and structure), and a fourth key theme related to school togetherness were identified. Children with and without ADHD discussed the importance of similar factors contributing to skilled and fun reading, except for supported autonomy, relatedness, and perceived value of rewards (reading for the sake of reading rather than for the reward itself) that were discussed more elaborately by those with ADHD.

Across Studies 1 and 2, no associations were found between baseline reading ability (NGRT) and reading motivation (MRQ), and limited weak or no associations were found between the ADHD-related variables and MRQ. Children with and without ADHD did not differ significantly in baseline reading motivation as shown in Study 2. Finally, correlational analyses in Studies 1 and 2 showed more consistent moderate-to-large associations between inattention and hyperactivity/impulsivity variables within the same measure (e.g., AULA, Conners 3 scales) and less frequent, relatively small, associations between variables (e.g., omission errors, parent-rated inattention) expected to measure similar constructs (e.g., inattention) across measures. The following section discusses the key quantitative and qualitative findings of this thesis regarding the role of choice, reward, and overall motivation (intrinsic and extrinsic) to reading as well as the effectiveness of the different measures of ADHD-related characteristics.

6.1.2 Discussion of Main Findings and Theoretical Implications

6.1.2.1 The Role of Choice: Quantitative Findings

The main purpose of Studies 1 and 2 was to investigate whether perceived story choice increases reading comprehension and enjoyment in children with different degrees of ADHD-related characteristics and whether choice effects are more pronounced for children with severe

ADHD-related characteristics and/or diagnosed ADHD. Drawing on the Study 1 findings, the positive effects of choice on the reading comprehension of children with minimal and severe inattention (and other ADHD-related characteristics including hyperactivity/impulsivity and interference) could be explained within the framework of the Four-Phase Model of Interest Development (Hidi & Renninger, 2006). According to this, choice may trigger subconscious interest resulting in an effortless allocation of attention and cognitive effort, thus contributing to enhanced reading performance (Hidi & Renninger, 2006). Within Self-determination theory (SDT), story choice may have also offered an opportunity for children with minimal and severe inattention to exercise a sense of control over their reading, which was reflected subsequently on their reading comprehension scores (Flowerday et al., 2004; Ryan & Deci, 2000).

Study 1 findings replicated, in part, Fridkin's study findings (2018), which also showed that choice can improve reading comprehension in this age group. Nevertheless, contrary to Fridkin's study (2018), the present Study 1 did not offer consistent significant evidence for the positive effects of choice on reading enjoyment at the level of a two-tailed hypothesis (p-value was slightly above the significance level); however, it could be argued that results for reading enjoyment reached significance at the level of a one-tailed test, appropriate for testing the Study 1 hypotheses (whether choice would increase reading enjoyment). Study 1 findings are also partially in line with research reporting the benefits of choice for reading comprehension and/or enjoyment (Flowerday et al., 2004; Patall, 2013). Rather than offering 'blind choice' to children (Flowerday et al., 2004), children of Study 1 (and also Study 2) had enough time to consider the two available options before choosing, reading through generic story-related materials including titles, cover pages, generic prologues, and reviews. While controlling for prior story interest and background knowledge through the development of new stories, this stage of familiarisation could have increased task meaningfulness, and in turn children's reading performance (Fridkin, 2018; Katz & Assor, 2007). It was hypothesised initially that choice, as a trigger of situational interest, would also elicit an increase in reading enjoyment; nevertheless, Study 1 findings did not point clearly in this direction. As discussed in Chapter 1, choice serves as a booster of situational interest, which represents the first phase of interest development (Renninger & Hidi, 2016). Therefore, children may have not been consciously aware of their interest levels at this initial phase, as indicated by the lack of consistent significant choice effects on reading enjoyment. Experiences of situational interest are commonly 'unexpected and ephemeral' (Renninger & Bachrach, 2015, p. 59), which raises a question as to whether self-reports represent valid measures of measuring the effects of situational interest on reading enjoyment (Renninger & Hidi, 2011). Rather than relying heavily on self-reports, this thesis took a step further to manipulate choice experimentally during reading interventions that assessed reading comprehension as an outcome of changes in children's attention, cognitive effort, and perseverance, expected to increase once situational interest was triggered (Fridkin, 2018). Study 1 findings are valuable, suggesting that choice could motivate children with minimal and severe inattention (and other ADHD-related characteristics) to engage with their reading, regardless of whether children have a pre-existing story interest.

Study 2 results showed the lack of consistent significant choice effects on reading comprehension and enjoyment. Study 2 findings may seem contradictory to the Study 1 findings at first glance, especially in the case of reading comprehension. A possible explanation for the less consistent significant effects of choice in Study 2 could be because of the small sample size (N = 24, 12 for each group) that makes it difficult to report significant results. Following from this point, a closer look at the effect sizes[47] for reading comprehension and enjoyment across Studies 1 and 2 could further unpack some of these findings. In Study 1, the effect sizes for choice effects on reading comprehension (choice effects, d = 0.3) and reading

[47] Cohen's d values (1988) are interpreted as follows: 0.2 – 0.5 = small; 0.5 – 0.8 = medium; > 0.8 = large.

enjoyment (choice effects, $d = 0.2$) were small. In Study 2, the effect sizes for choice effects, when compared with no motivation, on reading comprehension (choice effects, $d = 0.18$, small effect) and reading enjoyment (choice effects, $d = 0.6$, moderate effect) ranged from small to moderate similar to Study 1. Taking together children's greater reading comprehension and enjoyment (mean) scores in the choice than the no motivation condition in Study 2, the significance of results at the level of one-tailed hypothesis for reading enjoyment in Studies 1 and 2, and the effect sizes that ranged from small to moderate for reading comprehension and enjoyment across both studies, Study 2 findings also point towards some of the benefits of choice for the reading comprehension and enjoyment of children with and without ADHD. Study 2 effect sizes suggest that choice effects may exist, to a degree, and these could probably, become significant with a large sample.

In addition to the Study 2 sample size, I suggested another central issue related to the reading materials that may explain the lack of consistent significant choice effects in Study 2 (these explanations also account for the results around reward effects discussed in the next section). Studies 1 and 2 used different stories to measure reading comprehension. In Study 2, it was necessary to administer three rather than two stories, one for each condition. These stories were designed to be relatively shorter than those administered in Study 1 and to minimise the cognitive workload placed on children with ADHD (Brock & Knapp, 1996), which could have masked, in turn, choice effects. Nevertheless, the use of short passages in Study 2 could have been a compensatory strength for children, and especially children with ADHD (Zentall & Lee, 2012), making it difficult to report any additional gains (or greater in the case of those with ADHD) due to choice and/or rewards for reading comprehension and enjoyment. The stories used in Study 1 may be more ecologically valid, as young readers are expected, typically, to read long reading materials. Nevertheless, further research is needed testing reading materials of different length and difficulty level. In addition to this, reading comprehension scores were relatively skewed towards the maximum score (12) in Study 2 across the three conditions (choice, $M = 8.75$, reward, $M = 9.25$, no motivation, $M = 8.33$), despite amendments made after the pilot study with 8 to 9-year-old children. A second pilot study could have probably ensured with greater certainty whether the three stories were of equivalent reading comprehension and enjoyment, as well as whether these were still appropriate for use with slightly older children aged 9 to 11 years old.

Another related issue refers to the ecological validity of Studies 1 and 2. In these studies, children chose between two options, and thus the offered options were relatively limited. Nevertheless, in real-life school settings, children typically have a much broader variety of book options, for example when visiting the school library. In addition to this, children may choose different types of books (e.g., fiction or non-fiction) for different reasons (McGeown et al., 2020). As shown in Study 3 to a degree, children are more likely to read fiction, rather than non-fiction, literature to escape reality. Children's reasons and goals for reading could influence significantly their reading choices (McGeown et al., 2015). Therefore, supporting choice during reading is important, but not sufficient in the classroom, as educators should also help children understand the different types of experiences they can have when reading different books as wells as choose books that align with their interests, reading level, and skills to secure a more positive reading experience (McGeown & Wilkinson, 2021).

Findings from Studies 1 and 2 are in line with existing research and extend it to propose that educational interventions supporting situational interest can be equally effective for the learning/reading of both children with minimal and severe ADHD-related characteristics and/or diagnosed ADHD (DuPaul et al., 2012). Our understanding in this area is at a preliminary stage though, with the great majority of studies focusing on children with and without ADHD, without further exploring the effects of motivators in children with non-diagnosed ADHD-related characteristics. Regarding choice, previous research has reported consistently its benefits for the increase of intrinsic motivation and cognitive performance in neurotypical young people and adults (Flowerday et al., 2004; Patall, 2013; Renninger & Hidi, 2016). However, this has neglected the role of choice in the learning of children with ADHD-related characteristics, with or without an ADHD diagnosis, who are more likely to struggle with their academic motivation and reading (Smith & Langberg, 2018). Most choice studies in ADHD are also dated and employed single case study designs, and as a result, their findings are less applicable to reading research (Dunlap et al., 1994; Powell & Nelson, 1997; Shogren et al., 2004). Using a robust repeated measures design that counterbalanced the story and condition order (Fridkin, 2018), the current study offered further evidence for the reading benefits of choice for a community sample of children and has gone some way towards reporting such benefits for the reading of children with non-diagnosed minimal and severe inattention (and other ADHD-related characteristics).

Interestingly, consistent Study 1 and Study 2 findings do not support and extend Delay aversion and Optimal stimulation theories (Sonuga-Barke, 2005; Zentall, 1975) as well as limited research (Beike & Zentall, 2012) that has argued for the greater benefits of motivation on improving the performance/learning of people with severe ADHD-related characteristics compared to that of people with such minimal characteristics. Study 1 and Study 2 findings are in line with some research (Zentall & Lee, 2012) reporting equal, but not significantly greater benefits of reading motivation (positive feedback) for children with ADHD when compared with those without ADHD. Contrariwise, Beike and Zentall (2012, see Section 2.5.2 for further details on this study) offered some support for the greater benefits of content novelty, as another motivational trigger of situational interest similar to choice, on the reading comprehension of children with ADHD than those without ADHD. In the Beike and Zentall (2012) study, however, reading comprehension was only measured through a set of five questions (three literal and two inferential), presented in a multiple-choice format. The present Studies 1 and 2 involved a more robust assessment of reading comprehension, including a greater number of literal and inferential questions, with the latter ones expected to place more cognitive challenges on children as they require the combination of information from different parts of the text.

Overall, it is relatively challenging to explain the lack of interaction between choice and inattention/ADHD, due to the dearth of relevant literature exploring the reading of children with different degrees of ADHD-related characteristics. Literature in ADHD has investigated and reported predominantly the effects of rewards on improving behaviour (Ma et al., 2016) and/or cognitive performance during behavioural tasks. The role of intrinsic motivators in the learning of children with ADHD has been under-researched though. Studies 1 and 2 do not aim to offer evidence against the validity of Delay aversion and Optimal stimulation theories. They rather stress the need to extend these theories by incorporating intrinsic motivators, including choice, and further test empirically the effects of these motivators on the learning/reading of children with varying degrees of ADHD-related characteristics. Further research would help establish with greater certainty, whether intrinsic motivators could bring greater benefits in the case of children with ADHD than their non-ADHD peers, similar to extrinsic motivators mentioned earlier. Most importantly, it remains to be seen whether these more pronounced effects of (intrinsic) motivation can be transferred, consistently, to the learning of children with ADHD relative to that of their non-ADHD peers, or whether these greater motivational effects may be more specific to improving ADHD-related behaviour rather than learning/reading.

6.1.2.2 The Role of Rewards: Quantitative Findings

Study 2 also investigated the effects of rewards on the reading comprehension and enjoyment of children with and without ADHD, testing for any more pronounced reward effects on the reading outcomes of the former group. Drawing on the summary of findings presented earlier, rewards could bring about some benefits for reading comprehension (significant results) and enjoyment (non-significant results, but strong non-significant trend) compared with no motivation. Reward effects were not found to be stronger for the reading outcomes of children with ADHD than those without ADHD. The small sample size, as well as factors such as the length and readability of the stories mentioned in the previous section, may explain to an extent the lack of consistent reward effects on reading comprehension and enjoyment.

Drawing on literature with neurotypical children, there is a debate around the effects of rewards on affective (e.g., enjoyment) and cognitive engagement (e.g., reading performance) (Hidi, 2016). Several studies have supported the view that rewards affect negatively intrinsic motivation and performance (Becker et al., 2010; Deci et al., 1999; Deci et al., 2001; Schaffner et al., 2013; Vansteenkiste et al., 2010). According to Deci et al. (2001), external rewards undermine typically intrinsic motivation, performance, and learning due to their controlling aspects (although Deci et al. [1999] also acknowledged that reward effects may depend, to a degree, on the context in which these are offered). Other researchers have claimed that rewards are powerful motivators that may not always have detrimental effects on potential outcomes (Cameron & Pierce, 1994; Cameron et al., 2005). Others have proposed that rewards could have complex effects depending on several factors (some of these factors are mentioned later in this section) (Hidi & Harackiewicz, 2000; Lepper & Henderlong, 2000; McGeown et al., 2012).

Findings from this thesis underline that rewards could enhance reading comprehension and enjoyment to a degree. A possible explanation for the relatively positive contribution of rewards to reading comprehension and enjoyment is that rewards were administered in a relatively autonomous-supportive style with children choosing their reward from a list of options. Thus, rewards may have been perceived by children as indicators of hard work and perseverance rather than as controlling events (Hidi, 2000), which could have offset their potential undermining effect and contributed to greater reading comprehension and enjoyment compared with no motivation. Such findings indicate that the administration of rewards in non-pressuring and informational (rewards convey positive information about children's reading skills) rather than pressuring and controlling style could secure the positive effects for rewards on potential outcomes (Ryan & Deci, 2000).

Study 2 findings should be treated with caution, however, considering that several factors may moderate reward effects. For example, rewards may decrease intrinsic motivation and performance, when these are no longer present, as one needs to hold similar levels of intrinsic motivation and performance in the absence of previously offered external rewards (Lepper & Henderlong, 2000; Renninger & Hidi, 2016). Investigation of the potential undermining effects of rewards on reading comprehension and enjoyment was beyond the scope of this study. Further expanding on this argument about the undermining effect of rewards due to reward loss, future research should investigate more extensively reward effects at a whole-class level. In this study, each pair of children received a reward following the completion of the reading tasks. In the classroom, it is less likely that all children would receive a reward for personal effort and determination during reading/learning. In this scenario, there is a likelihood that children may perceive themselves as less competent when their classmates receive rewards more often than themselves, which could affect negatively their intrinsic motivation and performance. At a whole-class level, there is also a possibility that rewards could be perceived as relatively pressuring by some children, given that children need to maximise their efforts to win a reward, usually by outperforming others (perform against a normative standard), which could trigger a level of anxiety and, thus, undermine their performance (Vansteenkiste & Deci, 2003).

Empirical research (Luman et al., 2005; Marx et al., 2018) in ADHD has focused primarily on extrinsic motivators such as monetary rewards, and reward effects have been tested most commonly in terms of their benefits on improving ADHD behaviour (inattention, hyperactivity/impulsivity, interference) rather than learning. Such reward effects have been found to be positive for children with and without ADHD (Luman et al., 2005), and also greater in the case of children with severe ADHD-related characteristics and/or ADHD. To my knowledge, Study 2 is the first to extend previous theory and research suggesting that more easily applicable rewards (e.g., stickers, bookmarks) could benefit, to an extent, the reading of children with and without ADHD, despite the lack of consistent significant findings. In the case of children with ADHD, this is particularly valuable considering that the great majority of studies in ADHD have focused on medication and behavioural interventions previously reported to have limited or no effects on learning (Miranda et al., 2013; The M.T.A. Cooperative Group, 1999; 2004), with less emphasis placed on educational interventions, such as motivational interventions that target directly children's learning.

Interestingly, Study 2 findings did not extend the motivational theories of Delay aversion and Optimal stimulation (Sonuga-Barke, 2005; Zentall, 1975). These theories and relevant research (Luman et al., 2005) highlight the more salient effects of extrinsic motivators, including reward, on improving inattention, hyperactivity/impulsivity, and interference in children with ADHD than those without ADHD. Study 2 findings did not extend previous empirical evidence (Marx et al., 2018) to confirm the more pronounced effects of rewards on the reading of children with ADHD than their non-ADHD peers. Due to the small sample size, these findings should be further replicated to understand reward effects on learning; nevertheless, there is also a likelihood that rewards have stronger positive effects on improving ADHD-related behaviour (e.g., inattention), rather than learning in children with ADHD than those without ADHD (Marx et al., 2018).

Drawing on literature with neurotypical populations (Hidi, 2016; Murayama & Kuhbandner, 2011), extrinsic motivation, as promoted via reward, may prove effective for use especially in the case of those who lack genuine interest and intrinsic motivation for a task, or in the case of boring tasks. In this case, reward may serve as a strong motivator that generates interest and, subsequently, contributes to increased engagement and performance. Although the Study 2 findings did not report significant differences in baseline reading motivation between the two groups, children with ADHD represent a heterogeneous population. Previous studies show that children with ADHD are more likely to display lower than average academic motivation in comparison with their non-ADHD peers (Smith & Langberg, 2018). Thus, future studies could replicate Study 2 procedures, and further, expand on these to test for any greater effects of rewards on the reading comprehension and enjoyment of children with severe ADHD-related characteristics and/or diagnosed ADHD.

6.1.2.3 The Role of Intrinsic and Extrinsic Motivation: Overview of Quantitative Findings

The present quantitative findings highlight the benefits of intrinsic (choice) and extrinsic (reward) motivation for the reading comprehension and enjoyment of children with varying degrees of ADHD-related characteristics. Drawing on the Four-Phase Model of Interest Development (Hidi & Renninger, 2006), it is likely that both choice and reward triggered situational interest, which represents the first phase of interest development, contributing to increased effortless attention and engagement as reflected on children's increased reading performance and enjoyment. This thesis is one of the few that have manipulated experimentally the effects of both an intrinsic and extrinsic motivator during reading, contrary to several previous studies that have used primarily questionnaires (Becker et al., 2010; Wang & Guthrie, 2004), or explored experimentally the effects of intrinsic or extrinsic motivation on reading separately. Empirical research has underlined, primarily, the positive contributions of intrinsic motivation to reading contrary to the negative contributions of rewards (Becker et al., 2010). In the present Study 2, choice did not increase reading comprehension or enjoyment more than reward and, similarly, reward did not reduce either reading comprehension or enjoyment for children with and without ADHD. Interestingly, in Study 2, where intrinsic and extrinsic motivators were compared, reward, rather than choice, improved significantly reading comprehension. The present thesis findings pose the question for future studies to test experimentally whether intrinsic and extrinsic motivators are equally powerful, or whether one type is more powerful than the other.

It is worth noting here that the present findings should be interpreted within the framework of the Four-Phase Model of Interest Development (Hidi & Renninger, 2006). Situational interest, as promoted via story choice, represents the first phase of interest development; the goal should be to secure well-developed individual interest. Investigation of the long-term effects of choice was beyond the scope of this thesis. Nevertheless, in line with Hidi and Renninger's model (2006), future research should investigate whether and how situational interest can be further nurtured and supported to secure long-term individual interest and, subsequently, intrinsic motivation. Researchers and educators should focus primarily on applying reading practices that aim towards promoting intrinsic motivation, due to its more frequently reported benefits for proficient reading and reading for pleasure. The advantage of intrinsic motivation is that this is ongoing and independent of external players. Nevertheless, small and easily applicable rewards, such as stickers and certificates, could offer some extra motivation, especially in the case of less motivated readers (Deci et al., 1999; Lepper, 1998).

According to SDT (Deci & Ryan, 1985; Ryan & Deci, 2000), there are more autonomous forms of extrinsic motivation, in which actions are still extrinsically motivated, but these actions are in congruence with one's values, needs, and volitions. In Study 2, rewards were presented in a more autonomous-supportive style (children chose the reward they preferred among a limited selection of rewards), and the reward condition was always presented in the end, to maximise reward effects. Considering that reward provision is a relatively common practice in primary schools in England (Skipp & Hopwood, 2017), especially those rated as outstanding, future studies should explore the effects of rewards while counterbalancing the reward condition to understand the spectrum of reward effects (positive and negative) on potential reading outcomes and to support educators on how to administer rewards more effectively when needed. Also, findings from the current study open the door towards leveraging different situational factors such as choice and novelty, other types of interest (e.g., individual interest), as well as exploring longitudinally how situational interest can develop into more genuine forms of interest (individual interest), which could contribute, in turn, to enhanced reading motivation. For example, there is preliminary evidence indicating that children with ADHD may respond differently to motivational practices such as positive feedback (Zentall & Lee, 2012) and novelty (e.g., unusual characters) during reading (Beike & Zentall, 2012). Therefore, further research could elucidate which of these motivators may have stronger effects on the reading, especially of those with severe ADHD-related characteristics and/or ADHD.

Literature has explored intrinsic and extrinsic reading motivation in dichotomising terms, viewing these as two distinct constructs with differentiated reading outcomes, mostly positive in the case of intrinsic motivation and negative in the case of extrinsic motivation. Nevertheless, existing neuroscientific findings report that similar, rather than separate, brain areas (striatal areas of the reward circuitry mechanisms) are activated in the presence of either type of motivation (Hidi, 2016; Leotti & Delgado, 2011). In addition to this, I have argued that choice may trigger subconscious interest resulting in an automatic allocation of attention, thus contributing to heightened attention and enhanced reading performance (Hidi & Renninger, 2006). It was not within the scope of this study to uncover the mechanisms through which choice and reward impact reading comprehension and enjoyment. Nevertheless, there is some neuroscientific evidence suggesting a link between intrinsic motivation (autonomy), extrinsic motivation (reward), and the dopaminergic system, whose increased activation has been associated with high motivation and task performance in children with and without ADHD

(Volkow et al., 2011). Murayama and Kuhbandner (2011) found that monetary rewards may be particularly beneficial for tasks (e.g., trivia question games) that do not hold an intrinsic value and interest for learners, while rewards offered for interesting tasks may not bring additional gains to motivation and learning. It remains to be seen whether future neuroscientific research could also offer support for the positive effects of more school-friendly rewards, similar to those used in this thesis, and the effects of intrinsic motivators, including choice, on the reading of all children, particularly those with severe ADHD-related characteristics and/or ADHD.

The addition of another neurodivergent group, such as autistic children, could have also offered another insight into whether and how reading motivation, as explored via choice and reward, could benefit young readers with different neurodevelopmental conditions. Autistic children usually demonstrate strong and intense interests in certain activities, which have been described frequently in a negative connotation as 'restricted' and 'obsessive' (APA, 2013; Baron-Cohen & Wheelwright, 1999). Despite certain challenges due to unwanted repetition, leveraging autistic children's strong interests in school settings could be advantageous, similar to children with ADHD, with significant positive outcomes for learning and emotional well-being (Gunn & Delafield-Butt, 2016; Wood, 2021). Considering that children with ADHD and autistic children are in high need of stimulation in the classroom, future studies should move beyond deficit models that aim to 'fix the child' to investigate how motivating and stimulating classroom environments could support the reading and overall learning of neurodivergent children.

Finally, due to the thesis focus on the exploration of interactions between motivation and ADHD-related characteristics (with particular focus on inattention), other key reading-related factors, such as culture and gender, were not further included in mixed ANOVA designs to check for any interactions between these variables and motivation (choice/reward) for reading comprehension and enjoyment. Nevertheless, choice effects on potential outcomes may vary based on the cultural context (King & McInerney, 2014). For example, Iyengar and Lepper (1999) found that Anglo-American children displayed greater intrinsic motivation and performance when they chose their task contrary to Asian American children, who experienced greater intrinsic motivation when the selection of their task was made by significant others. These qualitative differences of choice effects may be because choice is viewed as a motivational experience that fulfills one's need for self-agency and self-determination in Western cultures. Contrariwise, choices made by authority figures or peers may be perceived as more important in Asian cultures because these choices are more likely to satisfy one's need for relatedness with others, an idea inherent in the Confucian culture (King & McInerney, 2014). Regarding gender differences, girls are usually found to enjoy reading more than boys (Clark, 2016). The effects of interest on text comprehension may also be more pronounced for boys, whereas girls may be more likely to persist with reading, irrespective of their interest levels (Oakhill & Petrides, 2007). Less is known as to whether boys with ADHD may differ in their reading motivation compared to girls with ADHD, with the former ones being in greater need of reading motivation similar to boys without ADHD.

6.1.2.4 Children's Perspectives on Reading Motivation: Self-Reports and Qualitative Research

Current empirical evidence around the relationship between academic (reading) motivation and ADHD is complicated. Previous studies have shown that children with ADHD report lower academic (intrinsic motivation) than children without ADHD (Carlson et al., 2002; Gut et al., 2012; Smith & Langberg, 2018). In particular, teacher and parent ratings as well as observations with children have shown that children with ADHD present lower academic (intrinsic) motivation than those without ADHD (Smith et al., 2019). Contrariwise, several studies that have used self-reports of motivation with children, such as the MRQ, have not shown any significant differences in academic motivation between the two groups (Birchwood

& Daley, 2010; Martin, 2014). This inconsistency may depend to a degree on the type of rating scale (e.g., child versus teacher scales). This taps into a wider methodological limitation in motivation research, which is the over-reliance of researchers on rating scales. Reading motivation is a relatively abstract, and, therefore, not directly measurable construct, which could make it difficult for children to reflect on this, using self-reports (Fridkin, 2018). Contrary to expectations, no associations were found between baseline reading ability (NGRT, reading scores in the no motivation condition) and baseline reading motivation (MRQ) in Studies 1 and 2. Similar non-significant associations were also found in Fridkin's study (2018) with eight-to-nine-year-old children. The findings from the present Studies 1 and 2 contradict previous frequent findings highlighting the positive association between reading motivation and reading comprehension in children aged 8 to 11 years old (Wigfield et al., 2016).

Constructive critiques of the MRQ (Davis et al., 2018; McGeown et al., 2012) acknowledge this as a useful widely tested measure that covers a range of reading motivation dimensions; nevertheless, these critiques also address some of its weaknesses including the small sample of children that initial studies used for validation (N = 105) and the fact that reliabilities for the MRQ sub-scales are, sometimes, lower than or just above acceptable (a < .70). This was also the case in this thesis, with a few sub-scales showing lower than acceptable reliability (e.g. reading challenge, a = .60, reading curiosity, a = 57 as reported in Study 1). Further expanding on this criticism, reading motivation dimensions in the MRQ may be related differentially to reading skill (Medford & McGeown, 2012; Wang & Guthrie, 2004). For example, Medford and McGeown (2012) found weak-to-moderate associations between reading challenge, reading involvement, both assessed by the MRQ, and standardised reading skill, but no associations between reading curiosity, measured via the MRQ, and reading skill. Another related challenge is that, although the original MRQ has 54 items covering 11 dimensions (Wigfield & Guthrie, 1997), the great majority of studies (Davis et al., 2018), including the Studies 1 and 2 of this thesis, have used revised versions of this questionnaire. As a result, different studies may conceptualise baseline reading motivation in different ways, posing several challenges when trying to understand the relationship between reading motivation and reading skill (e.g., comprehension) using questionnaires.

The qualitative findings of Study 3 are in line with previous limited research (Morsink et al., 2017) showing that children with and without ADHD are driven by similar motivators and extend these findings to confirm the importance of motivation in the reading of both groups. In Study 3, the two groups reported that reading an interesting book motivates deep-level reading engagement, increases attention levels (Renninger & Hidi, 2016), and in certain cases leads to a state of deep concentration (Ashinoff & Abu-Akel, 2021; Csikszentmihalyi, 2000) and cognitive focus (or hyperfocus as most commonly known in the case of children with ADHD). Children's feelings around the role of rewards during reading were mixed with some children reporting to enjoy rewards and others, especially children with ADHD, reporting to enjoy reading for the sake of reading rather than for a reward. This qualitative finding echoes the complexity of reward effects on motivation and reading as shown by existing quantitative evidence (Hidi, 2016). For instance, rewards could benefit, particularly, those children who find an activity, such as reading, relatively boring (Murayama & Kuhbandner, 2011), and these may increase children's confidence and beliefs of their competence (Hidi, 2000). Factors including the type of rewards (rewards offered following successful performance or rewards given simply for engagement with a task, irrespective of performance) and the presentation of rewards (autonomy-supportive versus controlling style) may also moderate the effects (positive or negative) of rewards.

Experiencing a level of control over reading, for example via the choice of reading material (Fridkin, 2018), relatedness with teachers and parents during reading, (Wigfield et al., 2016), as well as perceived competence (Rogers & Tannock, 2018), expressed as a child's need to possess a rich vocabulary base, were considered as equally important by children with and without ADHD. To a greater degree than their non-ADHD peers, children with ADHD shared positive feelings when reading with their parents or when having other people read to them and discussed the importance of supported autonomy, valuing the support of their teachers, parents, and friends when choosing a book to read. These findings are in line with the theoretical principles of SDT and relevant empirical research, which propose that fulfilment of the basic needs of autonomy, competence, and relatedness is central to the development of intrinsic motivation (Ryan et al., 2019).

Supportive parental involvement has been associated with enhanced reading motivation and academic achievement than controlling (e.g., 'I punish my child when they do poorly at school') parental involvement (Clark & Hawkins, 2010; Rogers et al., 2009). Parents and teachers who support child autonomy during reading, for example during book selection, could contribute towards a more positive reading experience for children. The procedure of choosing a book to read involves a level of self-regulation, especially in the case of unlimited choice offered in a library or a bookstore, and thus could be cognitively burdensome, particularly for some children with ADHD. Parent-child or teacher-child reading has also been found to benefit all children, and especially those with ADHD (Leonard et al., 2009), for example in terms of receptive vocabulary development (Law et al., 2018). Children's responses in the present Study 3 further point towards the meaningfulness of this reading practice.

Drawing further on the quantitative findings of Studies 1 and 2 (limited or no associations between reading motivation, ADHD variables, and baseline reading/no significant differences between children with and without ADHD on the MRQ) as well as the qualitative findings of Study 3 (both groups were driven by similar reading motivations), it could also be argued that children with ADHD are a heterogeneous population, and not all children with ADHD show necessarily lower reading motivation than their non-ADHD peers. Apart from the methodological challenges related to the MRQ, it is likely that failure to report lower reading motivation in children with severe ADHD-related characteristics and/or ADHD is also, in part, due to the characteristics of the child participants in this study. Present qualitative findings are valuable as they demonstrate that having severe ADHD-related characteristics and/or ADHD may not, automatically, turn a child into a less motivated reader. Reading motivation questionnaires, such as the MRQ, have been tested widely with neurotypical young people and have advanced considerably reading research. However, such questionnaires may not always encapsulate the full spectrum of reading motivational dimensions (McGeown et al., 2020) including autonomy, supported autonomy, escapism, factors affecting rewards as well as broader context-specific factors affecting reading and reading motivation such as classroom structure and noise as shown in Study 3.

Questionnaires such as the MRQ may not always encapsulate the full spectrum of reading motivational dimensions (McGeown et al., 2020). For instance, motivational constructs including autonomy, supported autonomy, escapism, factors affecting rewards were discussed as important by children with and without ADHD in Study 3. Nevertheless, these reading motivations are not included in the MRQ, which suggests that our understanding of children's reading motivation is relatively limited because motivational questionnaires to date are not necessarily optimal. Similarly, broader context-specific factors affecting reading and reading motivation such as classroom structure and noise were discussed extensively by children in the Study 3 interviews, however, the role of these environmental factors cannot be easily understood through traditional questionnaires. The MRQ has been highly influential over the last two decades, nevertheless, this was developed in the 1990s based on interviews with children and classroom observations in the US (McGeown et al., 2020), and thus this may not capture accurately the reading motivations and experiences of children nowadays (e.g., digital literacies). It is necessary to further conduct qualitative research studies to gain a deeper understanding of children's reading motivation in general as well as understand any individual differences in the reading motivations of children with different cognitive profiles, including children with ADHD.

The qualitative findings of this thesis indicate the important role of intrinsic and extrinsic motivation in the reading of children with and without ADHD. Nevertheless, this study comes with certain limitations. First, I explored reading motivation with clear research questions generated based on theory and research around choice and reward to further elucidate the Study 1 and Study 2 findings. Thus, these findings cannot be generalised easily beyond the context of the specific questions of this thesis to cover other dimensions of motivation (e.g., curiosity). Second, there was an impression that some children would discuss aspects of reading (e.g., contribution of reading to vocabulary development), not necessarily reflecting on personal thoughts, but sharing what they had learnt about the importance of reading in the classroom. This is not to undermine the value of child accounts, but rather to stress the need for further qualitative research with children with and without ADHD to further strengthen the findings of this thesis. Regardless of such limitations, these qualitative findings champion the use of mixed methods approaches that also incorporate the views of experts by experience including children. Future research should also seek teachers' perspectives in response to children's ideas and suggestions (McIntyre et al., 2005) around practices supporting reading motivation, such as teacher autonomy-support, and associated challenges during their delivery.

6.1.2.5 Measures of ADHD-related Characteristics

Findings from the correlational analyses of Studies 1 and 2 showed moderate-to-large associations between the inattention and hyperactivity/impulsivity variables within the same measure (e.g., AULA, Conners 3 scales) and less frequent, relatively weak, associations between variables (e.g., omission errors, parent-rated inattention) expected to measure similar constructs (e.g. inattention) across measures. Similar to the inconsistent associations among the

ADHD-related variables across measures, FA with all the variables in Study 1 did not produce pure theoretical factors (e.g., inattention factor) that could be further used in the analyses of the experimental hypotheses (e.g., mixed ANOVAs), except for the interference factor.

Regarding the Conners 3 scales, parents and teachers correlated highly on the inattention and hyperactivity/impulsivity scales in both studies, suggesting that children who were rated as inattentive were also more likely to be rated as hyperactive by their parents and teachers. Previous literature usually reported a weak-to-moderate parent-teacher agreement on the ADHD rating scales (Willcutt et al., 2012); nevertheless, there is also a trend towards greater parent-teacher agreement with increasing age (Narad et al., 2015), as shown when comparing parent-teacher agreement rates in preschool children (Murray et al., 2007) with those in older children and adolescents (Sibley et al., 2012). Findings from Studies 1 and 2 are in line with research showing greater parent-teacher agreement with older children (Narad et al., 2015), however, future research should explore this relationship across different age groups given that these findings could have important implications for the clinical assessment and diagnosis of ADHD. In the case of AULA, this measure distinguished between inattention (e.g., omission errors) and behavioural inhibition/impulsivity (e.g., commission errors) in Study 1, which indicates its relative effectiveness as an ecologically valid measure of ADHD-related characteristics. Nevertheless, large associations were found between inattention (e.g., omission errors) and hyperactivity (e.g., motor activity) in Study 2, which failed to provide evidence for the divergent validity of the measure.

I proposed three possible explanations for the strong association between the inattention and hyperactivity/impulsivity constructs within and across measures. First, it is likely that parents and teachers could not distinguish between inattention and hyperactivity/impulsivity, and as a result presence of inattention may have led them to report similarly the presence of hyperactivity/impulsivity and vice versa (Sims & Lonigan, 2012). Second, the lack of a distinction between these two constructs in the parent and teacher scales may be because the combined ADHD type is mostly reported in children (Reale et al., 2017). This was confirmed to a degree during Study 2, in which all children with ADHD presented the combined type. Third, such strong associations between inattention and hyperactivity/impulsivity may suggest that these constructs are distinct, but strongly associated constructs that interact together during the manifestation of ADHD (Toplak et al., 2009; Willcutt et al., 2012). Further expanding on this point, it has been argued that there might be a causal relationship between these constructs with inattention contributing to hyperactivity/impulsivity (Sokolova et al., 2016).

The Conners 3 parent and teacher scales differentiated between children with and without ADHD further supporting the discriminative validity of the scales (Hale et al., 2001; Izzo et al., 2019). Nevertheless, there is a risk of potential rater bias, considering that parents and teachers were aware (not 'blind') of children's group membership (ADHD or non-ADHD) when completing the scale, which could have affected their responses (e.g., reporting higher inattention and/or hyperactivity/impulsivity for children with ADHD). In the case of teachers, their ratings in ADHD scales could be affected to an extent by interpersonal differences in teacher perceptions (e.g., lenient or more severe in their ratings), teachers' age (e.g., older teachers may apply more effective classroom management practices than newly qualified teachers that could affect the manifestation of child ADHD-related characteristics) and random measurement error (e.g., teacher misreads a scale item) (Kraemer et al., 2003; Schultz & Evans, 2012). In the case of parents, their ratings could also be affected, to a degree, by the child's medication status. In this thesis, parents and teachers were advised to rate children's behaviour in the absence of medication. Nevertheless, most studies do not state explicitly whether teachers and parents rate children's behaviour in the presence or absence of medication. This information is important, as the severity of ADHD-related characteristics, and particularly hyperactivity/impulsivity, is more likely to reduce in the presence of medication (The M.T.A. Cooperative Group, 2004), which could interfere with the parent/teacher ratings of ADHD.

The AULA variables did not differentiate between children with and without ADHD in Study 2. This is not in line with previous research (Areces et al., 2018) showing that omission errors and reaction time in AULA would generate systematically the largest difference between the two groups. Failure to discriminate between the two groups was probably due to the small sample size, considering that children with ADHD showed a weaker performance (based on mean scores) on AULA variables (e.g., omission errors, motor activity) than children without ADHD. For instance, previous studies (Díaz-Orueta et al., 2014; Rodríguez et al., 2018) offering evidence for the discriminant validity of AULA included a relatively larger total number of participants (e.g., *N* > 50). Future research should further test AULA with community and clinical samples with ADHD, to develop a better understanding of how performance on the AULA looks like for community and clinical samples of primary-aged children across different age groups (Areces et al., 2018; Díaz-Orueta et al., 2014). For example, age has been found to predict children's probability of receiving a diagnosis of ADHD (Areces et al., 2018), with ADHD-related characteristics being more likely to decrease with age (Coghill et al., 2014). There is also a need for a cross-cultural validation of the AULA, as this has been evaluated primarily in Europe (e.g., Spain), and an evaluation of AULA with populations with different neurodevelopmental conditions, to validate its sensitivity and specificity to differentiate between children with different diagnoses who may also struggle with attention (e.g., autistic and dyslexic children) (Díaz-Orueta et al., 2014).

Overall findings from the present thesis highlight the inconsistencies between the different measures (rating scales, behavioural tasks) of ADHD-related characteristics. These findings are in line with previous research showing the limited effectiveness of different measures to assess similar ADHD constructs (Barkley & Fischer, 2011; Diamond, 2013; Sims

& Lonigan, 2012). Rating scales may provide retrospective and general information about children's daily functioning, whereas standardised tasks such as AULA may offer information for children's task-specific performance (Toplak et al., 2013). The results from FA in Study 1 offered some evidence towards this direction, given that parent and teacher scales loaded to one factor named as the *Daily functioning* factor, whereas most AULA variables loaded to a different factor named as the *Task-specific performance* factor, except for commissions and RT. As a result, it could be argued that weak-to-moderate associations between variables assessing similar ADHD constructs may suggest that these measures assess different expressions of similar, rather than different, ADHD constructs.

Limited weak or no associations were found between interference control, assessed by the Simon and Stroop tasks, inattention and hyperactivity/impulsivity measured by the Conners 3 rating scales and AULA in Studies 1 and 2. This empirical evidence finds support in the literature, which posits that difficulties with executive functioning (e.g. interference control) are not necessarily characteristic of children with ADHD-related characteristics (Diamond, 2013; Willcutt et al., 2005). Nevertheless, as discussed in Chapter 3, it is also worth mentioning here that a lack of reporting strong associations between interference control, inattention, and hyperactivity/impulsivity could be attributed, to a degree, to the type of the assessment of interference control or the task impurity of the executive functioning tasks. Strong associations between executive functioning, inattention, and hyperactivity/impulsivity may be present, especially when using rating scales rather than behavioural measures of executive functioning (Barkley & Fischer, 2011). Finally, the Simon and Stroop tasks may assess simultaneously additional EF skills, apart from interference control, including working memory and visual search skills (Friman & Miyake, 2017; Willcutt et al., 2005).

6.2. Limitations

The three thesis studies come with certain limitations. This section discusses the limitations specific to the participants, given that these were common throughout the studies. More specific study limitations, for example, regarding the study design (e.g., failure to manipulate the reward condition) and measures (e.g., limited focus of the MRQ) are explored extensively in Chapters 3, 4, and 5.

In Study 1 (Chapter 3), the aim was to recruit a community sample of children with no ADHD or any other diagnosis. Considering that approximately one-third of children were classified as having severe inattention based on parent, teacher, and behavioural tasks (the behavioural tasks and assessments were not conducted for clinical purposes though), it is difficult to exclude the possibility that some children could have met the criteria for an ADHD diagnosis at the time of testing. Given the limited availability and accessibility of diagnostic services in the UK, the long waiting lists (e.g. between a referral and an appointment with a specialist) to receive a diagnosis (one-third of children and adults wait two or more years, Shire [2017]), the still limited parent and teacher awareness and knowledge of ADHD as well as the continuing stigma surrounding ADHD (Aguiar et al., 2014; Mueller et al., 2012; West et al., 2005; Young et al., 2021), there remains a question as to how nonclinical community samples really are (Hollingdale et al., 2019; Rowland et al., 2015).

In Study 2 (Chapter 4), children with and without ADHD were matched properly based on chronological age, gender, and baseline reading ability to address the limitation of lack of properly matched groups in ADHD literature (Lee & Zentall, 2017; Miranda et al., 2013). Nevertheless, this does not preclude the possibility that additional individual factors, such as socioeconomic status and intelligence, could have contributed to children's baseline reading motivation, potentially explaining, to an extent, the absence of motivational differences between the two groups against predictions. Socioeconomic status, measured through pupil premium/eligibility for free school meals, and general IQ, assessed, to a degree, through receptive vocabulary, were measured in Study 2. However, due to the insufficient sample, it was not feasible to use these variables as covariates in further analyses. Drawing on research that supports the relationship between socioeconomic status (Kieffer, 2010), intelligence (Johann et al., 2020), home-related factors including parental involvement (Gonzalez-DeHass et al., 2005; Mudrák et al., 2020) and reading comprehension, lack of controlling for these variables is an important limitation that could affect the interpretations around the effects of motivation on reading outcomes. Another limitation in Study 2 related to the child background characteristics, is that all children were cognitively able, as indicated by receptive vocabulary scores on BPVS-III (≥ 70) and attended mainstream primary schools. This selection of children was made to ensure that they could perform the behavioural, and most importantly, the reading tasks of the intervention. Thus, findings should be interpreted with caution as these cannot be generalised to children with different intellectual profiles as well as to children with ADHD who experience greater behavioural/learning struggles and/or attend special schools.

On another note, all children who had a diagnosis of ADHD in Study 2, presented the combined ADHD type, which has been reported to be the most common in children and adolescents (Reale et al., 2017). Recruiting only children with this ADHD type is an important limitation. For example, there is some empirical evidence revealing motivational differences across the ADHD subtypes, with children with the combined ADHD type being rated, by parents and teachers, as more motivated by competitiveness and a need to be perceived as superior to others, whereas children with the inattentive type are more likely to be described as cooperative and passive in their learning style (Carlson et al., 2002). These findings are at an early stage and given the characteristics of the Study 2 sample, it was not possible to investigate this area further. Due to challenges related to the under-identification and under-diagnosis of

ADHD in the UK (Sayal et al., 2018; Young et al., 2021), the limited school access, and COVID-19 fieldwork disruptions, it was only feasible to recruit a small number of children with a combined ADHD diagnosis.

Another related limitation is that children with ADHD were not excluded in the presence of co-occurring conditions. Research with young people with neurodevelopmental conditions uses frequently rigid exclusion criteria such as excluding those with co-occurring conditions (Toplak et al., 2005). Nevertheless, the presence of co-occurring conditions in ADHD is typically the norm, rather than the exception (Astle & Fletcher-Watson, 2020; Reale et al., 2017). Children with combined ADHD also have a greater likelihood to present co-occurring conditions, than children with other ADHD subtypes (Reale et al., 2017). The inclusion of these children means that the study sample is more representative of this heterogeneous population. Despite this, it is difficult to rule out the possibility that co-occurring conditions, such as developmental coordination disorder and autism/autistic traits identified in some children with ADHD, could have added extra challenges to them when performing the reading and behavioural tasks and could have masked, at least in part, the effects of motivational choice and rewards on reading comprehension and enjoyment.

Finally, in Studies 2 (Chapter 4) and 3 (Chapter 5), the sample size was small. The number of participants recruited in previous research that manipulated experimentally choice and rewards ranges from case studies (Dunlap et al., 1994; Plumer & Stoner, 2005; Powell & Nellson, 1997) to studies recruiting a small, but more representative number of children (20 to 40 children with ADHD) (DuPaul et al., 1998; Morsink et al., 2017). According to the power analysis in Study 2, a sample of 24 children was not sufficient ($N \geq 28$) to detect medium effects of choice and reward as well as any significant interactions between choice/reward and ADHD status. Given that children's mean scores across the three conditions were towards the expected direction (children scored higher on reading comprehension and enjoyment in choice and reward compared with no motivation), there is a strong likelihood that a larger sample could have enabled to demonstrate the effects of choice and reward on the reading outcomes of children with and without ADHD with greater rigour. A minimum number of 12 participants has also been suggested as being adequate for qualitative research (Clark & Braun, 2013; Figard & Potts, 2015). In Study 3, the sample size was determined, to a degree, based on qualitative factors such as the pragmatic constraints of the study (e.g., school access) and the diversity of the sample (e.g., children aged 8 to 11 years old, not too wide age differences). No new themes were identified in the last two or three interviews in each group, and thus, it is likely that a total number of 24 children (12 for each group) was relatively sufficient.

6.3 Implications for School and Clinical Practice and Future Directions

The present thesis studies have several implications for school and clinical practice. They also offer a starting point to consider future directions.

6.3.1 Implications for School Practice and Future Directions

On a practical level, the thesis findings indicate that even small adjustments to the reading environment, promoted via easily manipulated motivators such as story choice and reward, could generate benefits for the reading outcomes of all children, irrespective of the severity of ADHD-related characteristics. These findings are in line with previous research showing that educational interventions targeting young people with severe ADHD-related characteristics and/or ADHD such as task and instructional modification, peer tutoring, computer-aided instruction, self-monitoring, and strategy training can have important learning benefits for children with and without ADHD (DuPaul et al., 2012).

Due to the high school workload, the increased stress levels as well as the perceived lack of resources and lack of training (Ofsted, 2019), especially for managing children's behaviour, teachers may have limited time and support over reading instruction. Therefore, whole classroom reading practices that support motivation could be seen are particularly attractive and supportive for teachers in mainstream primary schools. Several teachers regard learning at a whole-class level as their primary responsibility and, thus, behaviours such as inattention and/or hyperactivity-impulsivity are viewed as interfering with classroom instruction and creating stress (Hong, 2008; Richardson et al., 2015). Regarding the reading instruction of children with severe ADHD-related characteristics and/or ADHD, some teachers may have the impression that children either have or do not have a genuine interest in a task and are not always aware of how their reading practices can trigger and maintain interest in the classroom (Lipstein & Renninger, 2006). Others may also perceive practices supporting reading motivation as relatively demanding and time-consuming. The present findings stress the need towards further understanding whether and how practical tools including story choice, reward, novelty, vividness, surprisingness of text information, ease of comprehension, challenging plotline, and book illustrations (Beike & Zentall, 2012; Cordova & Lepper, 1996; Hidi & Renninger, 2006; Renninger & Hidi, 2016) could trigger situational interest and contribute, in turn, to the development of intrinsic reading motivation for the entire classroom and not only for children with severe ADHD-related characteristics and/or ADHD.

Another advantage of inclusive approaches to reading motivation is that they do not single out children with severe ADHD-related characteristics and/or ADHD as they target the entire classroom rather than children individually. During inclusive reading instruction, children with ADHD are not being withdrawn from the classroom, which could help reduce to an extent the stigma and marginalisation (Richardson et al., 2015) that some children with ADHD may experience in school as shown, to a small extent, in Study 3. Drawing further on the Study 3 findings, some children may also need additional individualised support, for example in terms of vocabulary development, irrespective of an ADHD diagnosis. In terms of supported autonomy, school staff may need to offer extra support, especially to children with ADHD during the process of selecting a book in the classroom or school library, for example, by helping them make reading lists based on their reading preferences and reading level. The work schools in the UK have done of levelling ‘real’ books to enable children to have supported choices is an example of current practice, which supports young readers’ autonomy. Teacher-child and/or parent-child joint reading may also prove beneficial, especially for some children with ADHD (Leonard et al., 2009). Similarly, simple parental reading practices, such as offering children choices during reading based on their reading level and interests, supporting children during book selection, reading to or with children before bedtime, adopting fun reading strategies, such as ‘acting out’ book scenes, and offering competence-enhancing feedback (e.g. praise) for child reading could be particularly motivating for young readers.

The Study 3 findings have practical implications for reading practice, but they also speak to a larger question, namely, the question on how to create warm and supportive school environments, in which all children feel valued and accepted. Positive peer relationships and child-teacher relationships are key contributors to the reading motivation, reading, and wellbeing of both children with and without ADHD (Richardson et al., 2015; Spilt, 2011). For instance, schools could structure sessions for paired reading and child-teacher reading as well as book clubs, during which children of different ages read with others, learn with and from their peers/teachers, exchange feedback and, most importantly, engage in shared fun reading-related activities (e.g., book discussions, art activities to share what they read with classmates and teachers). In addition to this, there is a need for teachers to establish clear expectations around child and teacher behaviour in the classroom and to minimise classroom noise that could be a barrier for the learning of all children, especially those with ADHD (Massonnié et al., 2019; Richardson et al., 2015).

Finally, it is worth noting that there is a high need for reading motivation research that is underpinned by the co-creation/co-production philosophy. In this thesis, I sought children’s perspectives, as their voices have been neglected systematically in the field of reading motivation. Nevertheless, conducting interviews alone does not constitute authentic involvement (Fletcher-Watson et al., 2019). Participatory approaches and co-production in reading (Fletcher-Watson et al., 2019; Pavlopoulou & Dimitriou, 2020; Pickard et al., 2021) provide opportunities for researchers to work with, rather than for, children, teachers, and parents towards shared goals around reading development and reading for pleasure, which could have a more meaningful impact on reading policy and school practice.

6.3.2 Implications for Clinical Practice and Future Directions

The findings from Studies 1 and 2 have important clinical implications for the assessment of ADHD. The current diagnosis of ADHD in children is based, primarily, on rating scales including the Conners 3 scales (Conners, 2008), the ADHD Rating Scale-5 (DuPaul et al., 2016), and the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) as well as clinical interviews with the child and/or a parent. Occasionally, clinicians may also perform observations of children.

Findings from this thesis propose that parent and teacher rating scales are highly informative, effective towards discriminating children with and without ADHD, and thus a necessary element of the diagnostic process. Nevertheless, these could be subject to several biases. For example, drawing on previous literature, factors such as ADHD awareness (Eisenberg & Schneider, 2007) and the diagnostic criteria used in the scales (DSM-V versus ICD-10, see Section 2.2 for these classification systems) could add further confusion to the assessment of ADHD based solely on rating scales. In addition to this, neuropsychological assessments, such as the widely used Continuous Performance Test, have become part of the protocol for an accurate assessment of ADHD. Such assessments can capture manifestations of inattention and hyperactivity/impulsivity; however, they lack ecological validity, and their predictive value is relatively low (Zulueta et al., 2018). For instance, inattention and hyperactivity/impulsivity may not be evident, when children are tested one-to-one in a quiet room with a single adult (Gualtieri & Johnson, 2005). The present thesis findings highlight, to a degree, that behavioural tasks, such as the Simon and Stroop tasks, may be less effective for use during the diagnostic assessment of ADHD, given the limited weak or no associations between these and the rest of the measures assessing inattention and hyperactivity/impulsivity.

Virtual reality tasks may offer more ecologically valid assessments of ADHD-related characteristics. These tasks are relatively more complex as they aim to replicate the cognitively challenging situations (e.g., simultaneous processing of multiple visual and auditory stimuli) that children face in everyday life (Iriarte et al., 2016). Drawing on the findings of Study 1, AULA proved as an effective measure. First, it distinguished between inattention (omission errors) and behavioural inhibition (commission errors). Then, its convergent validity was confirmed, to an extent, based on the associations between omission errors, parent-rated inattention, and teacher-rated inattention. Among the different ADHD measures, the greatest association was found between teacher-rated inattention and omission errors (inattention) in AULA, $r(98) = .40$, $p < .001$. Also, the AULA was the only ADHD measure that showed medium-to-strong negative associations with the NGRT in Study 1 (omission errors, $r(102) = -.42$, $p < .001$, RT, $r(102) = -.35$, $p < .001$, and RT to commission errors, $r(102) = -.20$, $p = .041$) and children's reading comprehension scores in the no motivation condition (baseline reading ability) in Study 2 (omission errors, $r(24) = -.61$, $p = .001$). In Study 2, AULA did not differentiate between the two groups, contrary to the Conners 3 scales. This finding could be attributed primarily to the small sample size, given that children with ADHD performed worse on all AULA variables than those without ADHD.

Apart from its implications for clinical practice, AULA could also have key educational implications, as it offers information about the challenges that children with ADHD-related characteristics could face when encountering various stimuli. Children's difficulty in sustaining attention over time during AULA (Díaz-Orueta et al., 2014; Iriarte et al., 2016) in the presence of both visual (e.g., writing on the whiteboard) and auditory stimuli (e.g., ambulance passing by, and children talking) may suggest that teachers need to simplify reading instructions and tasks, presenting each task at a time, while also making necessary seating re-arrangements. For instance, children with more severe ADHD-related characteristics and/or ADHD could benefit from seating at a quiet table close to the teacher, staying away from classroom doors and windows to reduce exposure to extra noise.

Overall, Study 1 and Study 2 findings point towards the need for a multi-method assessment to understand the ADHD phenotype in line with the National Institute for Health and Care Excellence (NICE) guidelines (2018). As mentioned earlier, parent and teacher scales may provide information about children's daily functioning and persistence of ADHD-related characteristics across two different settings (school, home). Previously, it has been argued that behavioural tasks serve as more objective measures of children's task-specific performance (Toplak et al., 2013). Nevertheless, these measures should be further tested with community and clinical samples of children with ADHD-related characteristics as some of these, such as the Stroop and Simon tasks, may not always prove effective towards ADHD assessment. Contrariwise, virtual reality tasks may represent more ecologically valid measures when exploring children's ADHD-related strengths and struggles in real-world situations as well as the relationship between ADHD-related characteristics (e.g., particularly inattention) and potential outcomes (e.g., reading comprehension).

6.4 Concluding Remarks

This thesis explored the role of intrinsic (choice) and extrinsic (reward) motivators in the reading of i) a community sample of children with minimal and severe ADHD-related characteristics i) a group of children with and without diagnosed ADHD. All children attended mainstream primary schools in England. I employed a mixed-methods approach, using both quantitative (behavioural tasks, questionnaires, interventions) and qualitative (interviews) methods, to develop a more comprehensive account of reading motivation and its implications for the reading of children with different cognitive characteristics. A major significant and novel finding is that inclusive reading motivational practices, such as story choice and reward, could benefit primary-aged children, regardless of the severity of ADHD-related characteristics. Further research is needed in this neglected area to support educators and parents on how to motivate children with ADHD-related characteristics to become lifelong proficient readers who read for pleasure. Following this direction requires that researchers flip the narrative, moving away from 'deficit' models that overemphasise the 'impairments' of young readers with ADHD-related characteristics towards investigating what these can achieve when experiencing motivating and stimulating classroom environments. Most importantly, it is of vital significance that researchers work alongside community and clinical groups of children with ADHD-related characteristics, teachers, and parents to ensure that findings from reading interventions are meaningful for schools and have a real impact on reading policy and practice.

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Appendices

Appendix A: Sample Pages of Conners 3 Rating Scales (Short Versions)

Parent Scale

Parent/ Guardian Questionnaire

Child's name: ....

Sex: Male ☐ Female ☐

Instructions: Here are some things parents might say about their children. Please tell us about *your* child and what he/she has been like in the ***past month***. Read each item carefully, then mark how well it describes your child or how frequently it has happened in the ***past month***.

0= In the past month, this was ***not true at all*** about my child. It never (or seldom) happened.

1= In the past month, this was ***just a little true*** about my child. It happened occasionally.

2= In the past month, this was ***pretty much true*** about my child. It happened often (or quite a bit).

3= In the past month, this was ***very much true*** about my child. It happened very often (very frequently).

Please **circle only one answer** for each sentence. It is important to respond to every sentence. For sentences that you find difficult to answer, please give your best guess.

Rating:	**0= Not true at all (Never, Seldom)**	**2= Pretty much true (Often, Quite a bit)**
In the past month, this was…	**1= Just a little true (Occasionally)**	**3= Very much true (Very often, Very frequently)**

1. Forgets to turn in completed work.	0	1	2	3
2. Is perfect in every way.	0	1	2	3
3. Fidgets or squirms in seat.	0	1	2	3
4. Is one of the last to be picked for teams or games.	0	1	2	3
5. Restless or overactive.	0	1	2	3
6. Does not know how to make friends.	0	1	2	3
7. Runs or climbs when he/ she is not supposed to.	0	1	2	3
8. Cannot grasp arithmetic.	0	1	2	3
9. Is difficult to please or amuse.	0	1	2	3
10. Needs extra explanation of instructions.	0	1	2	3
11. Is hard to motivate (even with rewards like candy or money).	0	1	2	3

1

Teacher Scale

Teacher Questionnaire

Student's name: ....

Sex: Male ☐ Female ☐

Time Known Student: ....

Instructions: Here are some things teachers might say about their students. Please tell us about this student and what he/she has been like in the ***past month***. Read each item carefully, then mark how well it describes this student or how frequently it has happened in the ***past month***.

0= In the past month, this was ***not true at all*** about this student. It never (or seldom) happened.

1= In the past month, this was ***just a little true*** about this student. It happened occasionally.

2= In the past month, this was ***pretty much true*** about this student. It happened often (or quite a bit).

3= In the past month, this was ***very much true*** about this student. It happened very often (very frequently).

Please **circle only one answer** for each sentence. It is important to respond to every sentence. For sentences that you find difficult to answer, please give your best guess.

Rating:	**0= Not true at all (Never, Seldom)**	**2= Pretty much true (Often, Quite a bit)**
In the past month, this was…	**1= Just a little true (Occasionally)**	**3= Very much true (Very often, Very frequently)**

1. Is constantly moving.	0	1	2	3
2. Has to struggle to complete hard tasks.	0	1	2	3
3. Inattentive, easily distracted.	0	1	2	3
4. Makes mistakes.	0	1	2	3
5. Bullies, threatens or scares others.	0	1	2	3
6. Cannot do things right.	0	1	2	3
7. Is angry and resentful.	0	1	2	3
8. Excitable, impulsive.	0	1	2	3
9. Is fun to be around.	0	1	2	3
10. Has trouble keeping his/her mind on work or play for long.	0	1	2	3
11. Has poor social skills.	0	1	2	3

Self-report

Self-report

Name: ....

Gender: Male ☐ Female ☐

Instructions: Here are some things that children might say. Tell us, in your opinion, how true you think these things are about you. Think about yourself in the ***past month***. Read each sentece carefully, then mark how true it is, or how often it happened to you in the ***past month***.

0= In the past month, this was ***not true at all*** about me. It never (or seldom) happened.

1= In the past month, this was ***just a little true*** about me. It happened occasionally.

2= In the past month, this was ***pretty much true*** about me. It happened often (or quite a bit).

3= In the past month, this was ***very much true*** about me. It happened very often (very frequently).

Please **circle only one answer** for each sentence. It is important to respond to every sentence. For sentences that you find difficult to answer, please give your best guess.

Rating:	**0= Not true at all (Never, Seldom)**	**2= Pretty much true (Often, Quite a bit)**
In the past month, this was…	**1= Just a little true (Occasionally)**	**3= Very much true (Very often, Very frequently)**

1. I blurt out the first thing that I think of.	0	1	2	3
2. I struggle to complete hard tasks.	0	1	2	3
3. It is hard for me to pay attention to details.	0	1	2	3
4. It is hard for me to sit still.	0	1	2	3
5. I can't pay attention for long.	0	1	2	3
6. I am good at some things.	0	1	2	3
7. I make mistakes.	0	1	2	3
8. I do things to hurt other people.	0	1	2	3
9. I have trouble understanding what I read.	0	1	2	3
10. I start fights with other people.	0	1	2	3
11. I like it when people say good things about me.	0	1	2	3
12. I tell the truth; I do not even tell 'the little lies'.	0	1	2	3
13. I have trouble with spelling.	0	1	2	3
14. I lose track of what I am supposed to do.	0	1	2	3
15. I have trouble playing or doing things quietly.	0	1	2	3
16. I get distracted by things that are going on around me.	0	1	2	3
17. I break things when I am angry or upset.	0	1	2	3
18. I have trouble finishing things.	0	1	2	3
19. Punishment in my house is not fair.	0	1	2	3

Appendix B: List of Readability Formulae

Please find below the 7 widely used readability formulae from readabilityformulas.com (click on each formula for further information). These formulae are used to indicate the average grade level, reading age, and difficulty level of the stories in Studies 1 and 2.

1. The Flesch Reading Ease formula
2. The Flesch-Kincaid Grade Level
3. The Fog Scale (Gunning FOG Formula)
4. The SMOG Index
5. The Coleman-Liau Index
6. Automated Readability Index
7. Linsear Write Formula

Appendix C: Example Comprehension Questions in Study 1

Story A (Wishing on a Star/ A Snowy Adventure)

Wishing on a Star: Comprehension Questions **Name:** ____________________

Answer each question about the story you have just read.

1. How do Alice and Ben feel at the start of the story? Tick the correct box.

Annoyed ☐ Scared ☐ Excited ☐ Disbelieving ☐

2. Why does Alice 'laugh harder' at Ben?

____

____

3. What do Alice and Ben usually do in the school holidays? (2 marks).

____

____

4. Choose the best group of words to fit the story. Circle your answer. (You must answer parts a and b).

a. The purpose of pages 2 and 3 is to:

encourage you to watch the Winter Olympics	explain why this holiday is important to Alice and Ben	tell you what it's like to go skiing

b. These pages also describe:

what you can do in the school holidays	what happens at a ski resort	how Alice and Ben are feeling

5. Which words in the story tell you that Alice and Ben have never visited the Swiss Alps before.

____

____

6. Why are the twins surprised that they need to put on 'layers and layers of clothing'?

____

____

1

Story B (Just Another Ordinary Day/ Something's Going On)

Just another Ordinary Day
Comprehension Questions

Name: ______________________

Answer each question about the story you have just read.

1. How does Jack feel at the start of the story? Tick the correct box.

Tired ☐ Worried ☐ Confused ☐ Annoyed ☐

2. Why does Jack think that it must be early?

____

____

3. What does Jack do on Page 3 that tells us that he is scared?

____

____

4. Who is Candy?

Jack's mum ☐ Jack's cat ☐ Jack's dog ☐ Jack's brother ☐

5. When Candy comes bounding into his room, how do you think Jack feels? Tick the correct box.

Annoyed ☐ Upset ☐ Relieved ☐ Excited ☐

6. Although Candy isn't allowed upstairs, how do we know that she gets on Jack's bed regularly?

____

____

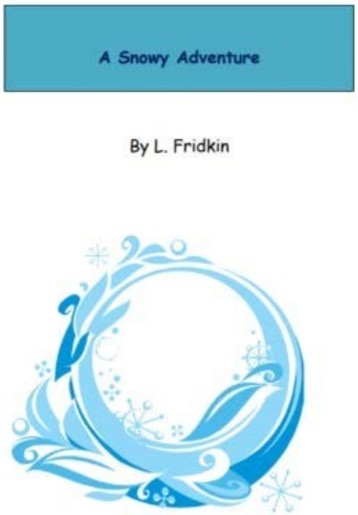
7. Which word on page 4 tells us that each of Jack's thoughts didn't last very long?

____

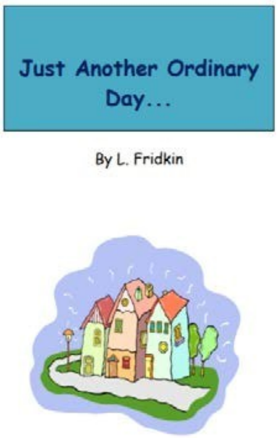
Appendix D: Titles, Cover Pages, Prologues and Child Reviews for Stories in Study 1

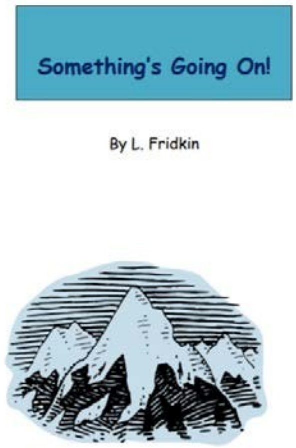
Titles and Cover Pages

Story A (Wishing on a Star/ A Snowy Adventure)



Story B (Just Another Ordinary Day/ Something's Going On)





Prologues

Story A (Wishing on a Star/ A Snowy Adventure)

The air smelled fresh and clean. The ground sparkled as though full of precious stones. The sun shone brightly.

All around pretty wooden houses were lined up in neat rows with a carefully cleared path leading to each front door.

Smoke curled from chimneys, reaching up to the blue sky above.

Just beyond the edge of the houses, snow-capped mountains stood grandly.

Everything looked as if it was from a postcard or a magazine.

1

Have you ever really, really wanted to do something but thought that it would never happen.

Is there something that has captured your imagination and left you thinking that you would love to try that something out?

What is it that you have felt inspired to do?

Swim with dolphins?

Write and perform a song?

Take a trip to the moon?

Meet your favourite football player or pop star?

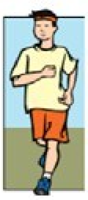
1

Story B (Just Another Ordinary Day/ Something's Going On)

In an ordinary street, in an ordinary town, street lights were being switched off. Inside the houses, alarms were waking their owners and children and adults stretched and yawned.

Some early risers were already preparing their breakfast. Others were leaving the house to go for a morning jog.

For most people, it was just another ordinary day.



- 1 -

There was a boy standing at the very top of the mountain. His arms were wide open. He looked as though he was shouting. Whatever he was saying, the sound was muffled.

Suddenly he started running. A second boy appeared. They were running, one after the other, down the north face of the mountain.

The first boy fell, tumbling hard, a blur of arms and legs.

Flashes of colour and noise... What on earth was going on?

And then, just like that, the dream ended.

1

Child Reviews

Story A (Wishing on a Star/ A Snowy Adventure)

Megan (aged 9)

I read this story because the first page attracted me. I really enjoyed it. The main character reminded me of my brother – I'm not sure if that's good or bad. I would like to read more stories like this as it was interesting and I found it easy to read.

Stuart (aged 8)

This story looked like it was going to be interesting. I think a lot of people would like to read this story. I enjoyed reading it and wanted to find out what was going to happen. It was exciting and I really liked the ending.

Story B (Just Another Ordinary Day/ Something's Going On)

Paul (aged 10)

This is a good story. It was interesting and I kept wondering what was going to happen next. I would tell my friends to read this as I think they would probably enjoy it. Sometimes it was funny and it made me think too.

Amy (aged 9)

I liked the way that things happened in this story. The characters were familiar and easy to imagine. It was nice to read and the ending made me smile. I think my friends would enjoy this story, I will definitely tell them about it.

Appendix E: Information Letters and Consent forms for Study 1

School Staff

Institute of Education

UCL

Information sheet for the Head teacher/ Assistant Head/Teachers

Topic of Study: The role of motivation in boys' and girls' attention and reading comprehension
Department: Psychology and Human Development
Name and Contact Details of the Principal Researcher: Myrofora Kakoulidou, myrofora.kakoulidou.14@ucl.ac.uk

Invitation for participation in a PhD research

You are being invited to participate in a new project that investigates the importance of motivation on children's attention and reading comprehension. I am particularly interested in exploring whether young readers concentrate and read better when given the opportunity to choose their reading material. This study has been designed so that it is both fun and educationally meaningful for your child and informative for you and your child's school. Below is an overview about the study aims and your involvement. My project is supervised by Professor Jane Hurry and Dr Frances Knight, this has received ethical approval from the Research Ethics Committee of UCL Institute of Education and the researcher has ensured an enhanced DBS.

What is this project about?

This research focuses on how motivation affects children's reading comprehension as well as whether children find it easier to read interesting texts. Other studies suggest that if children are interested they learn better, but we need to know more about how to get them interested in the first place and whether or not this is particularly useful for those children who tend to daydream or lose concentration.

Why have you been chosen?

This study has been designed to explore reading in Year 4 students from three mainstream schools in London. All teachers will be kindly asked to complete a short questionnaire about children's attention to gain a better idea about children's profile prior to the research. Teachers' recommendations at different stages of the research will also be taken into account. We do very much hope that you would like to have your students participate in this.

Do I have to take part in this research?

No. This research is not compulsory, it is voluntary. However, we very much hope that if you choose to take part in this study you and your students will find it a valuable experience.

What will happen if I participate in this study?

Prior to the main experiment, a questionnaire will be given to all children that explores their levels of reading motivation. A frequently used standardised reading test will also be given to all children to identify those students who may struggle to take part in the study due to severe reading difficulties. At this stage, your recommendations about students' reading comprehension would also be of great help. Children who will be excluded due to reading problems will be given a reading task that is adjusted for their level of learning where appropriate. On a different day, all children will be given a text chosen by the researcher and some relevant comprehension questions. On the completion of the reading task the researcher will read aloud a short reading enjoyment questionnaire and each child will be asked to complete this. A week after, all children in the class will be given different texts, they will choose which text they prefer to read and answer some comprehension questions. At the end, they will complete again a short questionnaire about whether they enjoyed the text or not.

During the study period, each child will also participate in some fun and meaningful attention activities outside the classroom for approximately 25 minutes and then return back to his/her classroom. The reading materials and questions have been successfully used in previous studies. Overall, I will visit your classroom approximately on six days which are more convenient to you.

Each teacher who agrees to take part in this study will be kindly asked to complete a short questionnaire about the attention levels of each student. Information based on this questionnaire will help the researcher understand whether young readers are more highly attentive during an interesting reading task. Teachers participating in this research will be provided with a £50 book voucher in order to thank them for their great contribution in this study.

I would really appreciate if you could circulate the attached information letter and consent form to parents. Those parents interested in having their child participate in the research are advised to return their completed consent form to the teacher before the research. Parents will also be provided with a short questionnaire exploring the levels of their children's attention that should also be returned to the teacher and then given to the researcher preferably before the implementation of the research. Please make sure that students are informed about the study and have understood the simple process that will be followed. I will also let them know briefly about the purpose of the research when I visit your classroom.

What are the possible advantages of taking part in this study?

Each child will have the opportunity to read enjoyable texts and act as little scientists. All students will be given a certificate of participation in order to thank them for their great contribution to this study. Your contribution in this research will help learn more about what texts help children concentrate and comprehend better.

What will happen with the results?

The information you give, and your child's attention, reading and motivation data will kept so long as it is needed for the research project. However, all the data is anonymized so names are not stored, only individual ID numbers which will be given to each child. Data will be reported in research/ publications/ seminars/ conferences anonymously, ensuring that no sensitive information is included and no participant can become identifiable. Also, individual children's results will not be shared with anyone beyond the research team. After the completion of this study we will send the school a summary of our findings and these will be made available to parents and children.

What do I need to do next?

I very much hope you will agree to participate in this study which we think investigates an important aspect of children's learning that is under-researched. You need to feel assured that the assigned attention and reading tasks will be interesting and educationally meaningful and will help us shed more light on what interventions help particularly those students struggling with reading comprehend better.

What is the process of raising an issue during the study?

If you want to ask any questions, raise any issues or make comments, please feel free to contact the researcher (please check contact details above).

Who is funding this research?

This research has received partial funding by the A.G. Leventis Foundation.

Data Protection Privacy Notice

Your personal data will be processed for the purposes outlined in this notice. The legal basis that would be used to process your personal data will be parent/guardian consent form. You can provide your consent for the use of your personal data in this project by completing the consent form that has been provided to you. Child verbal consent form will also be asked during the individual attention tasks. The data controller for this project will be University College London (UCL). If you are concerned about how your personal data is being processed, please contact UCL in the first instance at data-protection@ucl.ac.uk. If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/ . Personal data will not be transferred outside the EEA.

Thank you very much for taking the time to read this information sheet. I very much hope that you and your child would like to take part in this study.

If you are happy for your child to be involved, please complete the following consent form and the attention questionnaire and return to the teacher. Please feel free to contact me in order to discuss any concerns or arising issues regarding this research if you wish to.

Researcher's contact details

Email: myrofora.kakoulidou.14@ucl.ac.uk
Telephone number: [redacted]

UCL Institute of Education
20 Bedford Way, London WC1H 0AL

Institute of Education

UCL

Consent form for teachers

If you are happy to participate and have your students take part in this study, please complete this consent form.

	YES	NO
I would like to have my classroom participate in this research.	☐	☐
I have read and understood the information leaflet about the research.	☐	☐
I have discussed the information sheet with my classroom.	☐	☐
I understand that I can have my classroom withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used.	☐	☐
I understand that I can contact the researcher Myrofora Kakoulidou at any time for any arising enquiries.	☐	☐
I understand that the results will be shared anonymously and no participant will be identifiable.	☐	☐

Name of teacher: ....

Signature: .... Date: ....

Researcher's name: Myrofora Kakoulidou

Signature: [redacted]

Researcher's contact details

Email: myrofora.kakoulidou.14@ucl.ac.uk
Telephone number: [redacted]

UCL Institute of Education
20 Bedford Way, London WC1H 0AL

Parents/Guardians

Institute of Education

UCL

Choice effects on boys' and girls' attention and reading comprehension

Information sheet for Parents/Guardians

Title of Study: The role of motivation in the attention and reading comprehension of children
Department: Psychology and Human Development
Name and Contact Details of the Researcher(s):
Myrofora Kakoulidou, email: myrofora.kakoulidou.14@ucl.ac.uk, Tel.: 07923525362
Name and Contact Details of the Principal Researcher: Myrofora Kakoulidou, myrofora.kakoulidou.14@ucl.ac.uk

Invitation for participation in a PhD research

You are being invited to participate in a new project that investigates the importance of motivation on children's attention and reading comprehension. I am particularly interested in exploring whether young readers concentrate and read better when given the opportunity to choose their reading material. This study has been designed so that it is both fun and educationally meaningful for your child and informative for you and your child's school. Below is an overview about the study aims and your involvement. My project is supervised by Professor Jane Hurry and Dr Frances Knight, this has received ethical approval from the Research Ethics Committee of UCL Institute of Education and the researcher has ensured an enhanced DBS.

What is this project about?

This research focuses on how motivation affects children's reading comprehension as well as whether children find it easier to read interesting texts. Other studies suggest that if children are interested they learn better but we need to know more about how to get them interested in the first place and whether or not this is particularly useful for those children who tend to daydream or lose concentration.

Why has your child been chosen?

This study has been designed to explore reading in Year 4 students from approximately three mainstream schools in London and we do very much hope that you would like to have your child participate in this.

Does my child need to take part in this research?

No. This research is not compulsory, it is voluntary and the child can withdraw from the study at any stage. If you want your child to participate in the study please complete the consent form, answer the short attention questionnaire and return to the teacher. We very much hope that if you choose to take part in this study you and your children will find it a valuable experience.

What will happen if I participate in this study?

Each parent/guardian who agrees to have his/her child take part in this study will be kindly asked to complete a short questionnaire about their child's attention. Information based on this questionnaire will help the researcher understand whether young readers' attention affect their reading and whether they respond well to choice of reading material.

What will happen if my child participates in this study?

Each child will be encouraged to take part in some fun attention tasks (including a virtual reality task) for approximately 25 minutes and then return back to his/her classroom. In three days, all children in the class will read interesting reading material and answer relevant questions, which have been already used successfully in previous studies. One short questionnaire about children's motivation will also be given on a different date.

What will happen with the results?

The information you give, and your child's attention, reading and motivation data will kept so long as it is needed for the research project. However, all the data is anonymized so names are not stored, only individual ID numbers which will be given to each child. Data will be reported in research/ publications/ seminars/ conferences anonymously, ensuring that no sensitive information is included and no participant can become identifiable. Also, individual children's results will not be shared with anyone beyond the research team. After the completion of this study we will send the school a summary of our findings and these will be made available to parents and children.

What are the possible advantages of taking part in this study?

Each child will have the opportunity to read enjoyable texts and act as little scientists. All students will be given a certificate of participation in order to thank them for their great contribution to this study. Your contribution in this research will help learn more about what texts help children concentrate and comprehend better.

What is the process of raising an issue during the study?

If you want to ask any questions, raise any issues or make comments, please feel free to contact the researcher or her Primary Supervisor (please check contact details above).

Who is funding this research?

This research has received partial funding by the A.G. Leventis Foundation.

Data Protection Privacy Notice

Your personal data will be processed for the purposes outlined in this notice. The legal basis that would be used to process your personal data will be parent/guardian consent form. You can provide your consent for the use of your personal data in this project by completing the consent form that has been provided to you. Child verbal consent form will also be asked during the individual attention tasks. The data controller for this project will be University College London (UCL). If you are concerned about how your personal data is being processed, please contact UCL in the first instance at data-protection@ucl.ac.uk. If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/ . Personal data will not be transferred outside the EEA.

Thank you very much for taking the time to read this information sheet. I very much hope that you and your child would like to take part in this study.

If you are happy for your child to be involved, please complete the following consent form and the attention questionnaire and return to the teacher. Please feel free to contact me in order to discuss any concerns or arising issues regarding this research if you wish to.

Researcher's contact details

Email: **myrofora.kakoulidou.14@ucl.ac.uk**
Telephone number: [redacted]

UCL Institute of Education
20 Bedford Way, London WC1H 0AL

Institute of Education

Consent form for Parent/Guardian

If you are happy to participate, please complete this consent form and the attention questionnaire you will find on the other page and return to the teacher.

	YES	NO
I would like my child to participate in this research.	☐	☐
I have read and understood the information leaflet about the research.	☐	☐
I have discussed the information sheet with my child.	☐	☐
I understand that I can withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used.	☐	☐
I understand that I can contact the researcher Myrofora Kakoulidou at any time for any arising enquiries.	☐	☐
I understand that the results will be shared anonymously and no participant will be identifiable.	☐	☐

Name of child: Forename ……………………… Surname …..………………...

Male ☐ Female ☐

Name of parent/ guardian: ……………………………………………..

Signature: ………………….…. Date: ……………….…………

Researcher's name: Myrofora Kakoulidou

Signature: [redacted]

Researcher's contact details

Email: myrofora.kakoulidou.14@ucl.ac.uk
Telephone number: [redacted]

UCL Institute of Education
20 Bedford Way, London WC1H 0AL

Appendix F: Example Pages of the NGRT

Sentence Completion Section

Look at the sentences on this page. Each one has a word missing. Shade in the box beside the word that best fits the gap.

Do not write the word in the gap.

Look at the example below and then start the test.

Example

The children went out to _____ .

- ☐ clay
- ☐ plot
- ■ play
- ☐ pelt
- ☐ stay

1

A _____ has two wheels.

- ☐ car
- ☐ lorry
- ☐ tricycle
- ☐ bicycle
- ☐ tractor

2

The _____ runner wins the race.

- ☐ slowest
- ☐ safest
- ☐ fastest
- ☐ fussiest
- ☐ flattest

3

My mum's ring has a _____ in it.

- ☐ feather
- ☐ diamond
- ☐ pebble
- ☐ mirror
- ☐ writing

4

Lucy was taken to _____ in an ambulance.

- ☐ home
- ☐ shopping
- ☐ hospital
- ☐ accident
- ☐ school

Passage Comprehension Section

First Time Snorkelling

Ever since Emma started to learn ___1___ the sea she had wanted to go snorkelling. She had seen so many pictures of underwater life – the coral reefs and the ___2___ that live in them. She wanted very much to see these things for ___3___.

In the summer her family went on a holiday to the Caribbean where the ___4___ was clear blue. So, for the first time ever, Emma was able to try snorkelling.

As soon as they got to their hotel, Emma went out with her mum to buy some snorkelling gear. She knew that you needed a mask and pipe (called a snorkel) which you breathe through. Her mum also treated her to a pair of bright red flippers so that she could swim around more easily.

Emma's family were invited to go on a special snorkel boat which took them to the spots where they would be able to see really big fish. Everyone was excited. They couldn't believe how clear and blue the water was. Not like the sea in England. Looking over the side of the boat, Emma could see all the way down to the bottom of the sea.

The boat stopped and everyone jumped into the water. The sea was really warm! It took a while to get used to using the snorkel but Emma's dad showed her how to use it properly so that she could breathe with her face in the water.

There was a whole new world underwater. Red fish, yellow fish, fish with blue and pink spots. Long ones, fat ones, flat ones and round ones. Some of the fish were bigger than her head!

Right below her a large stingray glided past. It was bigger than her! She knew that stingrays were very gentle so she wasn't worried. It was amazing how it moved so easily in the water. Her dad dived down and swam along with it.

Her brother showed off, diving down and picking up shells from the sea bed. Every time she tried to copy him she breathed in a whole lot of salty sea water!

"Oh well," she thought. She had all of the holiday to practise!

1
- ☐ around
- ☐ about
- ☐ with
- ☐ for
- ☐ on

2
- ☐ fish
- ☐ birds
- ☐ people
- ☐ shells
- ☐ dogs

3
- ☐ themselves
- ☐ her
- ☐ itself
- ☐ herself
- ☐ ourselves

4
- ☐ cloud
- ☐ island
- ☐ trees
- ☐ sand
- ☐ sea

Appendix G: The Modified Version of the MRQ

Name: ______________________________ Class: ________________

Reading Questionnaire

I am interested in your reading. The sentences in this questionnaire describe how some learners feel about reading. Read each sentence and decide whether it describes a person who is like you or different from you. **There are no right or wrong answers.** I only want to know how you feel about reading. For many of the statements, you could think about the kinds of things you read in your class.

Here are two examples to try before we start the ones about reading:

If the statement is **very different from you**, circle a **1**.

If the statement is **a little different from you**, circle a **2**.

If the statement is **a little like you**, circle a **3**.

If the statement is **a lot like you**, circle a **4**.

I like ice cream.	1	2	3	4
I like spinach.	1	2	3	4

Okay, here are the ones about reading. Remember, there are no right or wrong answers. I am just interested in YOUR ideas about reading. To give your answer, circle ONE number on each line.

I will read each of the statements carefully, and then you need to circle your answer. Listen to each sentence and decide whether it describes a person who is like you or different from you.

1. I visit the library often with my family.	1	2	3	4
2. I like hard, challenging books.	1	2	3	4
3. I know that I will do well in reading this year.	1	2	3	4
4. I do as little schoolwork as possible in reading.	1	2	3	4
5. It is very important to me to be a good reader.	1	2	3	4
6. I read because I have to.	1	2	3	4
7. I like it when the questions in books make me think.	1	2	3	4
8. I read about my hobbies to learn more about them.	1	2	3	4
9. I am a good reader.	1	2	3	4
10. I read stories about fantasy and make-believe.	1	2	3	4
11. I often read to my brother, sister, friend, or relative.	1	2	3	4
12. I don't like it when there are too many people in the story.	1	2	3	4
13. I read to learn new information about things that interest me.	1	2	3	4

Please Turn Over

If the statement is **very different from you**, circle a **1**.

If the statement is **a little different from you**, circle a **2**.

If the statement is **a little like you**, circle a **3**.

If the statement is **a lot like you**, circle a **4**.

14. My friends sometimes tell me I am a good reader.	1	2	3	4
15. I learn more from reading than most pupils in the class.	1	2	3	4
16. I like to read about new things.	1	2	3	4
17. I like hearing the teacher say I read well.	1	2	3	4
18. I like being the best at reading.	1	2	3	4
19. If a book is interesting, I don't care how hard it is to read.	1	2	3	4
20. I sometimes read to my mum or dad.	1	2	3	4
21. My friends and I like to swap things to read.	1	2	3	4
22. I read a lot of adventure stories.	1	2	3	4
23. I don't like reading something when the words are too difficult.	1	2	3	4
24. I make pictures in my mind when I read.	1	2	3	4
25. I enjoy reading books about people in different cultures.	1	2	3	4
26. I usually learn difficult things by reading.	1	2	3	4
27. I don't like vocabulary questions.	1	2	3	4
28. Complicated stories are no fun to read.	1	2	3	4
29. I feel like I make friends with people in good books.	1	2	3	4
30. My mum or dad often praise my reading.	1	2	3	4
31. Finishing every reading task is very important to me.	1	2	3	4
32. I like mysteries.	1	2	3	4
33. I talk to my friends about what I am reading.	1	2	3	4
34. If I read something interesting, I sometimes lose track of time.	1	2	3	4
35. I read to improve my marks.	1	2	3	4
36. I like to tell my family about what I am reading.	1	2	3	4
37. If the project is interesting, I can read difficult material.	1	2	3	4
38. I enjoy reading books about people in different countries.	1	2	3	4

Appendix H: Internal Consistency of the MRQ Sub-scales for Study 1

Table H

Reliabilities of the MRQ Sub-scales in Study 1

Sub-scale	Reliabilities
1. Reading Efficacy	a = .52
2. Reading Challenge	a = .60
3. Reading Curiosity	a = .58
4. Aesthetic Enjoyment of Reading	a = .58
5. Importance of Reading	-
6. Compliance	a = .30
7. Reading Recognition	a = .54
8. Reading for Grades	-
8. Social Reasons for Reading	a = .73
10. Reading Competition	-
11. Reading Work Avoidance	a = .53

Note. N = 108. MRQ = Motivation for Reading Questionnaire. Reliability values taken as: <.50 = poor; .50-.75 = moderate; .75-.90 = good; >.90 = excellent (Koo & Li, 2016). Internal consistency for the dimensions of 'Importance of Reading', 'Reading for Grades' and 'Reading Competition' could not be calculated, because these included only an item in the revised version.

Appendix I: The 'Story Enjoyment/Interest' Scale

How did you find the story?

Hello! My name is Myrto and I am interested in your reading. You will find some sentences below that describe how some students felt about the story you just read. I am going to read each sentence and you will decide if that person is like you or different to you. **Circle the sentence that best describes you**. There are no right or wrong answers.

Here is an example

I like chocolate cake.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

Now circle the answer that tells us most about you.

1) I really enjoyed this story.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

2) I found it difficult to concentrate for the whole story.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

3) I was interested in what was going to happen.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

4) Answering the questions was difficult.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

5) I was not easily distracted when reading the story.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

6) This story was boring.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

7) The questions were easy to answer.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

8) I was not motivated to read the story.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

9) I would like to read more stories like this.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

10) I found it difficult to keep going.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

11) The questions were easy.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

12) I was sorry when the story ended.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

13) This story made me feel good about reading.

very different to me	a bit different to me	a bit like me	a lot like me
1	2	3	4

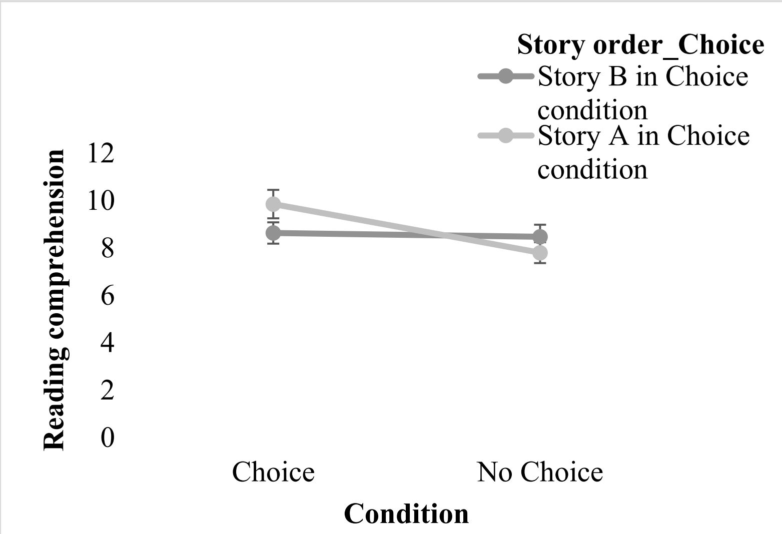
Appendix J: Choice Order and Story Effects and Interactions on Reading Comprehension and Enjoyment in Study 1

A mixed ANOVA with Condition (Choice, No Choice) as the within-subjects variable and Choice order (First, Second) as the between-subjects variable was conducted to test for any effects of Choice order on Reading comprehension scores. There was a main effect of Choice $F(1,101) = 8.02$, $p = .006$, $\eta_p^2 = 0.07$. There was no main effect of Choice order $F(1,101) = 0.06$, $p = .808$, $\eta_p^2 < 0.01$. There was no interaction between Reading scores across both conditions and Choice order $F(1,101) = 2.75$, $p = .100$, $\eta_p^2 = 0.03$.

A further mixed ANOVA with Condition (Choice, No Choice) as the within-subjects variable and Story order (Story A in Choice condition, Story B in Choice condition) as the between-subjects variable was applied to explore any effects of Story order on Reading comprehension scores. There was a main effect of Choice $F(1,101) = 10.15$, $p = .002$, $\eta_p^2 = 0.09$. There was no main effect of Story order $F(1,101) = 0.19$, $p = .663$, $\eta_p^2 < 0.01$. There was an interaction between Choice and Story order $F(1,101) = 7.45$, $p = .007$, $\eta_p^2 = 0.07$, such that children's reading comprehension scores were more positively affected by choice when reading Story A than when reading Story B.

Figure J1

Choice condition Story Effects on Reading Comprehension Scores in Study 1



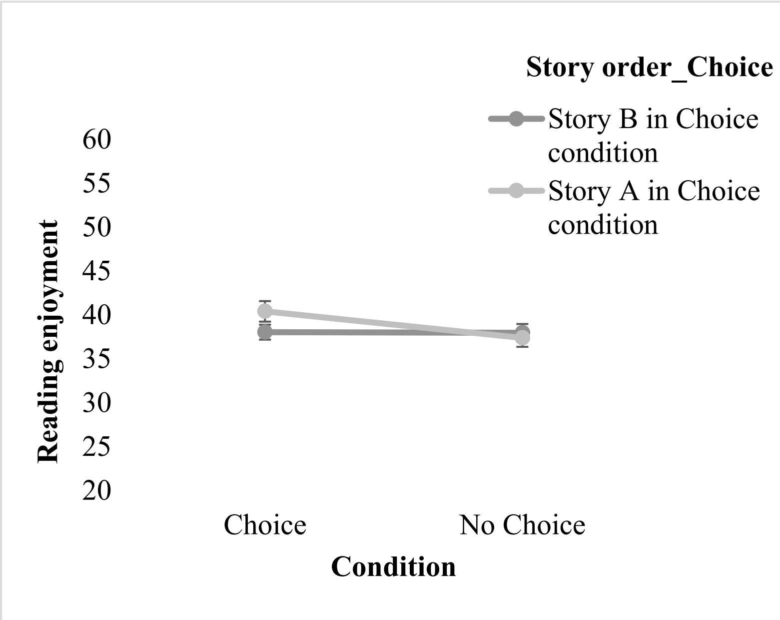
Note. Choice condition = Experimental, No Choice condition = Control. Error bars represent standard errors.

In terms of reading enjoyment, a mixed ANOVA with Condition (Choice, No Choice) as the within-subjects variable and Choice order (First, Second) as the between-subjects variable was conducted to test for any effects of presentation of Choice on Reading enjoyment scores. There was no main effect of Choice $F(1,100) = 3.75$, $p = .056$, $\eta_p^2 = 0.04$. There was no main effect of Choice order $F(1,100) = 0.02$, $p = .877$, $\eta_p^2 < 0.01$. There was no interaction between Reading enjoyment scores across both conditions and Choice order $F(1,100) = 1.03$, $p = .313$, $\eta_p^2 = 0.01$.

A further mixed ANOVA with Condition (Choice, No Choice) as the within-subjects variable and Story order (Story A in Choice condition, Story B in Choice condition) as the between-subjects variable was applied to test any effects of Story order on Reading enjoyment scores. There was a main effect of Choice $F(1,100) = 4.76$, $p = .031$, $\eta_p^2 = 0.05$. There was no main effect of Story order $F(1,100) = 0.53$, $p = .468$, $\eta_p^2 = 0.01$. There was an interaction effect between Choice and Story order $F(1,100) = 4.33$, $p = .040$, $\eta_p^2 = 0.04$, such that children's reading enjoyment scores were more positively affected by choice when reading Story A than when reading Story B.

Figure J2

Choice condition Story Effects on Reading Enjoyment Scores in Study 1



Note. Choice condition = Experimental, No Choice condition = Control. Error bars represent standard errors.

Appendix K: Means and Standard Deviations for all Three Groups in Reading Comprehension and Enjoyment by Condition in Study 1

Table K1

Means and Standard Deviations for Reading Comprehension by Group and Condition in Study 1

Measure	Group	*N*	*M (SD)* Choice	*M (SD)* No Choice
Conners 3	Minimal	42	9.93(3.30)	9.36(3.51)
Teacher-rated Inattention	Moderate	23	9.30(3.96)	8.04(3.16)
	Severe	33	8.06(3.84)	6.85(3.42)
AULA	Minimal	31	10.42(3.52)	9.52(2.97)
Omission errors	Moderate	33	9.24(3.55)	8.45(3.62)
	Severe	33	7.94(3.77)	6.58(3.36)
AULA	Minimal	32	9.22(3.77)	8.66(3.76)
RTV	Moderate	31	10.19(3.27)	8.39(3.27)
	Severe	34	8.21(3.91)	7.47(3.49)

Note. N = 108. *M* = Mean; *SD* = Standard Deviation; T scores converted from raw scores based on chronological age and gender are presented for Teacher-rated Inattention; Raw scores are presented for Omission errors and RTV; Total samples varied due to missing data.

Table K2

Means and Standard Deviations for Reading Enjoyment by Group and Condition in Study 1

Measure	Group	*N*	*M (SD)* Choice	*M (SD)* No Choice
Conners 3	Minimal	41	39.37(7.07)	38.12(7.05)
Teacher-rated Inattention	Moderate	23	40.52(6.56)	37.44(7.08)
	Severe	33	37.88(7.90)	38.03(7.39)
AULA	Minimal	31	39.26(6.93)	38.29(7.61)
Omission errors	Moderate	32	39.63(7.08)	39.40(6.87)
	Severe	33	39.15(7.34)	35.76(6.96)
AULA	Minimal	31	39.94(6.59)	39.06(8.05)
RTV	Moderate	31	40.48(6.49)	39.10(6.51)
	Severe	34	37.76(7.83)	35.44(6.68)

Note. *N* = 108. *M* = Mean; *SD* = Standard Deviation; T scores converted from raw scores based on chronological age and gender are presented for Teacher-rated Inattention; Raw scores are presented for Omission errors and RTV; Total samples varied due to missing data.

Appendix L: Moderation Analyses to Check for Interactions Between Choice and Attention in Study 1

I applied the MEMORE macro for SPSS (available at https://www.akmontoya.com/) to provide further support for the results of the trichotomisation method analysis (see Montoya, 2019 for a detailed description of the MEMORE tool). Three moderation analyses for reading comprehension and enjoyment each were conducted with Choice as the within-subjects variable and each Attention variable (Teacher-rated Inattention, Omission errors, and RTV) as the between-subjects (moderator) variable with 5000 samples and percentile bootstrapped 95% confidence intervals. In line with the whole-sample analysis and the trichotomisation method, no significant interactions were reported between Choice and the three Attention variables for reading comprehension and enjoyment.

Table L1

Results from Moderation Analyses Testing the Interaction between Choice (Reading Comprehension Scores) and Attention Variables Using the MEMORE Macro in SPSS in Study 1

Variable	Reading comprehension scores (Choice)			
	R^2	*MSE*	*F*	*p*
Conners 3				
Teacher-rated Inattention	< 0.001	13.34	0.04	.844
AULA				
Omissions	0.002	13.73	0.15	.70
AULA				
RTV	< 0.001	13.74	0.02	.879

N = 108. T scores converted from raw scores based on chronological age and gender are presented for Teacher-rated Inattention; Raw scores are presented for Omission errors and RTV.

Table L2

Results From Moderation Analyses Testing the Interaction Between Choice (Reading Enjoyment Scores) and Attention variables Using the MEMORE Macro in SPSS in Study 1

Variable	Reading enjoyment scores (Choice)			
	R^2	*MSE*	*F*	*p*
Conners 3				
Teacher-rated Inattention	0.004	51.86	0.37	.543
AULA				
Omissions	0.014	51.67	1.3	.258
AULA				
RTV	0.015	51.6	1.42	.237

N = 108. T scores converted from raw scores based on chronological age and gender are presented for Teacher-rated Inattention; Raw scores are presented for Omission errors and RTV.

Appendix M: Information Letters and Consent forms for Studies 2 and 3

School staff

Institute of Education

UCL

Information sheet for school staff

Topic of Study: The role of motivation in boys' and girls' and reading comprehension and enjoyment
Department: Psychology and Human Development
Name and Contact Details of the Principal Researcher: Myrofora Kakoulidou, myrofora.kakoulidou.14@ucl.ac.uk

Name and Contact Details of the Primary Supervisor: Professor Jane Hurry, j.hurry@ucl.ac.uk

Invitation for participation in a PhD research

You are being invited to participate in a new project that investigates the importance of motivation for children's reading comprehension and enjoyment. I am particularly interested in exploring whether young readers concentrate and read better when given the opportunity to choose their reading material. This study has been designed so that it is both fun and educationally meaningful for your students. Below is an overview about the study aims and your involvement. My project is under the supervision of Professor Jane Hurry, Dr Frances Knight and Dr Roberto Filippi. The researcher has received ethical approval by the Research Ethics Committee of UCL Institute of Education and ensured an enhanced DBS check.

What is this project about?

This research focuses on how motivation affects children's reading comprehension as well as whether children find it easier to read interesting texts. Other studies suggest that if children are interested they learn better, but we need to know more about how to get them interested in the first place and whether or not this is particularly useful for those children who tend to experience more attention/hyperactivity challenges in classroom.

Why have you been chosen?

This study has been designed to explore reading in students aged 8-11 years old who attend primary schools across the UK. We do very much hope that you would like to have your students participate in this.

Do I have to take part in this research?

No. This research is not compulsory, it is voluntary. However, we very much hope that if you choose to take part in this study you and your students will find it a valuable experience.

What will happen if I participate in this study?

During the study period, two children (one child with an ADHD diagnosis and one child with no ADHD) will participate in a set of fun and meaningful cognitive and reading activities outside the classroom. These fun activities have been properly designed and tested with primary-aged children. Apart from these activities, each child will also have the opportunity to take part in a 10-minute audio-recorded interview and talk about their experiences related to reading, attention and interest in classroom. The activities will last maximum 2 hours in total for each child and be spread preferably across a school day so that we will not add too much workload to children. The two children will be matched by age, sex and reading ability. Teacher's suggestions will be useful during this stage in order to identify the second child who will take part in the study. More specifically, teachers will be kindly asked to send the information letters to parents. Once the children have returned the consent forms, the teacher will need to choose one student without ADHD of similar sex and reading ability in order to be matched with the child with the ADHD diagnosis.

Each teacher who agrees to take part in this study will be kindly asked to complete a short questionnaire about the attention levels of the two students and a short questionnaire providing information about children's characteristics e.g. ethnicity. I would really appreciate it if you could circulate the attached information letter and consent form to parents. Those parents interested in having their child participate in the research are advised to return their completed consent form to the teacher prior to the research. Parents of participating children will also be given a short questionnaire to complete about their children's attention and return it to the teacher. Please make sure that the students are informed about the study and have understood the simple process that will be followed. I will also let them know about the study aims and process when I visit your classroom.

What are the possible advantages of taking part in this study?

Each child will have the opportunity to read enjoyable texts and act as little scientists. All students will be given a certificate of participation in order to thank them for their great contribution to this study. Your contribution in this research will help us understand more about strategies that help children concentrate and comprehend better, with the aim of helping children who find this difficult in the future.

What will happen with the results?

The information you give, and your students' attention, reading and motivation data will kept so long as it is needed for the research project. However, all the data is anonymised so names are not stored, only individual ID numbers which will be given to each child. Data will be reported in research/ publications/ seminars/ conferences anonymously, ensuring that no sensitive information is included and no participant or school staff member can become identifiable. Also, individual children's results will not be shared with anyone beyond the research team. After the completion of this study we will send the school a summary of our findings and these will be made available to parents and children.

What do I need to do next?

I very much hope you will agree to participate in this study which we think investigates an important aspect of children's learning that is under-researched. You need to feel assured that the assigned attention and reading tasks will be interesting and educationally meaningful and will help us shed more light on what interventions help particularly those students struggling with reading comprehend better.

What is the process of raising an issue during the study?

If you want to ask any questions, raise any issues or make comments, please feel free to contact the researcher or her Primary Supervisor (please check contact details above).

Who is funding this research?

This research has received partial funding by the A.G. Leventis Foundation.

Data Protection Privacy Notice

The data controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data. If you are concerned about how your personal data are being processed, please contact UCL in the first instance at data-protection@ucl.ac.uk. This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice: https://www.ucl.ac.uk/legal-services/privacy/ucl-general-research-participant-privacy-notice. Your personal data will be processed for the purposes outlined in this notice. The categories of data used will be as follows: name, age, gender, ethnicity, eligibility for free meals, pupil premium, children's scores on cognitive and reading tasks. The lawful basis that will be used to process your personal data is 'Public task' for personal data. Your personal data will be processed so long as it is required for the research project. We will anonymise all data and we will endeavour to minimise the processing of personal data wherever possible. The legal basis that would be used to process your personal data will be parent/carer consent form. You can provide your consent for the use of your personal data in this project by completing the consent form that has been provided to you. Child verbal consent form will also be asked during the individual attention/reading tasks. You have any right to withdraw from the study at any stage or ask the research team to erase any personal information. If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/. Personal data will not be transferred outside the EEA.

Thank you very much for taking the time to read this information sheet. I very much hope that you and your child would like to take part in this study.

Institute of Education

Consent form for teachers

If you are happy to participate and have your students take part in this study, please complete this consent form.

	YES	NO
I would like to have my classroom participate in this research.	☐	☐
I have read and understood the information leaflet about the research.	☐	☐
I have discussed the information sheet with my classroom.	☐	☐
I understand that I can have my classroom withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used.	☐	☐
I understand that I can contact the researcher Myrofora Kakoulidou at any time for any arising enquiries.	☐	☐
I understand that the results will be shared anonymously and no participant will be identifiable.	☐	☐

Name of teacher: ....

Signature: .... Date: ....

Researcher's name: Myrofora Kakoulidou

Signature: [redacted]

Researcher's contact details

Email: **myrofora.kakoulidou.14@ucl.ac.uk**
Telephone number: [redacted]

UCL Institute of Education
20 Bedford Way, London WC1H 0AL

Parents/Guardians

Institute of Education

UCL

Choice effects in the reading comprehension and enjoyment of primary-aged children

Information sheet for Parents/Carers

Title of Study: The role of motivation in the reading comprehension and enjoyment of primary-aged children
Department: Psychology and Human Development, UCL Institute of Education
Name and Contact Details of the Principal Researcher: Myrofora Kakoulidou, myrofora.kakoulidou.14@ucl.ac.uk, telephone: [redacted]

Name and Contact Details of the Primary Supervisor: Professor Jane Hurry, j.hurry@ucl.ac.uk

Invitation for participation in a reading motivation study

You are being invited to participate in a new PhD project that investigates the importance of motivation in the reading comprehension and enjoyment of children with and without ADHD. I am particularly interested in exploring whether young readers concentrate and read better when given the opportunity to choose their reading material or choose their reward. This study has been designed so that it is both fun and educationally meaningful for your child and informative for you and your child's school. Below is an overview about the study aims and your involvement. This project is under the supervision of Professor Jane Hurry and Dr Frances Knight. The researcher has received ethical approval by the Research Ethics Committee of UCL, Institute of Education and ensured an enhanced DBS check.

What is this project about?

This research focuses on how motivation affects children's reading comprehension as well as whether children find it easier to read interesting texts. Other studies suggest that if children are interested they learn better, but we need to know more about how to get them interested in the first place and whether or not this is particularly useful for those children who tend to experience additional challenges with concentration.

Why has your child been chosen?

This study has been designed to explore reading comprehension and enjoyment in children aged 8-11 years old. We do very much hope that you would like to have your child participate in this.

Does my child need to take part in this research?

No. This research is not compulsory, it is voluntary and the child can withdraw from the study at any stage. If you want your child to participate in the study, please complete the consent form, answer the short attention questionnaire and return to the researcher. We very much hope that if you choose to take part in this study you and your child will find it a valuable experience.

What will happen if I participate in this study?

Each parent/carer who agrees to have their child take part in this study will be kindly asked to complete a short questionnaire about their child's attention. Information based on this questionnaire will help the researcher understand whether young readers' attention affects their reading and whether they respond well to choice of reading material or reward provision. Parents will also need to ensure that their child does not take any ADHD medication at least 24 hours prior to the study, if applicable. Each teacher who agrees to take part in this study will be kindly asked to complete a short questionnaire about the attention levels of the child and provide information about children's characteristics e.g. ethnicity, eligibility for free meals/pupil premium. The teacher will need to nominate one more child from the classroom that will also participate in the study.

What will happen if my child participates in this study?

One child with ADHD and one child with no ADHD (and any other diagnosis) of same sex, age and similar reading ability will participate in a set of fun and age-appropriate reading and cognitive tasks for 2 hours each in a quiet room outside the classroom. Apart from these activities, each child will have the opportunity to take part in a 10-minute audio-recorded interview and talk about their experiences related to reading, attention and interest in classroom. Verbal child consent will be sought before the interview to ensure that each child participant is fine with this arrangement. Based on my previous work, children enjoy talking about their classroom experiences and using their voice to say what they like and what they do not like about their reading.

What will happen with the results?

The information you give, and your child's attention, reading and motivation data will be kept so long as it is needed for the research project. However, all the data are anonymised so names are not stored, only individual ID numbers, which will be given to each child. Data will be reported in research/ publications/ seminars/ conferences anonymously, ensuring that no sensitive information is included and no participant can become identifiable. In addition, individual children's results will not be shared with anyone beyond the research team. After the completion of this study, a summary of our findings will be made available to parents, teachers and children.

What are the possible advantages of taking part in this study?

Each child will have the opportunity to read enjoyable texts and act as little scientists. All students will receive a certificate of participation as a thank you for their great contribution to this study. Your child's participation in this research will help us understand more about strategies that help children concentrate and comprehend better, with the aim of helping children who find this difficult in the future. Parents/guardians of ADHD children will also receive a brief summary of their children's overall performance. All participants will be entered in a prize draw for 2x£50 Amazon vouchers and 2x£25 vouchers as a thank you for their help.

What is the process of raising an issue during the study?

If you want to ask any questions, raise any issues or make comments, please feel free to contact the researcher or her Primary Supervisor (please check contact details above).

Who is funding this research?

This research has received funding by the A.G. Leventis Foundation.

Data Protection Privacy Notice

The data controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data. If you are concerned about how your personal data are being processed, please contact UCL in the first instance at data-protection@ucl.ac.uk. This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice: https://www.ucl.ac.uk/legal-services/privacy/ucl-general-research-participant-privacy-notice. Your personal data will be processed for the purposes outlined in this notice. The categories of data used will be as follows: name, age, gender, ethnicity, eligibility for free meals, pupil premium, children's scores on cognitive and reading tasks. The lawful basis that will be used to process your personal data is 'Public task' for personal data. Your personal data will be processed so long as it is required for the research project. We will anonymise all data and we will endeavour to minimise the processing of personal data wherever possible. The legal basis that would be used to process your personal data will be parent/carer consent form. You can provide your consent for the use of your personal data in this project by completing the consent form that has been provided to you. Child verbal consent form will also be asked during the individual attention/reading tasks. You have any right to withdraw from the study at any stage or ask the research team to erase any personal information. If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/. Personal data will not be transferred outside the EEA.

Thank you very much for taking the time to read this information sheet. I very much hope that you and your child would like to take part in this study.

If you are happy for your child to be involved, please complete the following consent form and the attention questionnaire and return to the researcher. Please feel free to contact me in order to discuss any concerns or arising issues about this research.

Institute of Education

Consent form for Parent/Guardian

If you are happy to participate, please complete this consent form and the attention questionnaire you will find on the other page and return to the researcher.

	YES	NO
I would like my child to participate in this research.	☐	☐
I have read and understood the information leaflet about the research.	☐	☐
I have discussed the information sheet with my child.	☐	☐
I understand that I can withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used.	☐	☐
I understand that I can contact the researcher Myrofora Kakoulidou at any time for any arising enquiries.	☐	☐
I understand that the results will be shared anonymously and no participant will be identifiable.	☐	☐

Name of child: Forename ……………………… Surname ……………………...

Male ☐ Female ☐

Child's birthdate: ………………………..

Name of parent/ carer: ………………………………………….

Signature: ……………………… Date: ……………………………

Researcher's name: Myrofora Kakoulidou

Signature: [redacted]

Researcher's contact details
Email: myrofora.kakoulidou.14@ucl.ac.uk
Telephone number: [redacted]
Address: UCL Institute of Education
20 Bedford Way, London WC1H 0AL

Appendix N: Stories, Summaries, Child Reviews and Example Comprehension Questions in Study 2[48]

Story A (Bank robbery/Goodbye sweet dreams)

Bank robbery

What is this story about?

This is a story about someone peacefully asleep and what happens when someone disturbs their sleep.

Here are some things that other children have said about this story.

This is a nice mystery story and you do not know what is going to happen next. I will definitely tell my friends at school about this story.

[48] Two versions for each story were created. The story content remained the same; only titles, story summaries and story reviews (added later) differed.

Name: ……………………………..

Read the story below and answer each question about the story you have just read.

Bank robbery

The phone was ringing for a long time. Jessica thought that this was part of the nice dream she was having. She woke up and looked outside the window. It was still dark and cold. Jessica found it difficult to sleep these days and did not like it when people called her in the middle of the night. She answered the phone and heard a familiar voice. Muhammed told her that something serious had happened in her neighbourhood. Someone robbed the bank. Muhammed called Jessica to ask her if she could help safeguard the area. There were not many witnesses close to the bank. Most people had been keeping cosy inside their houses at the time. Muhammed spoke with a couple of witnesses to see if they knew anything about the robbery. The witnesses saw a person of medium height. The robber was wearing a blue skirt and black boots. The robber was also carrying a very large bag for the notes. The police caught three people outside the bank: Peter, Jane and Sandra. Peter was tall and wearing a hat. Jane kept tripping over her black boots and fixing her skirt. Sandra was nicely dressed with her leather coat placed in her small bag. After Muhammed's call, Jessica put on her uniform immediately and felt ready to do her duty.

Bank robbery **Name: ……………………………..**

Comprehension questions

Answer each question about the story you have just read.

1) What woke Jessica up?

Light outside Ringing phone Knock on the door The alarm clock

2) What is the first thing that Jessica did when she woke up?

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

3) How do you think Jessica is feeling when people call her in the night? Circle the right answer.

Excited Afraid Annoyed Anxious

4) What is Jessica's job?

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

5) What time of the day did Muhammed call Jessica on her phone? Circle the right answer.

Afternoon Morning Evening Lunchtime

6) Why did Muhammed call Jessica?

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

Story B (The taxi driver/The holiday)

The taxi driver

What is this story about?

It is nice to take some time off for holidays. However, sometimes things can get quite complicated.

Here are some things that other children have said about this story.

This story was funny and made me think of a similar story that happened in my family. I would tell my friends to read this.

Name: ……………………………..

Read the story below and answer each question about the story you have just read.

The taxi driver

Mrs Green is a nice old woman. Last year, Mrs Green travelled to Bristol to see three of her grandchildren. This year she decided to stay in London and visit her other two grandchildren. She likes spending the holidays with them. Before her visit, she went to the cake shop around the corner. On her way to the cake shop, she loved the snowy streets and the holiday decorations. When she arrived at the cake shop, she first thought to buy some chocolate muffins for her grandchildren. Then, she remembered that little John loved custard cakes and she changed her mind. She left the cake shop and stopped a taxi. She jumped in the back seat and asked the driver to take her to High Street. She decided to stop at High Street and enjoy the short walk to her grandchildren's house in Low Street. When Mrs Green was in the taxi, she kept chatting away. The taxi driver said that he could not hear a word she was saying. He said his hearing aid broke down that morning and he could not hear anything. Mrs Green was sometimes a bit chatty and she did not like people who stayed quiet. When she arrived at High Street, she got out of the taxi and closed the door loudly. She thought that the taxi driver was not telling the truth.

The taxi driver **Name: ………………………………..**

Comprehension questions

Answer each question about the story you have just read.

1) How does Mrs Green spend her holidays?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

2) What time of the year did Mrs Green visit her grandchildren? Circle the right word.

Easter Summer Christmas Autumn half term

3) On her way to the cake shop, how is Mrs Green feeling? Circle the right word.

Tired Embarrassed Angry Happy

4) Who is little John?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

5) How many grandchildren does Mrs Green have in Bristol? Circle the right word.

Three Two Five Six

6) What did Mrs Green buy from the cake shop?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Story C (A teacher's unusual day/A series of unexpected events)

A teacher's unusual day

What is this story about?

Upsets can sometimes happen, even to teachers of Year 4 classes. This is a story about one such event.

Here are some things that other children have said about this story.

This story is very interesting and fun to read. I really liked the ending and I would like to read more stories like this.

Name: ……………………………..

Read the story below and answer each question about the story you have just read.

A teacher's unusual day

Nessa woke up. It was 9 o'clock. She realised that she would be an hour late for work. She quickly put on some warm clothes, took her umbrella and her car keys, and then ran out the door. Nessa used to go to work by car, but today she would walk to work. On her way to work, she called the head teacher. She told him that she would be late because when she opened and tried to start the car, she could not find her keys. The head teacher said that she should not worry about being late; he would look after her class until she arrived. Nessa walked her usual route to school, enjoying her short break from Year 4. They were quite annoying. Then she noticed that her cat Henry was following her so she had to run ahead and round the corner to lose him. Henry could be quite annoying too. When she got to school she was pleased to see all her pupils working hard at their maths and getting all the head teacher's questions right. Maybe they did listen to her after all; maybe they were not too annoying. To her relief the head teacher smiled at her as he left the class. She had been a bit worried he would be cross. Anyway, she was glad that it would be Saturday tomorrow.

A teacher's unusual day **Name: ………………………………**

Comprehension questions

Answer each question about the story you have just read.

1) What time did Nessa get up that morning?

9 o'clock 8 o'clock 10 o'clock 11 o'clock

2) What is the weather like in the story?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

3) How does Nessa usually go to work? Circle the right word.

On foot By car By tube By bus

4) Where does Nessa work?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

5) What time does Nessa usually get to work? Circle the right word.

11 o'clock 10 o'clock 8 o'clock 12 o'clock

6) Why did Nessa take her umbrella?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

Appendix O: Choice Order and Story Effects and Interactions on Reading Comprehension and Enjoyment in Study 2

A mixed ANOVA with Condition as the two-level within-subjects variable (Choice, No Motivation) and Choice order (First, Second) as the between-subjects variable tested for any effects of presentation of choice on reading comprehension scores. There was no main effect of Choice $F(1{,}22) = .60$, $p = .448$, $\eta_p^2 = 0.07$. There was no main effect of Choice order, $F(1{,}22) = 0.91$, $p = .352$, $\eta_p^2 = 0.04$. There was no interaction between Reading scores across both conditions and Choice order $F(1{,}22) = 0.02$, $p = .879$, $\eta_p^2 \leq .001$.

A further mixed ANOVA with Condition as the two-level within-subjects variable (Choice, No Motivation) and Story type as the between-subjects variable (Story A in Choice condition, Story B in Choice condition) was applied to explore any effects of story type on reading comprehension scores. There was no main effect of Choice $F(1{,}22) = 0.65$, $p = .430$, $\eta_p^2 = 0.03$. There was no main effect of Story order $F(2{,}22) = 1.05$, $p = .368$, $\eta_p^2 = 0.09$. There was no interaction effect $F(1{,}22) = 1.44$, $p = .259$, $\eta_p^2 = 0.12$.

In terms of reading enjoyment, a mixed ANOVA with Choice as the two-level within-subjects variable (Choice, No Motivation) and Choice order (First, Second) as the between-subjects variable tested for any effects of presentation of choice on reading enjoyment scores. There was a main effect of Choice $F(1{,}22) = 5.93$, $p = .023$, $\eta_p^2 = 0.21$. There was no main effect of Choice order $F(1{,}22) = 2.89$, $p = .103$, $\eta_p^2 = 0.12$. There was no interaction between Reading enjoyment scores across both conditions and Choice order $F(1{,}22) = 0.53$, $p = .474$, $\eta_p^2 = 0.02$.

A further mixed ANOVA with Condition as the two-level within-subjects variable (Choice, No Motivation) and Story type as the between-subjects variable (Story A in Choice condition, Story B in Choice condition) tested for any effects of Story type on Reading enjoyment scores. There was a main effect of Choice $F(1,21) = 5.61$, $p = .028$, $\eta_p^2 = 0.21$. There was no main effect of Story order $F(2,21) = 1$, $p = .387$, $\eta_p^2 = 0.09$. There was no interaction effect $F(2,21) = 0.15$, $p = .858$, $\eta_p^2 = 0.01$.

Appendix P: Establishing Trustworthiness across the six phases of Thematic Analysis

Phases of TA	Actions to establish Trustworthiness
Phase 1: Familiarisation with the data	• Evaluation of personal pre-conceptions using a reflexive diary • Prolong engagement with data • Archives of all raw data • Use of a reflexive diary throughout the research process • Record preliminary thoughts and evaluation about potential codes and themes
Phase 2: Generation of initial codes	• Double-coding (supervisor coded 20% of interviews) with primary supervisor and discussion of codes and themes • Use of a reflexive diary to record preliminary interpretations and points discussed during supervision meetings • Records of the decisions made during code generation (audit trail)
Phase 3: Searching for themes	• Meeting with the primary supervisor • Diagramming to explore the connections between themes • Note-taking about the development of themes
Phase 4: Reviewing themes	• Meeting with primary supervisor to discuss themes and subthemes • Data interpretations tested against raw data • Triangulation using quantitative (Study 2) and qualitative (Study 3) data • Use of a diary and notes to record decisions around themes and subthemes
Phase 5: Defining and naming themes	• Meeting with primary supervisor to agree on theme and sub-theme names • Use of a diary to reflect on final themes and subthemes
Phase 6: Report production	• Checking the final report with the primary supervisor • A clear description of the research process • Shift from mere data descriptions to deeper interpretations in relation to literature • Discussion of the implications of findings in relation to reading policy and practice

Note. This table is an adapted version of a similar table used by Nowell et al. (2017).