Developing an intervention to improve reading comprehension for children and young people with autism spectrum disorders.

Horatio Turner, Anna Remington & Vivian Hill

Aim: A substantial proportion of children and young people with autism demonstrate accurate word reading but struggle to understand the content of what they are reading. There is an urgent need for further research in this area to enable educational professionals to implement evidence-based reading interventions.

Method / Rationale: This study analyses the effectiveness of an intervention designed to improve the reading comprehension of young people with autism and reading comprehension difficulties (mean age 13 years, 6 months). The intervention was delivered twice a week over a period of six weeks.

Findings: The results indicate that the intervention group (n=15) demonstrated a significantly greater increase in their reading comprehension than a 'treatment as usual' control group (n=14), showing an average of three years' improvement in their reading comprehension. Semi-structured interviews with participants indicated that many demonstrated a shift in their approach to reading, with a greater focus on comprehension and an awareness of transferring the skills they had learnt to other areas of the curriculum. Participants also identified that the intervention supported their speaking and listening skills.

Limitations: The small size of the sample in this study limits the generalisation of the findings. The robustness of the findings would be increased by including long-term outcome measures.

Conclusions: These findings present important implications for professionals working with young people and suggest that school-based reading interventions may be effective at developing the reading comprehension of individuals with autism.

Keywords: *Reciprocal teaching, autism, reading comprehension, meta-cognition.*

Introduction

Children and young people with autism spectrum disorders (ASD) constitute 11% of all children with Special Educational Needs (SEN) in England (DfE, 2014) and the majority (70%) of these students with ASD are educated in mainstream school settings. Children's academic attainment has a significant impact on their long-term educational, personal and professional outcomes. Jones et al. (2009) highlight that children with ASD frequently fail to realise their academic potential relative to their cognitive abilities, especially in the area of reading comprehension. Research findings suggest that a high percentage of children and young people with autism demonstrate considerable difficulties with reading comprehension despite showing relatively strong reading accuracy. The prevalence of individuals demonstrating reading comprehension difficulties with relatively strong reading accuracy varies between studies, ranging from 9% (Wei et al., 2015) to 35% (Nation et al., 2006). These wide variations may reflect use of different assessment tools and ages (Wei et al. assessed children aged 6-9 using a gap fill reading test and Nation et al. assessed young people aged 6-15 using verbally presented reading comprehension questions). The higher figure is consistent with research by Roberts (2013) which found in a sample of twenty-four 10-12 year olds with ASD, 35% demonstrated reading accuracy at least one standard deviation higher than their reading comprehension. These findings are in contrast to the 10% rate of discrepancy between accuracy and comprehension estimated in the typically developing population (Nation & Snowling, 1997).

Understanding written text is essential to access all areas of the curriculum, from scientific concepts to written problems in mathematics; as a result, many students with reading comprehension difficulties may be at risk of failing academically. This is reflected in the Government figures for 2013-2014 in England which reveal that only 28% of young people with ASD achieved five good GSCEs (A*- C grade), compared to 66% of students overall (Phillips & Pyle, 2011). While the principle of inclusion is valued throughout the education system, it presents considerable challenges for teachers working with these young people. The most recent research, conducted in 2011, identified that 55% of a large sample (1,787) of teachers felt that they did not have sufficient training to teach pupils with ASD (Phillips & Pyle, 2011).

In addition, due to the difficulties children with ASD often face with behaviour and social interactions, difficulties with reading comprehension can go unnoticed, especially if this is masked by proficient decoding skills (reading individual words accurately). Addressing these difficulties becomes particularly important as children move into secondary education, which requires students to develop increased independence in acquiring information from written texts. As a result, there is an urgent need for increased evidence-based practice in schools to ensure that children and young people with ASD have the literacy skills to enable them to reach their academic potential and achieve positive long-term outcomes.

Definition and prevalence

This paper uses the term autism spectrum disorders (ASD) as defined by the Diagnostic and Statistical Manual of Mental Disorders: DSM 5 (American Psychiatric Association, 2013, p. 299) as 'Persistent deficits in social communication and social interaction together with

restricted, repetitive patterns of behaviour, interests, or activities'. The publication of the DSM 5 criteria removed the distinction between autism and Asperger's Syndrome which was previously applied to individuals who share the main characteristics of autism but demonstrated age appropriate development of language and cognitive skills. Some of the participants in the current study have a diagnosis of Asperger's Syndrome. The prevalence of autism has been estimated at approximately 1% of the population, with roughly four times more males than females diagnosed with the condition (Baird et al., 2006).

Autism and reading comprehension

One explanation for the high number of young people with ASD and reading comprehension difficulties is that some of the core impairments of autism - theory of mind (ToM) and weak central coherence (WCC) - are essential skills for reading comprehension. Difficulties with ToM are often cited as one of the main barriers to comprehension for children with ASD and this is supported by research showing a strong correlation between scores on assessments of ToM and reading comprehension (Weissinger, 2013). Difficulties understanding the mental state of others and a lack of awareness of social situations may impact on the reader's ability to make inferences regarding the actions and intentions of characters in narrative texts (Briskman et al., 2001; Jolliffe & Baron-Cohen, 2000). Weak Central Coherence (WCC) is often cited as a potential strength in autism as it may endow an individual with a keen eye for detail (Happé & Frith, 2006). However, an overly detailed focus on individual words may prevent the reader from integrating information from different parts of a text and understanding the gist of a story (Randi et al., 2010).

Research on reading comprehension difficulties in the typically developing population indicates that poor comprehenders present with unique profiles of strengths and difficulties

on a range of component skills. Previous research has tended to focus on three key areas that contribute to reading comprehension difficulties: inference making, knowledge of narrative and syntactical structures, and meta-cognitive skills (Cain & Oakhill, 2007).

Reading is a complex process that requires the reader to integrate information from different parts of the text and draw on background knowledge to interpret characters' actions, the intentions of the author, and the meaning of novel vocabulary and phrases. These inferential skills can be particularly challenging for individuals with ASD, potentially due to the requirements for global processing of information and theory of mind (Loukusa & Moilanen, 2009). As a result, children and young people with ASD often experience greater difficulties answering inferential comprehension questions than factual questions (Myles et al., 2002; Roberts, 2013). Research suggests that knowledge of narrative and syntactical structure impacts on the ability of children with comprehension difficulties to produce an organised and coherent understanding of text (Cain, 2003). There is evidence that individuals with ASD experience particular difficulties linking events together in a structured narrative when retelling a story, as this skill places greater demands on the social and pragmatic aspects of language (Diehl et al., 2006).

Whereas good readers apply meta-cognitive strategies such as comprehension monitoring, predicting, questioning and note taking (Paris et al., 1983), individuals with comprehension difficulties tend to be less actively engaged with a text. Poor comprehenders are often motivated by decoding rather than understanding; as a result, they tend to focus on the mechanics of reading at the word level and are not consciously aware of using more strategic approaches to accessing a text (Cataldo & Oakhill, 2000). It is important to consider that reading is an interactive process whereby the reader actively monitors their comprehension

and constructs a mental model of the text which is continually adapted and revised as new pieces of information are added (Cain & Oakhill, 2007). This process of comprehension monitoring has been identified as a strong predictor of reading comprehension in typically developing and ASD readers (Cain et al., 2004; Kolić-Vehovec & Bajšanski, 2007; Roberts, 2013).

There is a small body of research into interventions targeting the component skills of reading comprehension; however, research with young people with ASD remains limited. A review of the research on teaching inference skills by Hall (2016) identified that explicit instruction in making inferences by drawing on background knowledge and integrating information from different parts of the text, led to improvements in reading comprehension for young people. Furthermore, there is some evidence from small-scale research by Åsberg and Sandberg (2010), which suggests that instruction designed to increase students' awareness of inferential questions and strategies to solve these, can improve the listening comprehension of young people with ASD. Interventions to improve readers' knowledge of narrative and text structure typically employ different forms of graphic organisers such as story maps or Venn diagrams. These approaches have shown significant improvements in readers' understanding of text and the ability to retell a story with a coherent narrative, even for beginner readers aged 6-7 (Manoli & Papadopoulou, 2012; Oakhill & Cain, 2016; Stringfield et al., 2011). Furthermore, research with young people with ASD has identified that teaching participants how to identify anaphoric references (a word that refers back to other words in the text to get its meaning) and the main idea in a text, can significantly improve reading comprehension (Roux et al., 2014).

Interventions teaching meta-cognitive skills tend to include a combination of inference skills and narrative structure but also include a specific focus on comprehension monitoring. This author's previous systematic review of the literature on teaching reading comprehension to children and young people with ASD between 1980 and 2016 (Turner, 2016) identified twenty-one interventions, three of which were experimental group-based interventions and the rest were single case study designs with 1-3 participants. Overall, the research findings appear to support the teaching of the component skills of reading comprehension; however, much of this research remains small scale in nature, with limited sample sizes and a lack of control groups. Furthermore, the inherent bias in publication means that it is not possible to compare the number of effective studies to ineffective ones.

As Oakhill and Cain (2016) argue, the most effective intervention is likely to be one that targets the unique strengths and difficulties of the reader involved, as some may show specific difficulties with inference while others may lack awareness of the need to monitor their own comprehension. As a result, meta-cognitive interventions encourage students to become more aware of the component skills in reading comprehension and teach strategies to overcome potential difficulties in these areas. Reciprocal Teaching (RT; Palincsar & Brown, 1984) is a well-established meta-cognitive intervention for reading comprehension difficulties that encourages learners to collaboratively explore the meaning of a text. It teaches the component skills of reading comprehension in the context of a group discussion facilitated by an adult who can identify and respond to the needs of individual learners. Inference skills are developed through making predictions, identifying the meaning of unfamiliar terms, and discussing learner-generated questions about the text. Furthermore, knowledge of narrative structure and comprehension monitoring is taught explicitly as part of

this process and learners use a process of questioning and summarising to practise these skills.

A synthesis of meta-analyses by Hattie (2009) identified 38 studies of RT with typically developing learners (677 participants) and found an overall strong effect size of 0.74. A previous meta-analysis by Rosenshine and Meister (1994) identified that when using researcher-developed outcome measures, RT demonstrated an effect size of 0.88; however, this was reduced to 0.32 based on standardised measures. Importantly, this research did not find a difference in effect sizes between interventions that were delivered by researchers or classroom teachers. RT appears to be a promising approach to developing reading comprehension as it provides repeated opportunities for learners to practise the component skills of reading comprehension.

There is also some tentative evidence to support the use of RT with learners with ASD. Research by Roberts (2013) delivered a Reciprocal Teaching (RT) intervention to three students aged 10-12 with ASD over a four-week period. The results revealed that two of the students made substantial gains in their ability to answer both literal and inferential questions, and produce an accurate summary of a text based on a standardised measure of reading comprehension. Further research by Truelove (2014) used an action research design to explore how to adapt an RT intervention with three 8-9-year-old pupils with ASD. This research identified that increasing the use of visual aids such as question cards and mind maps to support understanding and the use of skills learnt during the session was beneficial for the participants.

Nevertheless, in recent large-scale research of an RT-based intervention by the Hackney Learning Trust (Education Endowment Foundation, 2014) teachers reported that students'

social communication difficulties impacted on their ability to engage with the interactive demands of the task. These difficulties reflect the views of Dion et al. (2007) who suggest that although RT has been shown to be effective when implemented correctly, it has not been widely adopted because teachers find it challenging to implement. They argue that many students lack the confidence and social skills necessary to adopt the different roles in the group without close supervision from the teacher.

The research identified in this literature review demonstrates the promising but early stage of research in this field. There is an urgent need for evidence-based interventions to develop the reading comprehension of young people with ASD and there is some tentative evidence (Roberts, 2013; Truelove, 2014) suggesting that RT is a suitable candidate for this. The current study aims to evaluate the effectiveness of an RT-based intervention implemented with groups of young people with ASD over a six-week period. Furthermore, this study aims to use the views of participants following the study to inform the design of future interventions. It is hypothesised that the young people who participate in the intervention will show significant improvements on a standardised measure of reading comprehension compared to a control group who receive 'treatment as usual' for a six-week period. Furthermore, this project aims to elicit participants' views of the process and effectiveness of the intervention.

Method

Participants

This study includes 29 students between the ages of 11 and 15 (mean age: 13 years, 6 months). All participants had diagnoses of an autism spectrum disorder, including Asperger's Syndrome, provided by a multidisciplinary diagnostic team such as a Joint Communication

Clinic. Participants were allocated to either the intervention condition (n=15; 8 male and 7 female) or control condition (n=14; 12 male and 2 female) based on the order in which they were recruited. Therefore, the first 15 participants were allocated to the intervention condition and subsequent participants were allocated to the control condition. Participants were recruited from seven Local Authority Schools in the South of England, two of which were specialist settings for students with ASD. The remaining five schools were mainstream secondary schools, two of which contained specialist provisions for students with ASD. The inclusion criteria for this study were designed to enable a wide range of students to participate. Participants were considered for inclusion if they had been identified by their school as demonstrating reading comprehension difficulties and they achieved a standard score below 115 on the York Assessment of Reading Comprehension (YARC; Snowling, et al., 2009). Although this score places some participants in the average range for reading comprehension, it accounts for the unique profile of reading comprehension difficulties in individuals with ASD. Due to the nature of their difficulties, individuals with ASD may have excellent recall of factual information but struggle with questions which require understanding of inference and gist. As such, assessment over time by teachers who know them well was considered to be the most effective way to identify participants who would benefit from the intervention. Furthermore, participants were only included if they demonstrated reading accuracy equivalent to age seven or above as measured on the British Abilities Scales 3rd Edition, BAS-III (GL-Assessment, 2011) Word Reading subtest. The minimum accuracy score was established so that participants could access the assessment measures and intervention reading materials. Participants were also required to demonstrate normal or corrected to normal vision, sufficient hearing to access the intervention, and English mother tongue or equivalent standard of English Language. All participants had a

diagnosis of an autism spectrum disorder; however, separate data was not collected on the number of participants with Asperger's Syndrome.

Measures

The York Assessment of Reading Comprehension (YARC; Snowling et al., 2009) was used to assess reading rate and comprehension at baseline and as an outcome measure following the intervention. The YARC provides two measures of comprehension: the main measure is a comprehension score based on orally presented comprehension questions. The second measure is a separate score for summarisation of the text which students complete after they have answered the comprehension questions. Students completed the level of test appropriate for their age as recommended by the YARC manual. The YARC contains two parallel reading assessments (A and B) so that participants read different passages at the baseline and outcome assessments. These two parallel reading passages were counterbalanced across participants; therefore, half of the participants read passages A at baseline and the remaining half read passages B at baseline. Participants subsequently completed the remaining test for the outcome measure. A random sample of 10% of the comprehension and summarisation test papers were double marked by a colleague which yielded an inter-rater reliability agreement of 98%.

The Word Reading scale from the British Abilities Scales, 3rd Edition (BAS-III; GL Assessment, 2011) was used to establish a baseline and outcome measure of reading accuracy. The BAS-III contains two parallel reading tests (Reading Cards A and B) which were counterbalanced across participants so that half of the participants completed test A at baseline and the remaining half completed test B at baseline. Participants subsequently completed the remaining test for the outcome measure.

The Reading for Pleasure Survey produced by the National Literacy Trust was used to gather participant views on reading (National Literacy Trust, undated).

The Matrices scale from the Wechsler Abbreviated Scales of Intelligence, 2nd Edition (WASI-II; Wechsler, 2011) was used as a measure of non-verbal reasoning ability for all participants at the baseline stage in order to compare the non-verbal abilities of the intervention group to the control group.

The Vocabulary scale from the Wechsler Intelligence Scale for Children, 4th Edition (WISC-IV; Wechsler, 2004) was used as a measure of expressive vocabulary at baseline for all participants and the Wechsler Abbreviated Scales of Intelligence, 2nd Edition (WASI-II) was used as a measure of expressive vocabulary following the intervention for all participants. These two measures were chosen for their similar format and their use of standardised scores which enables comparison between the baseline and outcome results. Research by Zhou and Raiford (2011) compared the performance of participants on both the WASI-II and WISC-IV and suggest that the WASI-II Vocabulary subtest is a suitable substitution for the WISC-IV Vocabulary subtest.

A semi-structured interview was conducted with participants who had completed the intervention. Participants were asked for their views on the overall organisation and effectiveness of the intervention.

Analysis

The responses of participants in the semi-structured interview were analysed using a process of thematic analysis as outlined in Braun and Clarke (2006). The transcript data from the interviews was coded at a descriptive level to identify the main points of each comment. Many contributions were relatively short in these interviews, the majority of responses contained only one or two sentences and were followed by prompts for more information by the researcher. These codes were organised into potential subthemes and subsequently overarching themes, this was an iterative process in which the themes were reviewed several times to ensure that they were coherent and captured unique aspects of the data. The search for themes was guided by the research questions and aimed to identify factors which participants expressed as being relevant to their reading comprehension or the success of the intervention. Boyatzis (1998) recommends that it is best practice to compare the identification of themes with an impartial researcher to reduce any potential for bias. Given the researcher's close involvement with both the study and the semi-structured interview, it was decided to review the identified themes with a colleague, this indicated an inter-rater agreement of 87%.

Procedure

In this research, the participants first completed the baseline measures of reading comprehension and rate (YARC), and accuracy (BAS-III) during the same session, participants also completed the measures of vocabulary (WISC-IV), non-verbal reasoning (WASI-II) and Reading for Pleasure Survey (National Literacy Trust). Participants were then organised into groups of 3-4 within each school based on their reading accuracy score.

The intervention was delivered in two 45-minute blocks per week over a period of six weeks by the researcher. Following this, participants completed the outcome measures of reading

comprehension and rate (YARC), accuracy (BAS-III), vocabulary (WASI-II), and semi-structured interview.

The procedure used in this intervention is based on the work of Oczkus (2010), Palincsar et al. (1989), and Fischer Family Trust (2012). Adaptations were designed to take into account recent research conducting RT interventions with children with autism (Roberts, 2013; Truelove, 2014) and focused on providing a high level of contingent support and visual aids to support the social communication demands of the intervention (see Turner, 2016, for full details).

'The Fault in Our Stars' by John Green (2012) was chosen as the reading text for the intervention as this was highly rated by young people. During the intervention sessions, participants read short sections of the text and used a reciprocal questioning approach to explore the text in collaboration with their peers. This process was facilitated by the researcher and encouraged the students to practise four main skills: prediction, clarification of unfamiliar terms and words, asking questions about the plot and characters, and summarising short exerts of the story. Over the course of the intervention, students were encouraged to integrate these four skills simultaneously and apply them while reading, thereby replicating the process that skilled readers use subconsciously.

Students in the control condition received 'treatment as usual' which for the majority of participants, included some form of guided or independent reading intervention provided by their school as part of their usual timetable.

Results

Baseline comparisons

Table 1 below presents the baseline results for both intervention and control groups. Statistical analyses indicated that the intervention and control groups did not differ significantly on any of the baseline measures (see table 1 for details). Comparisons of reading ability between the intervention and control groups was conducted using standardised scores. The age equivalent scores are not compared using statistical analysis as they are calculated according to a three-month range and therefore may introduce an element of error to the analysis, but are presented here to illustrate the data.

Table 1: Comparison of baseline scores of intervention and control groups.

Variable	Assessment measure	Intervention mean score (SD) n=15 unless stated otherwise)	Control mean score (SD) n=14 unless stated otherwise	P value
Age	N/A	13.63 (1.19)	13.27 (1.30)	.449
Vocabulary	WISC-IV	7.53 (1.96)	7.50 (2.07)	.965
Non verbal reasoning (matrices)	WASI-II	42.40 (12.67)	42.80 (15.15) (n=10)	.944
Reading accuracy (standard score)	BAS-III	81 (5.33)	86.21 (10.74)	.106
Reading rate (standard score)	YARC	89.47 (12.92)	89.43 (11.90)	.993
Comprehension (standard score)	YARC	88.67 (11.44)	93.64 (12.57)	.274
Summarisation (ability score)	YARC	52.2 (11.37)	57.43 (9.58)	.193
Comprehension (age equivalent in years: months)	YARC	10:05	11:09	N/A

			6.53 (2.26)	6.75 (1.75)	.817
How good a reader are you? (scale of 1-10)	National literacy trust				
How much do you enjoy reading? (scale of 1=4)	National literacy trust		2.47 (0.99)	2.25 (0.71)	.591
How often do you read? (scale of 1=4)	National literacy trust		2.77 (1.30)	2.38 (1.06)	.480

Changes in reading comprehension

The participants' results on the YARC assessment at the two time points (time 1: baseline and time 2: outcome) were analysed using an ANCOVA, with comprehension outcome scores as the dependent measure, condition (either intervention or control) as the fixed factor and baseline comprehension scores as the covariate.

**Table 2: Comparison of scores at baseline and outcome points for the intervention and control groups.**

	Group	N	Time 1 mean (SD)	Time 2 mean (SD)	P value
Vocabulary	Intervention	15	7.53 (1.96)	9.73 (2.29)	.001
	Control	10	7.50 (2.07)	9.80 (3.36)	.031
Word reading (standard score)	Intervention	15	81 (5.33)	80.07 (5.54)	.497
	Control	14	86.21 (10.74)	88.00 (13.33)	.954
Reading rate (standard score)	Intervention	15	89.47 (12.92)	84.67 (12.92)	.228
	Control	14	89.43 (11.90)	88.50 (11.04)	.484
Comprehension (standard score)	Intervention	15	88.67 (11.44)	98.47 (14.92)	.001
	Control	14	93.64 (12.57)	89.07 (13.68)	.013
Comprehension (age equivalent in years: months)	Intervention	15	10:05	13:05	N/A
	Control	14	11:09	10:08	N/A

Summarisation (ability score)	Intervention	15	52.2 (11.37)	58.47 (11.07)	.070
	Control	14	57.43 (9.58)	54.5 (12.99)	.261

This analysis indicated that the comprehension score on the YARC assessment increased significantly more in the intervention condition than in the control condition: $F(2,26)=12.53$; p<.001 with an effect size of $r= 0.49$ (see figure 1). The mean score of the intervention group increased by 9.80 standard scores over the course of the intervention and the control group's mean score decreased by 4.5757 standard scores over the 6-week period of 'treatment as usual'. Repeated measures ANOVA was conducted to determine whether there was a significant difference between comprehension scores at the two time points for both groups. This indicated that comprehension scores in the intervention group were significantly higher at time 2 than time 1, $F(1,14)=17.84$; p=.001. Furthermore, comprehension scores in the control group were significantly lower at time 2 than time 1, $F(1,13)=8.35$; p=.013. Based on the age equivalent data provided by the YARC manual, it can be seen that the intervention group made 36 months of progress in their reading comprehension and the control group decreased by 11 months.

Figure 1: Graph of change in comprehension score from time 1 to time 2 in each group.
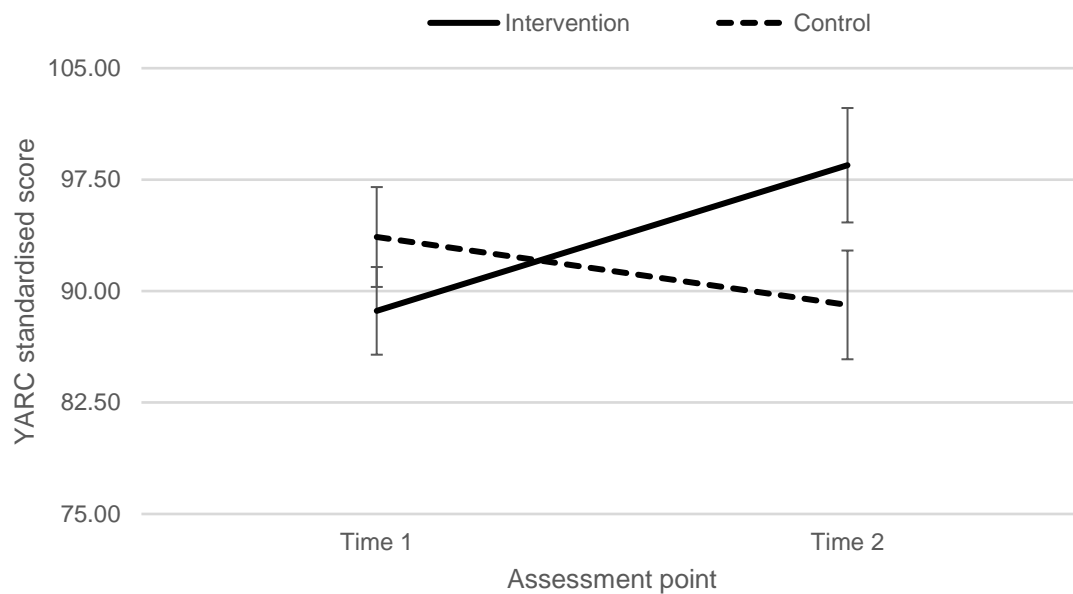
Other variables

The summarisation score in the intervention condition was higher at time 2 than time 1; however, this difference only approached statistical significance, $t(14)$=-1.914, p=.070. For the control group, the statistical analysis indicated that there was not a significant difference between scores at time 1 and time 2, $t(13)$=1.175, p=.261 for summarisation. Statistical analyses indicated that there were no other significant differences between the two groups on any of the other measures (vocabulary, non-verbal reasoning, reading rate and reading accuracy).

Qualitative results

Analysis of participants' responses to the semi-structured interview identified four main themes: 1. Materials and organisation of the intervention. 2. How the intervention supported the participants' reading. 3. Generalisation and retention of strategies. 4. Group and collaborative working. These themes are summarised below. Each of these themes contained several subthemes which for the purposes of brevity have been collapsed in this article. For full details see Turner (2016).

Theme 1: Organisation of the intervention

In this theme, participants responded with general impressions of the organisation of the intervention and many commented on the difficulties combining a regular reading intervention with the demands of their curriculum lessons. This was particularly an issue for older participants who reported concerns that it would impact on their exam revision or required missing other enjoyable lessons. Several of the students acknowledged that attending the reading intervention was a short-term compromise that would be beneficial for their education in the long term.

> Researcher: *'You weren't very happy about joining the group at the start, can you tell me more about that?'*
>
> Student: *'Yes, because we are doing GCSEs at the moment and I thought I should be revising for it, but when I got into it, it helped in a way' (Girl aged 14).*

Theme 2: How the intervention supported the students' reading

In this theme, many of the students reported a shift in their approach to reading with a greater emphasis on the comprehension of text rather than a mechanical approach to decoding. This was reflected in the fact that several respondents reported that they had learnt not to skip over unfamiliar words and could report strategies that they could use to clarify the meaning of unfamiliar words.

> *'It helped me understand…if I'm stuck on a word, how to help it make sense. It helped me by wanting to read more instead of skipping a word out…' (Boy aged 12).*

Participant responses in this theme also reflected a greater awareness of comprehension monitoring through the use of summaries of the text. Respondents reported that generating a

summary could support the memory demands of a text and increase their understanding of subsequent sections.

> *'I was trying to remember more stuff … because if you can remember what happened a couple of pages back it will help you to understand the story better' (Boy aged 12).*

Theme 3: Generalisation and retention of strategies

Many of the students reported that they would be able to apply the strategies they had learnt to their English classes and identified different genres of literature where these skills might be useful.

> *'In English we're doing poems and I sometimes use the strategies which helps in lessons' (Girl aged 14)*

Student responses indicated that many could imagine using the clarifying strategy in different subject lessons where they might encounter complex language. Students did not identify other strategies that they could transfer to different subjects. This suggests that they felt most confident with the clarifying strategy as its relevance for understanding text is clear.

> *'If I have a word in Geography that doesn't make sense I can try to fit another word into it to make more sense for me.' (Boy aged 12)*

Theme 4: Group and collaborative working

Participants reported that working with peers in different year groups presented a unique opportunity for social interaction. Students also reported that they found the collaborative nature of the group provided a scaffold to support their understanding of the text and formulate their own contributions. One surprising finding was that several students reported

that the group had a positive impact on their confidence with speaking. Responses indicated that participants benefited from the clear structure and routine of the activities and the supportive nature of the small group. These factors appeared to provide opportunities to experience success and contributed to the students' confidence.

> *'This group has really helped with my speaking and listening skills. Before, I didn't speak in lessons …. but I got into trouble for talking to my friend in science class' (Girl aged 12).*

> *'I prefer reading group to reading in class. It's comfortable and less crowded you see' (Girl aged 15).*

Discussion

The results indicate that the intervention group demonstrated a significantly greater increase in their comprehension scores than the control group. This translated to an average of three years' progress with their reading comprehension as measured by the YARC, whereas the control group decreased by 11 months. These findings are consistent with previous small-scale research on younger children (Roberts, 2013; Truelove, 2014) and suggests that Reciprocal Teaching may be an effective intervention to build the comprehension skills of young people with ASD. These results are further strengthened by the lack of significant differences between the two groups on measures of reading accuracy and vocabulary following the intervention. This finding suggests that the improvement in reading comprehension was a specific impact of the intervention which could not be explained in terms of increased reading accuracy or vocabulary.

The finding that the control group demonstrated a decrease in both the comprehension and summarisation measures was surprising given that most of these students received some form of reading intervention during this period (such as reading with an adult or structured programmes such as Accelerated Reader). This finding could not be explained as an artefact of the YARC pre and post (A and B) forms as these were counterbalanced across the participants. As the researcher was not blinded to the condition of each participant, there is some potential for researcher bias. However, this was controlled as far as possible by conducting an inter-rater reliability check on the completed YARC forms. Therefore, the finding that the majority of participants in the control group decreased in their comprehension skills is likely to be a negative practice effect. As Nunn (1998) suggests, repeated testing of participants may reduce motivation for a task due to the way in which they perceive their own performance. This has implications for the role of Educational Psychologists in practice who may often use repeated testing to monitor students' response to an intervention over time.

Based on the measure of summarisation, students in the intervention condition did not make significantly more progress than students in the control condition. While many of the students in the intervention condition demonstrated an increase in their summarisation score (mean increase of 6.27 ability scores; SD=12.68), the large standard deviation figure highlights that these results were more variable than for the comprehension questions (mean increase of 9.80 standardised scores; SD=8.99). Summarisation skills are likely to tap areas of cognition that are relative areas of weakness for students with ASD such as global processing of information and working memory (Happé & Frith, 2006; Hill, 2004). This finding suggests that students would benefit from further practice in identifying the main idea of a text and using this to generate a summary.

These results are supported by the reports of participants that they generally found the sessions beneficial, and many could identify strategies that they would be able to apply to their reading in English and sometimes in other subjects. Students reported feeling confident applying some but not all the strategies to other subjects. Anecdotal reports from teachers suggested some students appeared more motivated and engaged with literature in other lessons; however, these reports could not be substantiated with objective assessment measures. An important finding was that many of the participants reported a shift in their approach to reading, with a greater focus on the comprehension of text rather than a mechanical approach to decoding. Participants reported a greater awareness of monitoring their own comprehension and identifying when they did not understand rather than skipping over challenging parts of the text. Most participants were able to identify at least one new strategy that they were able to use to independently support their comprehension. Furthermore, an area that received considerable attention from participants was the role of group work and how this facilitated understanding, provided opportunities for social interaction, and developed confidence with speaking.

These findings suggest that participants derived multiple benefits from the intervention depending on their individual needs with reading. These students may benefit from further practice at bridging the skills learnt in the intervention to other areas of the curriculum so that any benefits are applied across different areas of their learning. In practice, a reading intervention is likely to be delivered by school staff who are able to subsequently help students apply these skills in their other lessons. It is suggested that the RT approach may be most effective when implemented as part of a whole school approach to literacy intervention.

As such, all staff would be aware of the skills being taught and could support students to apply them across a range of subjects.

Limitations and future research

The composition of the control and intervention conditions was kept as similar as possible and assessments of participants' expressive vocabulary and non-verbal reasoning indicate that there was not a significant difference between the two groups on these measures. However, data regarding the relative number of participants with ASD or Asperger's syndrome in each group was not available. An uneven distribution of these diagnoses between the groups may have influenced the results. A potential source of bias in the present study comes from the researcher involvement in both the delivery and evaluation of the project. Every care was taken to reduce the impact of researcher bias by using standardised assessment tools and measures of inter-rater reliability. Furthermore, it is quite possible that students in the intervention condition were unintentionally influenced by completing the outcome assessment with the researcher. It is possible that they tried harder on the outcome assessment to please the researcher or to validate the effort they had made to attend the intervention. As a result, it would be useful to replicate these results using assessors who are blind to the treatment condition. Nevertheless, the model adopted in the current study has high ecological validity as in real school settings the intervention and assessment would likely be delivered by the same person. Future research may be able to overcome these limitations by including a measure of long term impact and including a method to evaluate the extent to which students can transfer the skills to other areas of the curriculum.

Conclusion

Reading comprehension remains an under-researched area of learning both in the ASD and typically developing populations. Schools may prioritise the social communication and behavioural needs of young people with ASD as these difficulties are often the most apparent to adults. However, there is substantial evidence that reading comprehension remains a challenging task for many young people with ASD and this may be further masked by proficient reading accuracy skills. The current study contributes to the understanding of reading comprehension in young people with ASD. The study builds on the existing evidence base and adds further support to the use of an RT-based intervention to develop the reading skills for young people.

Address for correspondence

Dr Horatio Turner,

Babbage House,

Castle Hill,

Cambridge, CB3 0AT

Email: horatio.turner@cambridgeshire.gov.uk

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th Ed)*. Washington, D.C: American Psychiatric Association.

Asberg, J. & Sandberg, A. D. (2010). Discourse comprehension intervention for high-functioning students with autism spectrum disorders: preliminary findings from a school-based study. *Journal of Research in Special Educational Needs*, *10*(2), 91–98. https://doi.org/10.1111/j.1471-3802.2010.01147.x.

Baird, G., Simonoff, E., Pickles, A., Chandler, S., Loucas, T., Meldrum, D. & Charman, T. (2006). Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: The Special Needs and Autism Project (SNAP). *The Lancet*, *368*(9531), 210–215. https://doi.org/10.1016/S0140-6736(06)69041-7.

Boyatzis, R.E. (1998). Transforming qualitative information. Cleveland, OH: Sage.

Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa.

Briskman, J., Frith, U. & Happe, F. (2001). Exploring the cognitive phenotype of autism: Weak 'central coherence' in parents and siblings of children with autism: II. Real-life skills and preferences. *Journal of Child Psychology and Psychiatry*, *42*(3), 309–316.

Cain, K. (2003). Text comprehension and its relation to coherence and cohesion in children's fictional narratives. *British Journal of Developmental Psychology*, *21*, 335–351.

Cain, K. & Oakhill, J. (2007). *Children's comprehension problems in oral and written language: A cognitive perspective*. New York: Guilford Press.

Cain, K., Oakhill, J. & Bryant, P. (2004). Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability, and component skills.

Journal of Educational Psychology, *96*(1), 31–42. https://doi.org/10.1037/0022-0663.96.1.31.

Cataldo, M. & Oakhill, J. (2000). Why are poor comprehenders inefficient searchers? An investigation into the effects of text representation and spatial memory on the ability to locate information in text. *Journal of Educational Psychology*, *92*(4), 791-799.

DfE. (2014). *Special Educational Needs in England 2014*. London: Department for Education.

Diehl, J., Bennetto, L. & Young, E. (2006). Story recall and narrative coherence of high-functioning children with autism spectrum disorders. *Journal of Abnormal Child Psychology*, *34*(1), 83–98.

Dion, E., Fuchs, D. & Fuchs, L. (2007). Peer-mediated programs to strengthen classroom instruction: Cooperative learning, reciprocal teaching, classwide peer tutoring and peer-assisted learning strategies. In L. Florian (Ed.), *The SAGE Handbook of Special Education* (pp. 451–461). London: SAGE Publications Ltd.

Education Endowment Foundation. (2014). *LIT programme: Evaluation report and executive summary, October 2014*. Retrieved from https://educationendowmentfoundation.org.uk/public/files/Projects/EEF_Project_Report_LITProgramme.pdf.

Fischer Family Trust. (2012). *Reciprocal reading: A guide to using reciprocal reading strategies to develop comprehension*. Unpublished Training Manual.

GL Assessment (2011). *The British Abilities Scales 3rd Edition (BAS-III).* London: GL Assessment.

Green, J. (2012). *The fault in our stars*. New York: Dutton Books.

Hall, C. (2016). Inference instruction for struggling readers: A synthesis of intervention research. *Educational Psychology Review*, *28*(1), 1–22. https://doi.org/10.1007/s10648-014-9295-x.

Happé, F. & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *36*(1), 5–25. https://doi.org/10.1007/s10803-005-0039-0.

Hattie, J. (2009). *Visible learning: A synthesis of meta-analyses relating to achievement*. London: Routledge.

Hill, E. (2004). Evaluating the theory of executive dysfunction in autism. *Developmental Review*, *24*(2), 189–233.

Jolliffe, T. & Baron-Cohen, S. (2000). Linguistic processing in high-functioning adults with autism or Asperger's syndrome. Is global coherence impaired? *Psychological Medicine*, *30*(5), 1169–1187.

Jones, C. R., Happe, F., Golden, H., Marsden, A. J., Tregay, J., Simonoff, E., …& Charman, T. (2009). Reading and arithmetic in adolescents with autism spectrum disorders: Peaks and dips in attainment. *Neuropsychology*, *23*(6), 718–28. https://doi.org/10.1037/a0016360.

Kolić-Vehovec, S. & Bajšanski, I. (2007). Comprehension monitoring and reading comprehension in bilingual students. *Journal of Research in Reading*, *30*(2), 198–211.

Loukusa, S. & Moilanen, I. (2009). Pragmatic inference abilities in individuals with Asperger Syndrome or high-functioning autism. A review. *Research in Autism Spectrum Disorders*, *3*(4), 890–904. https://doi.org/10.1016/j.rasd.2009.05.002.

MacLaughlin, B., Hershel, J. & Dean. (2013). Prevalence and incidence rates of autism in the

UK: Time trend from 2004–2010 in children aged 8 years.

https://doi.org/10.1136/bmjopen-2013-003219.

Manoli, P. & Papadopoulou, M. (2012). Graphic organizers as a reading strategy: Research

findings and issues. *Creative Education*, *3*(3), 348.

Myles, B. S., Hilgenfeld, T. D., Barnhill, G. P., Griswold, D. E., Hagiwara, T. & Simpson, R.

L. (2002). Analysis of reading skills in individuals with Asperger syndrome. *Focus on

Autism and Other Developmental Disabilities*, *17*(1), 44–47.

Nation, K., Clarke, P., Wright, B. & Williams, C. (2006). Patterns of reading ability in

children with autism spectrum disorder. *Journal of Autism and Developmental

Disorders*, *36*(7), 911–919. https://doi.org/10.1007/s10803-006-0130-1.

Nation, K. & Snowling, M. (1997). Assessing reading difficulties: The validity and utility of

current measures of reading skill. *British Journal of Educational Psychology*, *67*(3),

359–370.

National Literacy Trust (undated). *Reading for pleasure survey for KS2 and above.* Available

at http://www.literacytrust.org.uk/assets/0000/7669/Reading_for_pleasure_survey_-

_KS2_.pdf. Accessed on 29 March 2017.

Nunn, J. (1998). *Laboratory psychology: A beginner's guide*. Hove: Psychology Press.

Oakhill, J. & Cain, K. (2016). Supporting reading comprehension development from research

to practice. *Perspectives on Language and Literacy*, *42*(2), 32-39.

Oczkus, L. (2010). *Reciprocal teaching at work: Powerful strategies and lessons for

improving reading comprehension* (2nd ed.). Newark, Del: International Reading

Association.

Palincsar, A. & Brown, A. (1984). Reciprocal teaching of comprehension-fostering and

comprehension-monitoring activities. *Cognition and Instruction*, *1*(2), 117–175.

Palincsar, A., Campione, J. & Brown, A. (1989). *Structured dialogues among communities of first grade learners.* Paper presented at the Annual Meeting of the. American Educational Research Association (San. Francisco, March 28, 1989).

Paris, S. G., Lipson, M. Y. & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, *8*(3), 293–316. https://doi.org/10.1016/0361-476X(83)90018-8.

Phillips, L. & Pyle, K. (2011). *Teacher training on autistic spectrum disorders: Ambitious about autism*. Slough: NFER.

Randi, J., Newman, T. & Grigorenko, E. L. (2010). Teaching children with autism to read for meaning: Challenges and possibilities. *Journal of Autism and Developmental Disorders*, *40*(7), 890–902. https://doi.org/10.1007/s10803-010-0938-6.

Roberts, E. (2013). *Autism and reading comprehension: Bridging theory, research and practice.* University College London, Institute of Education, Theses. Retrieved from http://eprints.ioe.ac.uk/18561/.

Rosenshine, B. & Meister, C. (1994). Reciprocal teaching: A review of the research. *Review of Educational Research*, *64*(4), 479–530.

Roux, C., Dion, E., Barrette, A., Dupere, V. & Fuchs, D. (2014). Efficacy of an Intervention to enhance reading comprehension of students with high-functioning autism spectrum disorder. *Remedial and Special Education*, *36*(3), 131–142. https://doi.org/10.1177/0741932514533998.

Sedgewick, F., Hill, V., Yates, R., Pickering, L. & Pellicano, E. (2016). Gender differences in the social motivation and friendship experiences of autistic and non-autistic adolescents. *Journal of Autism and Developmental Disorders*, *46*(4), 1297–306. https://doi.org/10.1007/s10803-015-2669-1.

Snowling, M.J., Stothard S.E., Clarke, P., Bowyer-Crane, C., Harrington, A., Truelove, E., Nation, K. & Hulme, C. (2009). *York Assessment of Reading for Comprehension - Passage Reading*. London: GL Assessment.

Stringfield, S. G., Luscre, D. & Gast, D. L. (2011). Effects of a story map on accelerated reader postreading test scores in students with high-functioning autism. *Focus on Autism and Other Developmental Disabilities*, *26*(4), 218–229.

Truelove, E. (2014). *How can I enhance a reciprocal teaching intervention to support the reading comprehension skills of two children with ASC? An action research study*. University of Sheffield. Retrieved from http://etheses.whiterose.ac.uk/6786/.

Turner, H. (2016). *Developing an intervention to improve reading comprehension for children and young people with autism spectrum disorders.* University College London, Institute of Education, Theses.

Wei, X., Christiano, E. R., Yu, J. W., Wagner, M. & Spiker, D. (2015). Reading and math achievement profiles and longitudinal growth trajectories of children with an autism spectrum disorder. *Autism*, *19*(2), 200–210. https://doi.org/10.1177/1362361313516549.

Wechsler, D. (2004). *Wechsler Intelligence Scale for Children 4th UK Edition (WISC-IV-UK).* Oxford: Pearson Clinical.

Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence - Second Edition (WASI-II).* Oxford: Pearson Clinical.

Weissinger, K. (2013). *Factors associated with individual differences in reading comprehension for typically-developing students and for a pilot sample of students diagnosed with autism spectrum disorder.* University of Rhode Island, Open Access Dissertations. Paper 70. http://digitalcommons.uri.edu/oa_diss/70.

Wingate, M., Kirby, R. S., Pettygrove, S., Cunniff, C., Schulz, E., Ghosh, T., … Wright, V.

(2014). Prevalence of autism spectrum disorder among children aged 8 years. *MMWR*

Surveillance Summaries, *63*(2), 1-21.

Zhou, X. & Raiford, S. E. (2011). *Using the WASI–II with the WISC®–IV: Substituting*

WASI–II subtest scores when deriving WISC–IV composite scores. Technical Report.

Retrieved from http://images.pearsonclinical.com/images/ca/webinars/wasi-ii-wisc-

iv-editorial-lr.pdf.