The use of structured teaching strategies to support students on the autism spectrum to stay on-task in mainstream classrooms

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A NOTE ON TERMINOLOGY

The term autism spectrum disorder (ASD) is used only when discussing the diagnostic criteria described in The Diagnostic and Statistical Manual of Mental Disorders: DSM 5 (American Psychiatric Association, 2013). Student participants in this research have been referred to as students on the autism spectrum, or students on the spectrum, throughout. At the time of writing, this is the preferred terminology within the Cooperative Research Centre for Living with Autism (Autism CRC). However, it is acknowledged that the language with which the autism spectrum is described is rapidly evolving.

About the Cooperative Research Centre for Living with Autism (Autism CRC)

The Cooperative Research Centre for Living with Autism (Autism CRC) is the world's first national, cooperative research effort focused on autism. Taking a whole-of-life approach to autism focusing on diagnosis, education and adult life, Autism CRC researchers are working with end-users to provide evidence-based outcomes which can be translated into practical solutions for governments, service providers, education and health professionals, families and people on the autism spectrum.

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Abstract

Students on the autism spectrum who attend mainstream schools may find aspects of independent learning challenging. In particular, these students may have difficulty staying on task and transitioning between tasks. There is a need for teachers to provide effective strategies as part of their everyday practice to assist students on the spectrum within mainstream classroom settings. This project aimed to design and evaluate the effectiveness of an intervention involving two strategies of structured teaching: visual schedules and work systems. Research to date has largely focused on evaluating these strategies within special education or autism-specific contexts. The current project evaluated the use of visual schedules and work systems when implemented as inclusive, whole-class practices, to support students on the spectrum in their mainstream classroom environments. A mixed-methods research design was adopted to gather data across three phases. Phase 1 involved the use of a case-study approach with the aim of trialing the intervention, as well as to test and refine research methods to be used in Phase 2. In Phase 2, a multiple baseline design was used to investigate the impacts of the intervention, when delivered by mainstream teachers in their classrooms, to support the learning and engagement of students on the spectrum. In Phase 3, an online survey and semi-structured interviews were utilised to gather feedback from mainstream teachers about the intervention. Findings from the pilot study highlighted the feasibility of employing visual schedules and work systems in mainstream settings, and enabled refinements of the research methods for use in mainstream classrooms. The results of Phase 2 indicated that the intervention significantly improved observed on-task behaviours for students on the spectrum. Findings from Phase 3 revealed that mainstream teachers who had viewed and trialled in the intervention package had found it helpful and suitable for everyday practice. Overall, this research offers preliminary findings suggesting that visual schedules and work systems can be effectively implemented by mainstream school teachers to support independent, on-task learning for students on the spectrum.

1. Introduction

For students on the autism spectrum, differences in social communication, restricted and repetitive patterns of behavior, adherence to routine, restricted interests, and/or sensory differences (American Psychiatric Association, 2013) may pose significant challenges in mainstream schools. Behavioural and cognitive differences may affect ways that students on the spectrum approach school tasks and transitions. Specifically, attending to and completing tasks can be challenging for many students on the spectrum (Ashburner, Ziviani, & Rodger, 2010; Banda & Kubina, 2006). Furthermore, repetitive and restricted behaviours can be barriers to learning (Leekam, Prior, & Uljarevic, 2011), as difficulties with transitions and shifts in thought may affect the ways that students respond to ever-changing tasks, activities and routines in school environments (Hill, 2004).

Additionally, differences in executive functioning capabilities may influence the ways that students on the spectrum approach and stay on-task, transition between activities, and independently follow activities involving sequential steps (Banda & Grimmett, 2008; Hill, 2004; Milley & Machalicek, 2012). The differences in executive functioning of these students may contribute to, and exacerbate anxiety about schoolwork, as well as impact on students' ability to self-regulate. Ultimately, these behavioural and cognitive differences may lead to difficulties engaging with the school curriculum and lower educational outcomes for students on the spectrum (Ashburner, et al., 2010; Laurent & Rubin, 2004; Stoner, Angell, House, & Bock, 2007).

In Australia, 73% of students on the spectrum attend mainstream schools (Autism Awareness, 2014), however many parents and caregivers have observed that current supports available in these settings are often inadequate (Autism Awareness, 2014; Lilley, 2012). An important consideration of teaching students on the spectrum is supporting them to navigate transitions successfully, perhaps by using individual guidance or prompting from teachers and support staff (Milley & Machalicek, 2012). However, these strategies risk students becoming overly reliant on prompting to transition from one activity to another (Cihak, 2011; Dettmer, Simpson, Myles, & Ganz, 2000; Humphrey, 2008), to the detriment of the development of their own independence in navigating transitions.

Incorporating supports into the way that classroom tasks are structured and visually presented may reduce teacher prompting and promote students' own self-monitoring and self-regulation of task engagement. In order to be practical for teachers, supports for students on the spectrum need to be easily integrated into regular classroom practice (Dingfelder & Mandell, 2011), and foster an inclusive educational environment.

1.1 Universal Design for Learning

Universal Design for Learning (UDL) is a key framework for inclusive educational practice. The aim of UDL is to promote equal access to learning for all students. It is framed by the principles of representation, expression or action and engagement (CAST, 2011). If teachers apply principles of UDL to their whole-class teaching, they may be able to spend less time adjusting materials and delivery for individual students (Jiminez et al., 2007) and reduce students' reliance on teaching staff (Giangreco, 2013). For students on the spectrum, UDL adjustments may enable them to engage in learning with their peers with minimal adjustments. UDL principles therefore allow students on the spectrum to remain with their peers and reduce the likelihood of situations in which they feel isolated, singled out, or stigmatised by having special supports for learning. The UDL framework addresses a need to provide strategies suitable for whole-class settings where students on the spectrum can engage in learning to the best of their ability.

1.2 Structured teaching

Structured teaching refers to a group of strategies that are used to create an environment where students on the spectrum can operate with increasing independence (Bennett, Reichow, & Wolery, 2011; Hume, Loftin, & Lantz, 2009). Structured teaching was originally developed in North Carolina during the early 1970s, as a core component of the Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH) programme (Mesibov & Shea, 2010). Since this time, this practice model has frequently been applied in special education (Howley, 2015) and autism-specific education settings (Humphrey & Parkinson, 2006; Peerenboom, 2003). The structured teaching framework is suitable to use with individuals of various ages and levels of functioning (Mesibov & Shea, 2011). Mesibov, Howley & Naftel (2016) and Hume (2015) have highlighted four key elements of structured teaching:

a) physical structural arrangements of the environment
b) visual schedules
c) work systems
d) visual structure.

These components and their related strategies for practice are detailed in Table 1.

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Table 1: Elements of structured teaching

Structured teaching element	Strategies
Physical structure of environment Supports sensory and executive functioning differences by adding meaning and context (Mesibov et al., 2016).	▪ Clearly defined areas for activities ▪ Clear labelling and positioning of materials ▪ Minimising auditory and visual distractions ▪ Seating arrangements that suit the individual needs of students on the spectrum (e.g., providing physical space around desks, seating students on the spectrum at the back or near the teacher, etc...) ▪ Provision of a sanctuary space ▪ Use of routines
Visual schedules Provide visual cues to sequence predictable events, give notice of anticipated changes and encourage independent transitions.	▪ Weekly schedules ▪ Individualised timetables ▪ Pictorial schedules ▪ Photographic schedules ▪ Temporal order visual representations (e.g., first-then or what-next?)
Work systems and task organisation Structures tasks systematically such that visual and physical cues answer the following: 1. What is the task or activity to do? 2. How much work is there to do and how much time will it take? 3. How do I know that progress is being made and when work is finished? 4. What must I do next? (Mesibov et al., 2004)	▪ Individual work systems at desks with numbered tasks on the left and finished work to be placed on the right ▪ Work systems in folders with left to right organisation (unless right to left is more culturally appropriate) and itemised tasks ▪ Tasks broken down and organised visually so that they are easy to follow
Visual structure Supports understanding of the environment and activities by presenting information with visual clarity.	▪ Using text or images to convey rules or instructions ▪ Organising materials to make their function clear ▪ The use of white space to make parts of instructions clear ▪ Colour coding

Much of the research dedicated to studying the efficacy of visual schedules or work systems indicates that these strategies may be very successful or partially successful in changing target behaviours, including decreasing maladaptive behaviours and increasing the productivity and independence of children on the spectrum. The results of previous research show that students who use work systems or visual schedules engage in more on-task behaviour (Bryan & Gast, 2000; Hall, 1995; Hume & Odom, 2007; MacDuff et al., 1993). The use of visual schedules has also been shown to enhance the capacity of students on the spectrum to independently transition between tasks (Cihak, 2011; Dettmer et al., 2000; Fage et al., 2016; Massey & Wheeler, 2000; Mechling & Savidge, 2011; Pierce et al., 2013; Schmit et al., 2000).

As shown in Table 1, visual schedules and work systems are two of the key strategies of structured teaching used to support students on the spectrum to focus on designated tasks and manage transitions. These strategies may be adopted by teachers to support a broad range of students in

mainstream classrooms, including other students with complex learning needs (Bryan & Gast, 2000; Hume & Reynolds, 2010; Hume, Sreckovic, Snyder, & Carnahan, 2014). Nevertheless, further research is needed to assess whether these strategies are viable and effective in the context of mainstream school settings.

1.3 Visual schedules

Visual schedules are employed to provide predictability within the classroom environment. Specifically, visual schedules inform students about upcoming events in the day and utilize sequential pictures, symbols and/or written language to achieve this. According to the National Autism Center (2015), schedules are among its 14 "established interventions" suggesting that there is compelling evidence of their effectiveness in developing students' planning abilities and fostering independence. A review of evidence-based practices for people diagnosed with ASD by Wong et al. (2015) also concludes that schedules are evidence-based. Knight, Sartini, and Spriggs (2014) support the effectiveness of visual schedules in improving on-task behaviour and facilitating smooth transitions, although Waters, Lerman, and Hovanetz (2009) report that when visual schedules are used to transition from a preferred activity (e.g. computer games) to a non-preferred activity (e.g. academic work), they are ineffective without the use of reinforcers.

Overall, these findings suggest that using visual schedules in schools are an effective strategy for supporting students on the spectrum. A noteworthy limitation of the present research, however, is that this intervention has not been delivered by a mainstream classroom teacher or as an established component of classroom practice.

1.4 Work systems

Work systems provide a means of structuring tasks, or elements of a task, which students can use to understand:

a) what they are expected to do
b) how much work is required
c) how much progress they are making or when work is finished
d) what task to focus on next (Hume & Reynolds, 2010; Mesibov, Howley, & Naftel, 2016).

Work systems therefore share some common elements with visual schedules (i.e. sequencing tasks or task elements). Both Wong et al. (2015) and the National Autism Center (2015) maintain that current evidence for the effectiveness of work systems is limited by the relatively small number of studies that have addressed this strategy.

Of the studies that have evaluated the usefulness of work systems specifically with school-aged children on the spectrum (Hume & Odom, 2007; Hume, Plavnick, & Odom, 2012; Mavropoulou, Papadopoulou, & Kakana, 2011; O'Hara & Hall, 2014), only findings from Mavropoulou et al. (2011) showed that using work systems led to improvements in on-task behaviour, engagement, task accuracy, self-regulation of behaviours and independent working habits. However, significant improvements in on-task behaviour were recorded for only one of two participants (Mavropoulou et al., 2011).

Other research by Hume and Odom (2007) found that work systems appeared to increase on-task behaviour and reduce prompting for three students. Research by Hume et al. (2012) also suggested that work systems for students on the spectrum can lead to reduced teacher prompting and improved task accuracy. Notably, the gains made through the use of work systems in special education settings were generalised to mainstream classroom settings.

Lastly, the findings by O'Hara and Hall (2014) provide some evidence of increased engagement during break time play activities among students on the spectrum after the introduction of work systems. Taken as a whole, this preliminary research suggests that work systems may have potential benefits in supporting students on the spectrum, and that work systems seem suitable for use across different settings. Nevertheless, research on the use of work systems within mainstream school settings has been very limited (Hume et al., 2012; O'Hara & Hall, 2014), with no data available on the effectiveness of the intervention when delivered by mainstream classroom teachers.

Evidently, further research is required to clarify whether the benefits of work systems and visual schedules apparent in special education and clinical settings, can be extended to inclusive, mainstream school environments.

1.5 Research aim

The aim of this research was to develop and evaluate the effectiveness of an intervention using visual schedules and work systems in mainstream classrooms. Given that there is limited research on the utility of these strategies in mainstream classrooms, a three-phased approach was employed to systematically develop and assess the intervention in partnership with teachers.

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2. Phase 1

2.1 Aim

The aim of Phase 1 was to refine a structured teaching intervention package for use in mainstream classrooms, and to pilot a method for evaluating its effectiveness.

2.2 Methodology

2.2.1 Research design

A case study method was used in one mainstream classroom. Case study designs aim to illuminate the detail of a specific situation and highlight the complexity of the environment (Yin, 2014), which in this case, was the interaction between research practice and the complex context of the mainstream classroom setting.

2.2.2 Participants

The intervention was planned by a teacher for an identified nine-year old male student. He was diagnosed with Asperger Disorder at six years of age. At the time of the study, this student was in Year 3 in a Year 3-4 composite class. The Kaufman Brief Intelligence Test, second edition (KBIT-2; Kaufman & Kaufman, 2004) indicated that the student had average academic ability. Initial classroom observations indicated that the student often engaged in off-task behavior (e.g., did not start work immediately, played with objects, was often not engaged with learning).

2.2.3 Setting

The student's school was a small regional public primary school of 114 students. The class had 20 students, including four students on the spectrum. The student's teacher accommodated for varying abilities by using scaffolded lessons, different activities for students and year levels, as well as one-to-one and small group activities. Prior to the case study, a daily visual schedule was displayed although it was not regularly used or updated.

2.2.4 Intervention and materials

The student's teacher was required to implement an intervention to assist the identified student (and potentially other students) to stay on task and transition independently between tasks. The teacher was given a workbook written by Haas (2015) that was specifically designed to instruct mainstream classroom teachers on how to create and implement a visual schedule in the form of a

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daily timetable, as well as a work system for a literacy task. The workbook also included the benefits of using a visual structure, links to online resources and examples of visually organised tasks. The researcher showed additional examples of work systems to the teacher, including pictures of a carrel desk with numbered drawers and symbols, a folder with 'to do' and 'finished' pockets and a checklist. The teacher used his own checklist format, which conformed to the definition of a work system by visually conveying information about what task to do, how much work was expected, how to know it was finished, and what to do next (Howley, 2015; Hume & Odom, 2007; Mesibov, Shea, & Schopler, 2004).

2.2.5 Procedure

A handwriting task was used to assess the student's independence while working. For this task, the whole class was required to write several lines of alphabet letters. After working on a longer written composition, there was then a transition to the computers where students typed out their work.

In order to identify appropriate dependent variables that could be used to assess the student's productivity and attention to task before and after the introduction of the intervention, the first researcher consulted the teacher about the student's behaviour. Two types of the identified student's behaviours were observed, coded, and measured. These were behaviours associated with being on-task or getting work done, and problem behaviours associated with being off-task. Other dependent variables measured by observation included teacher prompting, response latency (time taken before starting work) and amount of work completed.

The research team took observations from the back of the classroom or while circulating among the whole class. At the end of the intervention, student and teacher views of the strategies were measured using surveys designed for the study. The surveys consisted of both Likert and open-ended questions, which explored teacher and student perceptions of the value and practicality of using these strategies in mainstream classrooms. Specifically the surveys included questions in regard to the ease of implementation and helpfulness of using structured teaching approaches in the classroom, student motivation to use these strategies, and likelihood of recommending these strategies.

2.2.6 Data collection

When taking observations, the researchers took care to ensure that neither the student participant, nor his classmates, were aware of a particular student being the subject of attention. Observations were usually taken from the back of the classroom or while circulating among the whole class. Inter-rater reliability was trialed with a trained secondary observer. There was agreement for on-

task behaviours at 90.39%, and off-task behaviours at 90.15%. For teacher prompting, inter-rater reliability was at 87.18%.

2.3 Findings

This case study informed the refinement of the intervention package, which included providing the teacher with supplementary information on visual schedules and work systems, and a checklist to help with implementation of the strategies. Task selection in consultation with the teacher was found to be a feasible way to work within a mainstream classroom setting, and to capture data in an ecologically valid way. The process used to identify behaviours that would be appropriate dependent variables involved both direct input from the teacher and consultation to confirm the researcher's observations.

On the social validity measure, the student indicated that the timetable was of some help, and the work system was very helpful. The teacher reported that the timetables were very useful and easy to implement in the classroom, and that the work systems were very helpful in keeping the student on-task and helpful for other students. However, the teacher suggested that he would not recommend work systems as a whole-of-class intervention, due to the time required to develop the task checklists for students with diverse abilities.

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3. Phase 2

3.1 Aim

The aim of this phase of the research was to investigate the effect of visual schedules and work systems on the on-task behaviours, productivity and independence of students on the spectrum, when these strategies were implemented by a mainstream teacher for the whole class.

3.2 Methodology

3.2.1 Research design

To address the aims of Phase 2, a multiple-baseline, single-case experimental design across participants was used.

3.2.2 Participants

All four participants were students in primary school who met the following eligibility criteria: (a) verified as having a diagnosis of Autism Spectrum Disorder (ASD) by the Queensland Department of Education and Training; (b) attending mainstream classes in upper primary years; (c) having the academic ability to complete set work in their classroom; and (d) being perceived by their teachers as having difficulty staying on task and/or transitioning between tasks. Three of the students were in their fifth year of schooling and one student was in their third year. Information about diagnoses was provided by the parents. The Social Responsiveness Scale (SRS-2) also provided a quantitative measure of ASD traits (Constantino & Gruber, 2007). All students had total t-scores over 60, indicating clinically significant differences in reciprocal social behavior (Constantino & Gruber, 2012). Students' academic ability was assessed using the Kaufman Brief Intelligence Test, Second edition (KBIT-2; Kaufman & Kaufman, 2004). These scores and the ages of participants are shown over in Table 2.

Table 2: Student characteristics

Name[1]	Age	SRS-2 T score	KBIT-2
James	10 years, 7 months	61	Above average
Aaron	10 years, 4 months	75	Above average
Edward	11 years	69	Average
Sam	8 years, 11 months	>90	Average

[1] All names are pseudonyms.

3.2.3 Setting

The study took place in two mainstream primary schools and all classes had 20 to 25 students. For James, Aaron, and Sam, the intervention was implemented by their classroom teacher during whole-class lessons. For Edward, visual schedules were implemented by the classroom teacher, while the work systems component of the intervention was delivered during whole-class Languages other than English (LOTE) lessons by the LOTE teacher.

3.2.4 Procedures

In the pre-baseline stage, teachers were consulted about when off-task behaviours were likely to occur. Teachers were given a workbook closely modelled on work by Haas (2015) with guidance about how to design and carry out visual schedules and work systems. In the baseline stage, the first author observed each student during the selected task, or LOTE lesson, a minimum of five times over a 2-3 week period to establish baseline rates of target behaviours. Student behaviours and teacher prompting were measured from the start of the task. Ten-second partial interval coding was used and both on-task and off-task behaviours were recorded if they were observed during this interval. Observations began when the teacher gave instructions to commence work until the task was completed. Reliability of coding was measured with a second observer who had been trained in the coding procedure during the Phase 1 study.

3.2.5 Intervention

The intervention phase began by providing the teacher with the intervention workbook (Haas, 2015) and meeting in person with the teacher to discuss the contents of the workbook. The intervention consisted of individual visual schedules, structuring tasks with lists or instructions, and giving visual cues about work (e.g., visual timers, pages marked with an end point) and what to do next (e.g., concrete materials for the next task, next item on the schedule).

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3.2.6 Dependent variables

On-task behaviour was operationalised as writing, or typing where the writing implement was held touching the paper or where the student pressed a key on a keyboard. Off-task behaviours differed between students. Off-task behaviours for James included being out of his chair, walking around the room, talking and working on other activities. For Aaron, off-task behaviours included reading under his desk, refusal to work and talking. Edward's off-task behaviours were talking, being away from his chair, reading, and throwing objects. Sam's off-task behaviour was work refusal. Teacher prompting was operationalised as any form of instruction or cue given by the teacher, teacher aide or adult volunteer to direct the student's attention to the task, work system or schedule. Prompting consisted of:

a) verbal directions
b) using the student's name
c) gesturing/pointing
d) touching the student
e) touching/tapping the student's chair or desk
f) using a visual cue
g) using proximity
h) hand over hand guidance.

The total number of words written or typed were recorded, when possible, for students engaged in writing tasks.

Social validity of the intervention was measured using a survey where teachers and students provided feedback about the ease and helpfulness of visual schedules and work systems.

3.3   Findings

For all students, the proportion of intervals where both observers agreed was over 87% on all measures. Fidelity was measured using an implementation checklist. The number of baseline and intervention phase sessions varied between students. A maintenance probe was conducted only in James' classroom.

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3.3.1 On-task behaviours

Figure 1 shows that a change in on-task behavior between baseline and intervention was apparent for all participants. James' on-task behaviours increased from 20% intervals (range: 5% - 36%) during baseline to 53% (range: 29% - 79%) during the intervention. This increase was found to be a large, significant effect (Tau-U = .6458, p = .045). During the maintenance probe session, the percentage of intervals during which James was on-task fell to 8%.

Aaron's on-task behaviours increased significantly with a large effect size (Tau-U = .8333, p = .0225) from a mean of 40% of intervals during baseline (range: 19% - 80%) to a mean of 60% (range: 47% - 68%) during intervention.

Edward showed the greatest change in on-task behaviours, with a statistically significant improvement and a large effect size (Tau-U = 1.25, p = .004). Average intervals at baseline increased from a mean of 9% (range: 0% - 26%) to 65% (range: 57% - 78%).

Sam's on-task behaviours increased from an average of 61% during baseline (range: 37%-90%) to 86% (range: 85% to 90%). This change constituted a moderate effect size but did not reach statistical significance (Tau-U = .35, p = .3913).

3.3.2 Off-task behaviours

The change measured between baseline and intervention phases for off-task behaviours was not statistically significant for any participants.

3.3.3 Teacher prompting

No significant difference was found for teacher prompting between baseline and intervention phases.

3.3.4 Words written

James and Aaron showed significant increases in productivity measured by the number of words written during observations. James wrote a mean of 36 words at baseline (range: 0-68), which increased significantly (Tau-U =.7857, p = .0184) to 77 after the intervention (range: 41-148). Aaron's productivity rose from an average of 37 words in baseline sessions (range: 10 – 72) to 105 (range: 78-121) after the intervention (Tau-U = 1.5, p = .0015). Sam's change in words written between phases was not statistically significant, and no data was collected for Edward because the class was not consistently engaged in writing tasks during observation sessions.
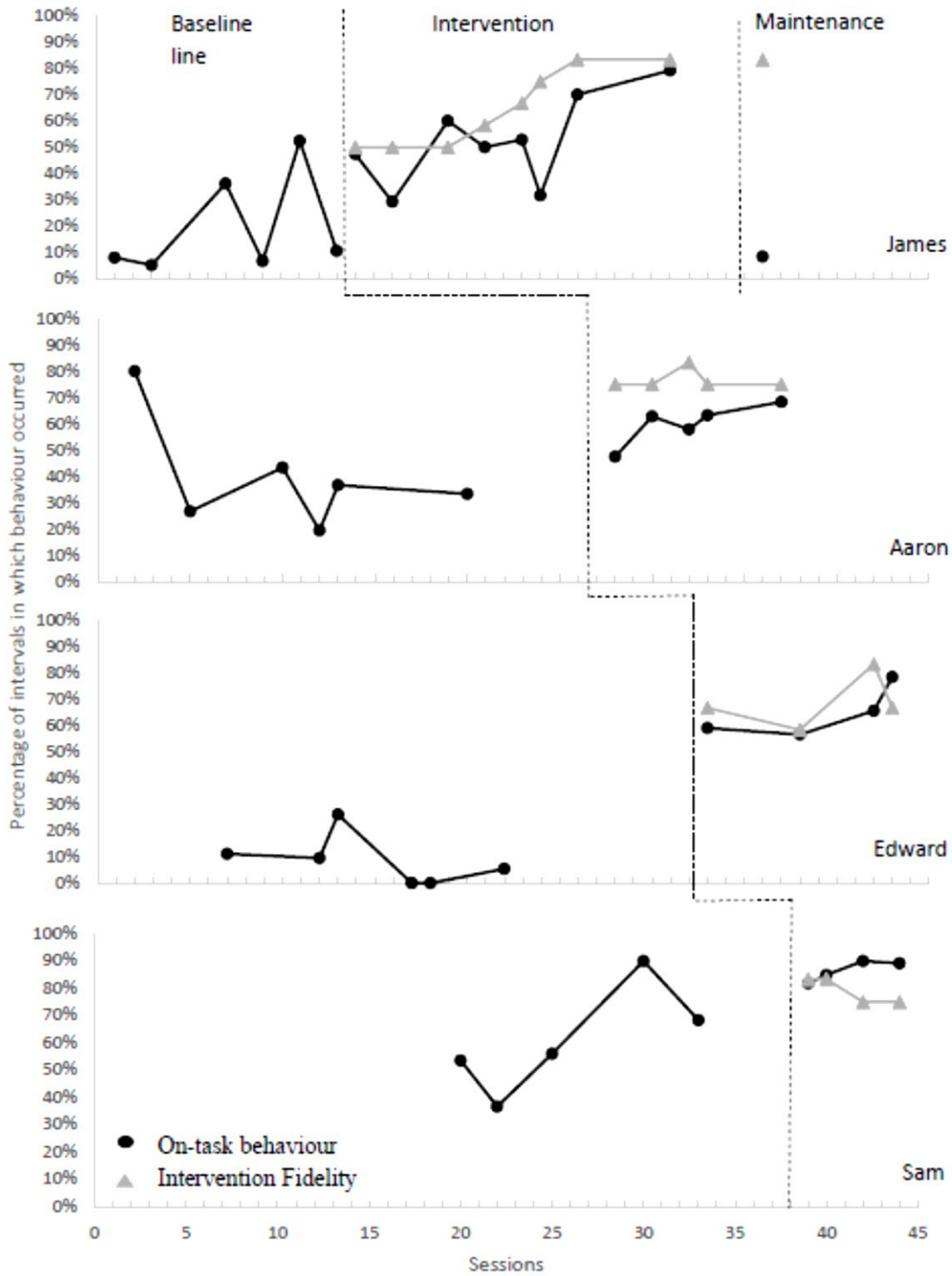
Figure 1. Percentage of intervals in which students were observed engaging in on-task behaviours.

4.   Phase 3

4.1   Aim

The aim of this phase of the study was to explore the views of mainstream primary school teachers on the use of visual schedules and work systems as described in a resource developed from the workbook used in Phases 1 and 2 - *Finished! The On-task Toolkit* (Macdonald & Haas, 2016) - and to obtain their feedback on its utility in assisting teachers to implement these strategies in their classrooms.

4.2   Methodology

Study design

A mixed-methods approach was used across two stages. In stage 1, a two-part survey was used to assess teachers' responses to the intervention package, *Finished! The On-task Toolkit* (Macdonald & Haas, 2017) and the strategies it outlines. In stage 2, a qualitative case-study approach was used to obtain further feedback about the use of the strategies outlined in the toolkit, and to capture the complexity and richness of the classroom experience implementing it (Yin, 2014).

4.2.1 Stage 1

Participants

Forty-one mainstream primary teachers participated in an online survey giving feedback on the intervention package. The teachers' years of experience ranged between 1 and 35 years. All 41 completed Part 1 of the survey and 22 completed Part 2.

Materials

Finished! The On-task Toolkit (Macdonald & Haas, 2017) included four sections on structured teaching strategies including:

   a) background information
   b) use of structured teaching in mainstream classrooms
   c) information about visual schedules
   d) information about work systems.

Additional resources in the toolkit included links to online resources, templates, fact sheets and checklists.

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4.2.2 Stage 2

Participants

Four mainstream teachers who had participated in the online survey also participated in semi-structured interviews about their experiences of using the *Finished! The On-task Toolkit* (Macdonald & Haas, 2017) in their classrooms.

Procedure

Semi-structured interviews were used to gather information about classes that the participants had taught, strategies they were currently using, how they implemented strategies described in the toolkit, how students responded, and what they thought about using the strategies. General feedback and suggested areas for improvement on the toolkit were also gathered.

4.3   Findings

The online survey required teachers to rate their levels of knowledge and confidence in using visual schedules and work systems, before and after reading the toolkit. Results revealed significant increases for teachers' confidence in using visual schedules ($Z = -2.543$, $p = .001$) and in using work systems ($Z = -2.708$, $p = .007$). No significant improvement was found in teachers' knowledge of using visual schedules and work systems. The teacher's responses to the toolkit were overwhelmingly positive, in that they found it easy to follow and useful.

All four teachers who trialled the toolkit's strategies had some level of success and all were keen to continue using the strategies in their future classes. Qualitative feedback indicated that these teachers were able to independently deliver the intervention as part of their everyday practice. Both visual schedules and work systems were considered by teachers to be useful for all students.

5.   Discussion

5.1   Outcomes

The overarching objective of this research was to improve mainstream school learning experiences for students on the spectrum, who may experience difficulties in engaging with on-task activities

and coping with transitions. A large number of students on the spectrum attend mainstream classrooms without receiving specialist support (Autism Awareness, 2014). Although interventions exist which may be helpful (National Autism Center, 2015; Wong et al., 2015), there has been a dearth of evidence on their effectiveness when delivered by teachers in mainstream classrooms.

The aim of this project was to develop, implement and evaluate an intervention involving the use of visual schedules and work systems, which could be used in mainstream schools as part of everyday teaching practice. The findings from the pilot study helped researchers clarify appropriate data-collection procedures, and provided useful information on the culture of mainstream classrooms, and the need for data-collection procedures that accommodate the disruptions that occur with great frequency in these classrooms. In this way, researchers refined the intervention package and gathered ecologically valid observations.

Phase 2 results indicated that visual schedules and work systems effectively supported four students on the spectrum to stay on-task during activities within their mainstream classrooms. These findings are consistent with previously reported findings that the use of visual schedules and work systems increase on-task behaviours (Bennett et al., 2011; Hume & Odom, 2007; Hume et al., 2012; Mavropoulou et al., 2011; O'Hara & Hall, 2014). The present study adds to previous findings by offering new insights on the effectiveness of the intervention in mainstream schools.

Phase 3 data revealed that teachers who had accessed the toolkit found it to be helpful and suitable to use in their classrooms. While the increase measured in teachers' knowledge of the strategies was not significant, this may have reflected the already high levels of knowledge among participants. Teachers' level of confidence in using visual schedules and work systems improved significantly and they reported that they would continue to use the toolkit's strategies and share their knowledge with their colleagues.

5.2   Implementation

While supporting students who are having difficulty staying on task is a compelling reason to use visual schedules and work systems, the effectiveness of these strategies, even in an authentic context, is not enough to ensure they will work as intended in the mainstream classroom on every occasion. The way in which these strategies are conveyed to teachers will determine a) whether they are implemented, and b) the extent of their effectiveness. While the underlying principles of the intervention remain the same, teachers who participated in the last phase of the study highlighted variety of ways that visual schedules and work systems can be implemented (e.g., using pictures or symbols or the use of technology). By incorporating adaptability in the design of

the intervention, fidelity to the essential components of structured teaching may increase (Dearing, 2009) and mainstream school teachers are more likely to adopt the intervention as part of their everyday practice.

5.3   Limitations and future directions

The most salient of limitations of this research pertained to the challenges of conducting research in mainstream classroom environments, and the consequent lack of environmental control. While it is important to gather information reflective of environmental validity, data must also be reliable. In the context of this study, the complexity of classroom environmental factors may have impacted the delivery and evaluation of visual schedules and work systems.

A second shortcoming of the present study was the small numbers of participants across the three phases, which is a common limitation of single-subject research designs (Zhan & Ottenbacher, 2001). It would have been preferable to include more participants, especially with the online survey and interviews in Phase 3. The teachers who did participate in this phase of research were self-nominated and motivated to further their knowledge and experience of supporting students on the spectrum. Although their feedback on the toolkit was insightful, questions remain about whether teachers with a limited understanding of autism would share their perceptions that the tool kit was easy to understand, and the strategies were feasible and valuable.

The present study investigated the effectiveness of visual schedules and work systems in supporting students on the spectrum within their mainstream school classrooms. These strategies may have other benefits which have not yet been explored. For instance, further investigation of structured teaching strategies could focus on curriculum and learning outcomes for students on the spectrum (Howley, 2015). Furthermore, future studies could explore the potential of structured teaching strategies in fostering functional skills, such as emotional regulation and social communication skills. Additionally, the potential benefits of structured teaching strategies for typically developing students and students with other special needs warrant further exploration.

The teachers who trialed the toolkit recommended other ways of enhancing teachers' understanding of structured teaching strategies, including video modelling and face-to-face professional development. A further Autism CRC project on the utilisation of these research outcomes is therefore focusing on the development of an eLearning package that includes video modelling, resources for face-to-face professional development, and online templates.

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6. Conclusion

This research addressed the need for effective educational methods that can be used in mainstream school settings to support students on the spectrum. While many previous studies indicated that visual schedules and work systems can help students on the spectrum to stay on-task and independently transition between set tasks (Bennett et al., 2011; Hume & Odom, 2007; Hume et al., 2012; Knight et al., 2014; Mavropoulou et al., 2011; O'Hara & Hall, 2014), the application of these approaches to mainstream contexts was largely unexplored. This project aimed to bridge this research-to-practice gap by exploring the effectiveness of these strategies in mainstream classroom settings.

The Universal Design for Learning (UDL) approach was used to develop an inclusive way of providing support to students on the spectrum, thereby enhancing their access to quality education within an inclusive learning environment (UN General Assembly, 2007). By promoting a whole-of-class approach, this project aimed to make classrooms more autism-friendly, and to reduce the need for individualised approaches that may make students on the spectrum feel isolated or stigmatised.

The current project has contributed to the field of research focusing on the effective delivery of structured teaching strategies in ecologically valid settings. The refined intervention package may be viewed as an eclectic approach (Kasari & Smith, 2013) which realistically aims to support students on the spectrum to learn in inclusive education classrooms. The current methodological design may assist researchers of future studies to investigate other autism interventions in mainstream schools.

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