Outcomes of structured teaching for children on the autism spectrum: does the research evidence neglect the bigger picture?

Marie Howley
University of Northampton

The adoption of 'structured teaching' is evident in educational settings worldwide and has fast become one of the key 'tools' in autism education. As calls for evidence-based practice have increased, research evidence has grown to interrogate the effectiveness of structured teaching components. Previous systematic literature reviews of the research evidence suggest that structured teaching has positive effects upon problem behaviours and also increases engagement and independent task organisation. This literature review builds upon previous reviews in order to explore the effects of structured teaching upon behaviour and learning, asking what the research evidence actually measures in relation to these two concepts. Gaps in the research evidence are identified, and discussion focuses upon the need for research which investigates the role of structured teaching components in meaningful learning, the need for greater attention to evaluate social validity of the approach which takes into account those who implement and indeed those who receive the intervention and finally the need for research to analyse the effects of structured teaching upon alternative outcomes of 'well-being' and 'quality of life'.

Introduction

In recent years, significant resources have been deployed to develop expertise in approaches to teaching children on the autism spectrum. There is widespread agreement that no single approach to autism education has been shown to be more effective than another and no single approach is likely to meet all the needs of an individual (e.g., Jones, English and Guldberg et al., 2008). Research evidence is increasingly called for in order to evaluate strategies and outcomes for those who receive autism interventions. Some strategies have become commonplace in special school contexts; in particular, this includes the use of 'structured teaching' as advocated by the 'Treatment and Education of Autistic and related Communication handicapped

CHildren' (TEACCH) approach (Mesibov, Shea and Schopler, 2005; Schopler, Mesibov and Hearsey, 1995).

Early developments of the TEACCH approach were firmly rooted in a holistic perspective (Schopler, 2005) and an understanding of the 'culture of autism' (Mesibov et al., 2005, p. 19). The foundation for the development of structured strategies is evident in early research into the effects of structure upon children with autism (e.g., Rutter and Bartak, 1973; Schopler, Brehm and Kinsbourne et al., 1971). This early research focused upon the development of skills and behaviour with Schopler et al. (1971) concluding that children with autism 'responded better' to structured sessions than unstructured; moreover, Mesibov et al. (2005) suggest that 'children with lower developmental functions became more disorganized the less structure they had' (p. 4).

Structured teaching was first introduced in the UK in one local authority in 1990 (Preece, Lovett and Lovett et al., 2000) and quickly became established in classroom practice (e.g., Jones et al., 2008; Jordan and Jones, 1999). Key purposes of structured teaching are identified by Schopler et al. (1995) as development of independence and self-esteem and management of behaviours; it is further argued that development in each of these areas facilitates teaching and learning (Mesibov and Howley, 2003). Moreover, Mesibov in an interview with Adam Feinstein (2001) explains that:

> '. . . I think that the TEACCH approach comes more out of the Gestalt tradition, which focuses on meaningfulness and understanding. My argument is that, if a thing makes sense to someone, if they understand it, then it is going to promote their learning more effectively.' [online]

Key components of structured teaching (see Table 1) are designed therefore to maximise understanding in order to manage behaviours, increase independence and self-esteem and promote learning. Mesibov and Shea (2010) suggest that 'many aspects of the visual skills of individuals with

Table 1: Key components of structured teaching

> 1) Physical structure: visually structuring and clarifying boundaries, designating specific teaching areas for specific purposes and addressing sensory issues by removing distractions.
>
> 2) Schedules: Visual presentation of sequence of activities 'what' and 'when', often referred to as visual timetables in UK classrooms; schedules are individualised according to understanding and include objects, picture, symbols and written schedules.
>
> 3) Work systems: visual structure that provides individualised information to the learner about 'what work', 'how much work', 'what progress am I making', 'what do I do when I'm finished'? Work systems include working from left to right with a container for finished work; sequenced picture, colour, symbol task lists; written 'to do' lists.
>
> 4) Visual structure and information: visual organisation of tasks, visual clarification of task requirements and concepts, visual instructions.
>
> (Mesibov and Howley, 2003; Mesibov et al., 2005; Schopler et al., 1995)

autism are preserved or even superior to same-age peers' (p. 573). They argue that the use of visual information promotes engagement and reduces distress; hence, visual information underpins all components of structured teaching.

A number of studies have investigated use of the TEACCH approach and the impact upon behaviours and skills (e.g., Norgate, 1998; Ozonoff and Cathcart, 1998; Panerai, Ferrante and Caputo, 1997; Panerai, Ferrante and Caputo et al., 1998; Panerai, Ferrante and Zingale, 2002; Panerai, Zingale and Trubia et al., 2009; Siaperas and Beadle-Brown, 2006; Tsang, Shek and Lam et al., 2007; Van Bourgondien, Reichler and Schopler, 2003; Van Bourgondien and Schopler, 1996). In 2010, Mesibov and Shea identified the need for research focusing on the 'individual components' and 'mechanisms' of the structured teaching approach (p. 575). It is within this context that this narrative literature review seeks to identify and analyse the existing research evidence base in relation to the use of structured teaching component strategies. This review therefore examines research evidence in relation to physical structure, schedules, work systems and visual information. Given that the key purposes of the approach are identified as improving behaviour and facilitating learning, a thematic approach is adopted in order to analyse research evidence relating to *behaviour* and *learning* outcomes. Subsequent discussion reflects upon three key issues: first, gaps in the research evidence relating to behaviour and learning outcomes; second, the need to investigate social validity more thoroughly; and third, the need for research into structured teaching and the impact upon alternative outcomes related to well-being and quality of life.

Search strategy

A decision was made early on to reject a systematic review that might preclude much of the existing evidence that is predominantly based on very small sample sizes and single-subject design; hence, a narrative review was undertaken, and research evidence included all papers appearing in peer-reviewed journals that included key words and terms used in the search, regardless of sample size. Although small samples limit any generalisations that can be made, nevertheless, research findings based upon small samples inform what Bassey (1999) refers to as statements of 'fuzzy generalisations'; findings from small samples may identify '. . . that something has happened in one place and that it may happen elsewhere' (p. 52). With this in mind, the inclusion of small-scale studies offers opportunities to make comparisons across the research evidence, interrogating that evidence to identify behaviour and learning outcomes. A total of 27 studies were reviewed, and a summary can be found in Appendix A, Table A1.

Key word searches were conducted using a number of databases including: Education Research Complete (EBSCO), Ingentia, Swetswise, Web of science, ZETOC and Autism data (National Autistic Society's database). In addition to 'autism', 'learning' and 'behaviour', initial key words were identified as: physical structure, schedules, work systems and visual information. During the review, further key words were identified as: activity schedules, picture schedules and picture timetables.

It emerged early on in the review process that a number of research claims relating to 'schedules' and 'activity schedules' have origins in approaches other than structured teaching; notably these are predominantly behavioural strategies associated with 'Applied Behaviour Analysis' (ABA). Structured teaching clearly derives some practices from behavioural approaches as can be seen in the use of schedules, work systems and visual instructions that use visual images to represent necessary steps in a sequence identified through task analysis. A review by Mesibov, Browder and Kirkland (2002) concludes that:

> *'much of the research on scheduling has focused on teaching individuals with developmental disabilities to complete a specific daily living activity (sometimes called an activity schedule) or to complete series of these tasks. This series of tasks is usually a 'to do' list . . .'* (p. 78)

The term 'activity schedule' is one which arose in many of the small-scale studies reviewed, and thus, this term was added to the key word search.

Structured teaching and behaviour

The most commonly reported research evidence relates to the use of schedules and work systems, focusing primarily on two types of behaviours: (1) behaviours defined as challenging or problematic, including for example self-injury,

aggression and self-stimulatory behaviours; and (2) sets of learning behaviours defined in the research as on-schedule, off-schedule, on-task, off-task and engagement (see 'Learning' below).

Problem behaviour: schedules
Reducing and managing behaviours is identified as a key purpose of structured teaching (Mesibov and Howley, 2003; Mesibov et al., 2005), so it is not surprising that the focus of many studies is to identify the impact of structured teaching strategies upon problems or challenging behaviours such as self-injury and self-stimulatory behaviours. A review of 13 studies by Banda and Brimmett (2008) explored implementation of 'activity schedules' and outcomes relating to social and transition behaviours, concluding that studies indicate that activity schedules decrease 'problem' behaviours. Likewise, Lequia, Machalicek and Rispoli (2012) analysed evidence relating to the use of 'activity schedules' with the purpose of reducing challenging behaviours, identifying 18 studies and concluding that research evidence indicates that the use of activity schedules results in improved appropriate behaviours and in reduced challenging behaviours.

Many of the studies included in the current review report reduction in problem behaviours. For example, Dooley, Wilczenski and Torem (2001) observed decreased problem behaviours including dangerous, disruptive, kicking, biting, crying and screaming behaviours in one 3-year-old boy when using an activity schedule to make transitions between activities. They also report that changes in behaviour were maintained throughout the school year and also transferred to the home setting. Similar findings are reported by O'Reilly, Sigafoos and Lancioni et al. (2005) and Schmit, Alper and Raschke et al. (2000) who investigated the effects of activity schedules as an antecedent intervention on challenging behaviours and levels of self-injury; both studies report decreases in problem behaviours. O'Reilly et al. (2005) claim that significantly less self-injury was observed when their 12-year-old participant had used an activity schedule and correspondingly increased engagement when he was observed 'actively and appropriately involved with instructors or items' (p. 306). The researcher also includes anecdotal feedback from an assistant who describes the child as happier and seeking more interaction and communication; this is notable as the inclusion of the perceptions of adults is rarely reported in the studies reviewed. Likewise, Probst et al. (2010) report decreased problem behaviours in a 7-year-old girl when using schedules and choice boards while teaching social-communication skills. Informal conversations with the girl's mother and carers report consistent views that the intervention was 'helpful and disburdening' and that the child was less aggressive and more predictable (p. 152). Many report increases in problem behaviour when returning from intervention to non-intervention conditions in A-B-A-B single-subject design studies (Odom, Brown and Frey et al., 2003). For example, Dettmer, Simpson,

Smith Myles et al. (2000) report aggression and tantrums in two boys during the withdrawal phases of schedule use.

Studies focus on varying age groups, for example Massey and Wheeler (2000) report decreased challenging behaviour in a 4 year old, Bennett, Reichow and Wolery (2011) found reductions in stereotypical behaviours and escape attempts in three pre-school children, while Watanabe and Sturmey (2003) demonstrated reduced challenging and self-stimulatory behaviour in three adults when schedules included choices of tasks. Probst et al. (2010) report significant reduction in problem behaviours in three adults when using schedules together with work systems; in addition, semi-structured interviews with three members of staff indicated that 'social validity is high' (p. 158) as respondents report 'reduced uncertainty . . . and less misunderstandings' (p. 157).

Engagement is a recurring theme within many studies, and a notable correlation emerges between decreased problem behaviours and increased 'engagement' and 'on-task' behaviours such as work, daily living and play behaviours (Bennett et al., 2011; Buschbacher, Fox and Clarke, 2004; Dooley et al., 2001; Machalicek, Shogren and Lang et al., 2009; Massey and Wheeler, 2000; Pierce and Schreibman, 1994; Watanabe and Sturmey, 2003). This research evidence appears to support Mesibov and Shea's (2010) claim that visual structure reduces stress and anxiety, which in turn reduces problem behaviours at the same time promoting engagement.

Structured teaching and learning
Mesibov and Howley (2003) argue that by managing behaviours, structured teaching facilitates teaching and learning and in particular 'meaningful access to all aspects of the curriculum' (p. 16). It is to this aspect that this literature review now turns.

Learning behaviours: schedules, work systems and visual information
Most of the studies that have investigated structured teaching components focus on observable behaviours related to engagement, on-task/off-task, on-schedule behaviour, independence, transitions, independently locating activities, attending to activities for example by looking at materials, organising tasks and materials and completing tasks (Betx, Higbee and Reagon, 2008; Bryan and Gast, 2000; Chiak and Ayres, 2010; Dauphin, Kinney and Stromer, 2004; Dettmer et al., 2000; Hall, McClannahan and Krantz, 1995; Hume and Odom, 2007; Krantz, MacDuff and McClannahan, 1993; MacDuff, Krantz and McClannahan, 1993; Morrison, Sainato and Benchaaban et al., 2002; Watanabe and Sturmey, 2003; Welterlin, Turner-Brown and Harris et al., 2012). All of these could be described as learning behaviours, that is, behaviours necessary for individuals to be ready to learn.

Earlier small-scale studies focused on the use of schedules in family contexts, concentrating on daily living, self-care and leisure (Clarke, Dunlap and Vaughn, 1999; Krantz et al., 1993; MacDuff et al., 1993), concluding that the use of schedules result in increased engagement and 'on-task' behaviour in these contexts. More recently, Mesibov et al. (2002) make a clear distinction between the purposes of using schedules for daily living tasks and those used in schools and classrooms that require a balance between required activities and individual choice and preferences. They offer guidance on teaching schedule use as a positive behaviour intervention and identify key purposes of schedule use relating to transitions, independent performance of tasks, following routines and self-management of leisure activities, themes that are repeated within small-scale classroom-based studies (e.g., Bryan and Gast, 2000; Dettmer et al., 2000; Dooley et al., 2001) and adult services contexts (e.g., Watanabe and Sturmey, 2003). An additional component of choice making was included in Watanabe and Sturmey's study in which giving individuals a choice of tasks within the schedule was measured as a variable that positively affected on-task/off-task learning behaviour.

Research evidence also reports positive outcomes in relation to task engagement, behaviour and independence through the use of work systems (e.g., Hume and Odom, 2007; Hume, Loftin and Lantz, 2009; Hume, Plavnick and Odom, 2012). Links between increased engagement and decreased problem behaviours are claimed; for example Bennett et al. (2011) conclude that the use of a left–right work system, together with physical structure and visual schedules, resulted in increased engagement and task completion concurrently with reductions in stereotypical behaviours.

Further to investigations into the use of schedules and work systems, others have explored the effects of visual information upon transitions, on-task behaviour and adult prompting. Dettmer et al. (2000) used multiple visual supports that included schedules, sub-schedules (which could be described as work systems), a finished box and visual information to teach independent activity transitions to two children while Mavropoulou, Papadopoulou and Kakana (2011) investigated the effects of visual structure and task organisation upon on-task behaviour, prompting and independence. This study is of particular interest as the focus is upon components of visual information, that is, visual organisation, visual clarity and visual instructions, investigating the effects of visual information upon 'play behaviours', but again with a focus of on-task/off-task. Ganz and Flores (2008) report increased play behaviours between children with autism and their peers with the use of visual strategies within play themes based on children's preferred interests and familiar activities. Although the study makes no explicit link to the TEACCH approach, or to structured teaching, the use of visual strategies and preferred interests is clearly related.

Physical structure
Although predominantly small scale it is clear that a number of studies have investigated three of the four components of structured teaching, that is, schedules, work systems and visual information. Physical structure, however, is relatively neglected in the research evidence and fewer studies focus on this component. This may be due to the more easily observable effects of schedules, work systems and visual information and, importantly, may also be due to the difficulty in isolating 'physical structure' as an independent variable within such studies.

However, Welterlin et al. (2012, p. 1833) report 'improvement in children's work skills' for young children as a result of parents being taught to 'use physical structure as an antecedent intervention' with the use of furniture and boundaries and organisation of materials. Bryan and Gast (2000) allude to this component in that they describe the physical environment and set-up of the resource classroom in which their research took place. In particular, they refer to 'literacy centres' which had distinct purposes and which were clearly demarcated; likewise, Panerai et al. (2002) briefly mention physical organisation and clarification to include 'place-activity correspondence' and a 'clear and predictable' environment (p. 322), although no improvement or deterioration in skills or behaviour could be attributed to this aspect of structured teaching. In addition, physical structure is also mentioned in Hume and Odom's (2007) research, which, while focusing on the effects of a work system, identifies components of work systems including the minimising of visual and auditory distractions, a feature of physical structure.

Although many studies report increases in learning behaviours, far less attention is paid to precisely what individuals are learning and why. Learning content or curricular investigated include: functional skills (Krantz et al., 1993; Kurt and Parsons, 2009; MacDuff et al., 1993); peer engagement, interaction and play (Betx, Higbee and Reagon, 2008; Ganz and Flores, 2008; Mavropoulou et al., 2011); and social skills incorporated into a computer-based schedule (Kimball, Kinney and Taylor et al., 2004). Curriculum subjects represented in the research are physical education (PE; Zimbelman, Paschal and Hawley et al., 2007), language, literacy and art (Bryan and Gast, 2000), although the focus of these studies is again on learning behaviours within the curriculum context and not on what children learned in relation to the subject nor why.

One study that does begin to investigate learning beyond that which is described above as learning behaviours is that of Hume et al. (2012) who report increased accuracy in task completion of language and literacy tasks when using a work system, claiming:

> 'This is the first investigation of the impact of the
> work system on task accuracy – as previous studies
> have only reported the effectiveness in increasing

on-task behaviour and task completion, rather than the quality or accuracy of the work.' (p. 1459)

This study provides some evidence that use of a work system improves accuracy of task completion and simultaneously reduces the need for adult prompts; here, we see consideration of *understanding* which correlates with task accuracy.

Gaps in the evidence

This review indicates three significant gaps in the research evidence. First, the focus on measuring observable behaviours results in a clear gap in the evidence in relation to *what children are learning* and *why they are learning what they are learning*. Second, social validity of structured teaching components, and in particular, the views of those implementing the approach, are worthy of more in-depth analysis when investigating 'what works and why'. Finally, the research evidence neglects to thoroughly consider an important part of the picture, largely ignoring the impact of the approach upon the inner experiences and well-being of individual learners. Consideration of each of the above would add to the empirical evidence in order to fully understand the 'bigger picture'.

Measuring behaviour and learning behaviours: only part of the picture

Research evidence supports the key purposes of structured teaching and Mesibov and Shea's (2010) claim that structured teaching promotes engagement and reduces confusion and distress. Overall, there appears to be a general consensus in relation to implementation of structured teaching components and outcomes related to problem behaviours, with the majority of researchers claiming reduced problem behaviours in individuals when using schedules, work systems and visual information. Given that managing behaviours associated with autism are essential precursors to facilitating learning (Mesibov and Howley, 2003), these results have direct implications for enabling individuals on the spectrum to be 'ready to learn'. Moreover, results also indicate that structured teaching components produce positive results with much of the research evidence indicating a direct correlation between reduced problem behaviours and increased learning behaviours such as engagement, on-task, transition, organisation and independence.

However, while there is evidence that the approach has a positive impact upon both problem and learning behaviours, there remains a significant anomaly. Structured teaching is argued by Mesibov (2001) to be more 'Gestalt' in its approach to learning, concerned with understanding of the 'whole' rather than isolated components and with a focus on meaning and understanding; despite this claim, the research evidence focuses predominantly upon measuring isolated behaviours and largely neglects the 'bigger picture'. This propensity to focus primarily on observable behaviours neglects other crucial aspects of learning, including *what* individuals *learn and understand* and indeed *why* they learn

what they learn. While Zimbelman et al. (2007) do attempt to investigate learning in relation to PE, they focus solely upon amount of time engaged in physical activity, neglecting to consider what students *learned* in the context of PE lessons – here again, we see an explicit focus on behaviours and not on meaningful learning and understanding, which Mesibov (2001) claims that the TEACCH approach is more concerned with. There is a marked scarcity of research evidence other than that which can be counted and measured, that is, single or sets of behaviours; little attention is paid to investigate the precise nature of what individuals learn and why, thus neglecting the 'bigger picture'.

A call for in-depth evaluation of social validity

Numerous small-scale studies report positive outcomes in relation to problem and learning behaviours, and collectively, these studies make a valuable and significant contribution to a 'bigger picture'. However, this review reveals a distinct lack of in-depth analysis of perceptions of those using, and indeed the learners who are receiving the approaches under investigation. In 1978, Wolf acknowledged the importance of the perceptions of society in relation to ABA research and explored the challenges of considering 'social validity' within a positivist paradigm. He determined features of social validity as social significance of goals, social appropriateness of procedures and social importance of effects (p. 207). More recently, Callahan, Shukla-Mehta and Magee et al. (2010) suggest that social validation is a 'critical step' in validating educational outcomes, arguing:

> *'Whether or not a particular intervention. . . . receives widespread social validation can determine the extent to which the intervention or model is adopted and implemented within schools, homes, and clinics.'* (p. 75)

The move towards acknowledging the importance of social perceptions has been gradual. This is reflected in a few studies that have included measures of 'social validity' albeit still within the positivist paradigm, using Likert numerical rating scales as measures of social perceptions (Bryan and Gast, 2000; Hume and Odom, 2007; Hume et al., 2012; Massey and Wheeler, 2000; Mavropoulou et al., 2011; Morrison et al., 2002). Views of parents, teachers, support assistants and other professionals are reported as reflecting agreement with observed increases in learning behaviours relating to on-task/off-task, engagement, independence, transitions and reductions in adult prompting. However, quantitative measurements of social perceptions are arguably extremely limited and fail to capture any in-depth insight that may be better obtained through qualitative methods.

While few studies have explored social perceptions in-depth, some have attempted to capture the views of those implementing structured teaching strategies through the use of informal conversations and semi-structured interviews

(e.g., Probst et al., 2010). Zimbelman et al. (2007) surveyed PE teachers who attended an autism training course with the aims of exploring perceptions of the effectiveness of schedules and whether schedules increase on-task behaviour in a PE setting. Their pre- and post-training surveys included 5-point scales together with a number of open questions: pre-training survey questions asked about expectations of the usefulness of schedules and barriers or problems participants anticipated in implementing schedules; post-survey questions aimed to identify satisfaction and perceived effectiveness of schedules, modifications required, additional support needed and recommendations for use of schedules in PE settings. Results indicated that teachers believed that many students could benefit from visual instructions, although some expressed concerns regarding the displaying of visual aids in a PE environment. Although this is an interesting study in that it attempts to explore perceptions of PE teachers, resultant evidence is extremely weak due to a number of methodological limitations including lack of consistency in wording of questions, lack of definitions for respondents and failure to address one of the key research questions when collecting data. Nevertheless, there is a clear attempt to obtain more reflective comments through the use of qualitative, open-ended questions in combination with quantitative methods.

Consideration of social validity in relation to structured teaching is of real interest; no matter how compelling behavioural outcomes appear, implementation of any strategy is also dependent upon the views of those who both use and receive the intervention. While not refuting the importance of existing empirical evidence, neglecting a more qualitative research approach (which may be applied equally rigorously and empirically) results in limited evidence of 'social validation'; a mixed methods approach that combines quantitative and qualitative approaches in order to 'generate a more accurate and adequate understanding of social phenomena' (Biesta, 2012) may take us a step further to understanding the 'bigger picture'.

The need to evaluate alternative outcomes
Burgess and Gutstein (2007 p. 80) suggest that self-determination, self-esteem, control of choice, independence and autonomy are 'predictive of well-being' and as such should be included in 'Quality of Life' indicators for people with autism. As structured teaching aims to promote independence and self-esteem, it could be argued that the research evidence indicates positive results in relation to these concepts, for example showing that the approach increases both independent choice making (Watanabe and Sturmey, 2003) and task completion (Hume and Odom,

2007; Hume et al., 2012). However, it is perhaps a little surprising that research evidence neglects to investigate individual levels of self-esteem and while applauding the potential for positive outcomes in relation to behaviours, it is disappointing that only two studies pay any attention to individual internal states relating to 'well-being' (Hume, Loftin and Lantz, 2009) and 'happiness' (O'Reilly et al., 2005). Mesibov and Shea (2011) present a case for considering 'soft variables' for individuals on the spectrum that consider both quality of life and inner experience. Research that investigates these alternative outcomes, alongside research that measures problem and learning behaviours, would enrich the evidence and provide important insight into the 'bigger picture'.

Conclusion
In 2001, Mesibov suggested that structured teaching is underpinned by a Gestalt approach to learning that focuses upon meaningfulness and understanding; in addition, Schopler (2005) reiterates that TEACCH and structured teaching are holistic in their approach. However, this review demonstrates that the existing research evidence fails to capture the 'whole' picture. Future research is needed therefore to:

i. explore how structured teaching components contribute to 'meaningful' learning, investigating *what* children learn in relation to curriculum content and *why* children learn what they learn;
ii. investigate in greater depth the perceptions of those who implement and receive structured teaching interventions by adopting a mixed-method approach; and to
iii. identify the impact of structured teaching upon so-called 'soft outcomes' including quality of life and well-being.

Until research is conducted which investigates all of the above, the evidence base represents only a part of what is a much bigger picture.

Address for correspondence
    Marie Howley,
    School of Education,
    University of Northampton,
    Park Campus, Boughton Green Road,
    Northampton NN2 7AL,
    UK.
    Email: marie.howley@northampton.ac.uk.

Appendix A

Table A1: Record of Structured Teaching research evidence

Study	Structured Teaching component & key words	Participants & setting	Design & methods	Findings	PB	LB	LC
Bennett et al. (2011)	Left to right work system Finished basket Physical structure Visual schedule Routines Engagement Stereotypic behaviours Escape	2 x m 1 x f pre-school ch (24–72 months)	**Study 1:** 2 x m A-B-A-B withdrawal design **Study 2:** multiple base-line across stimuli (puzzles) design 1 x f	**Study 1** Increased engagement and task completion, decrease when returned to base-line condition Reduction in graduated guidance/prompts Reduction in stereotypic behaviour and escape attempts **Study 2** Increased engagement Decreases in stereotypic behaviour Decrease in time needed to complete puzzles Reduction in graduated guidance	X	X	
Betx et al. (2008)	Activity schedule Choice board Peer engagement Peer play Social interaction	3 dyads preschool, 5 x m 1 x f receiving intensive behavioural intervention (lab-based x 1 and public school based x 2)	Non-concurrent multiple baseline design Independent observers, 20 s momentary time sampling	Increased peer engagement, reduced prompts.		X	
Bryan and Gast (2000)	Picture Activity Schedule (book) On-task, off-task, on schedule, off schedule Engagement Task completion	Resource base, 3 m 1f	A-B-A-B design Daily session language/ literacy and art Observations plus social validity Likert scales: teacher, TA, SALT	On-schedule results, increased engagement/on-task/task completion; decreased when schedule withdrawn Social validity – divided opinions regarding whether picture schedule was responsible for students' learning Agreed increases independence and could be used in other classrooms. Agreed could be used for all students, and that they are useful classroom tool		X	X
Buschbacher et al. (2004)	Photo turn taking board, photo/icon choice board, timer, photo/ icon task analysis strips icon self-regulator Engagement Problem behaviours Interaction	1 x m (7 yrs)	Multiple baseline design across routines Social validation	Decreased challenging behaviours Increased engagement Increased interaction	X	X	

Table A1: Continued

Study	Structured Teaching component & key words	Participants & setting	Design & methods	Findings	PB	LB	LC
Chiak and Ayres (2010)	Photo and video schedules Transitions Independence Routines	3 x m (12 & 2 x 13), 1 x f (11)	Alternating treatments design, static/video schedules	Increased independent transitions Static picture x 2 Video x 1		X	
Clarke et al. (1999)	Photo schedule Routines (dressing) Disruptive behaviour Engagement	1 x m (10 yrs)	Reversal design	Increased engagement, decreased disruptive behaviour Reduced time to complete routine	X	X	
Dauphin et al. (2004)	Computer-based activity schedules Embedded video models Picture notebook On-task Choice board	1 x m (3 yrs)	Observations three phases	Increased on-schedule Completed 'say and do' play activities with figures		X	
Dettmer et al. (2000)	Visual supports Transition Schedules Sub-schedules Portable schedule Attention	2 x m (5 & 7yrs)	A-B-A-B design; observations	Less time to respond to information to transition Reduction in verbal prompts Reduction in handling to move Aggression & tantrums in both boys when schedule not used Increased independence 1 child	X	X	
Dooley et al. (2001)	Activity schedule Transitions PECS Pre-school Behaviour: disruptive, kicking, biting, crying, screaming	1 x m (3 yrs) Spec Ed pre-school class T + 2 TAs	Baseline-withdrawal design T and TAs counted instances of disruptive and compliant behaviours during periods of activities	Decreased problem behaviours Increased compliance during transitions Increased positive interaction with teachers. 'allowed more time for learning' (p. 60)	X	X	
Ganz and Flores (2008)	Visual strategies Scripts Peers Verbal communication Unscripted speech	Private pre-school for typically developing ch 3 x m (3–6 yrs)	Changing criterion, single-subject design 4 weeks, 30mins per day, 4–5 days per week. Baseline – followed by intervention; peers given instructions, participants given scripts	Improvements in the use of script phrases, context-related comments, and intervals in which speech occurred for all three participants		X	
Hall et al. (1995)	Photo schedule Engagement On-schedule behaviour Independence	1 x m (7 yrs)	Non-concurrent multiple-baseline design	On-schedule and engagement showed increasing trend Prompt reduction		X	

Table A1: Continued

Study	Structured Teaching component & key words	Participants & setting	Design & methods	Findings	PB	LB	LC
Hume and Odom (2007)	Work system Task engagement Behaviour Independent work & play	3 x m (6, 7, 20 yrs) Play area in classroom University library	A-B-A-B withdrawal of treatment design Social validity pre- and post questionnaire; rating scale 1–5	Increased on-task behaviours Reduced adult prompts Increased independent work and play for all 3 participants. All agreed increased independence, reduced off task behaviour, teacher prompting reduced		X	
Hume et al. (2012)	Individual work system Independence Classroom organisation Generalisation Skills Accuracy of task completion Adult prompting	3 x m (7 yrs) Special education class & general ed. class	Multiple-probe across participants design Social validity: pre post questionnaires, rating scale	Increased task accuracy Generalisation across settings Agreed accuracy, independence, generalisation increased, teacher prompts reduced		X	X
Kimball et al. (2004)	Activity schedules Video models Instructional cues Independence Computer-mediated video-enhanced activity schedules Social skills	1 x m (3 yrs)	Case example: aged 3 computer-based activity schedule; aged 4 video enhancement to teach him how to make play bids	Made play bids for activities portrayed in films		X	
Krantz et al. (1993)	Photo activity schedules Engagement Social initiations Disruptive behaviour	3 x m (6, 7, 8 yrs) Home living tasks	Multiple baseline across participants	Increased engagement & social initiations Decreased disruptive behaviour Maintained 10 months	X	X	
MacDuff et al. (1993)	Photographic activity schedules Behavioural intervention On-task behaviour On-schedule behaviour Engagement	4 x m (2 x 9, 11, 14 yr) Community-based setting	Multiple baseline across participants design	On-task: baseline, considerable variability across sessions, 1 boy almost never scored on-task Increased on-task with each teaching session On-schedule – no scores in baseline for any of the boys. Means of 90% at all stages following teaching. No prompts during maintenance, re-sequencing or generalization phases		X	
Machalicek et al. (2009)	Photo activity schedules play	3 x m (6, 7, 12 yrs)	multiple baseline design across participants	Increased play Decrease challenging behaviours	X	X	

Table A1: Continued

Study	Structured Teaching component & key words	Participants & setting	Design & methods	Findings	PB	LB	LC
Massey and Wheeler (2000)	Photo schedule and verbal directions	1 x m (4 yrs)	Case study	Increased engagement at work and leisure; decreased challenging behaviour at work, increased behaviour at leisure	X	X	
Mavropoulou et al. (2011)	Visual structure Task organisation Visual instructions –, pictures/photos illustrating steps, product sample, jigs, picture dictionaries with written labels & words Visual clarity – limiting irrelevant or extra materials, using colour, large photos Independence On-task/off task Task accuracy Teacher prompts TEACCH	2 x m, (7 yrs) self-contained class special elementary school	Single subject research design A-B-A-B Filmed; observations (15 min sessions, 10 s intervals 10 s to record, 45 intervals per student per session) momentary time-sampling to record on/off task; partial interval recording of teacher prompts; event recording task completion and performance Total 34 sessions recorded. 1–2 sessions per child, per day, 3.6 months Social validity: rating agreement scale PE instructor, school nurse, social worker	Mixed picture; visual instructions had effect on all variables Increase on task & task completion BUT visual structure effective for 1, questionable for 1 Decrease in off task behaviour when tasks visually structured Social validity – pre intervention agreed importance of instructional goals Post – disagreed that students could not play independently Neutral about ability to start and finish 1 play activity Agreed students could not start and finish more than 1 activity		X	
Morrison et al. (2002)	Photo schedules of play choices Defined play areas On-task/off-task Play correspondence Stereotypic behaviour	2 x m (3 & 4 yrs) 2 x f (5 yrs)	Multiple baseline design across subjects Social validity checklist	Increase on-task play behaviours and play correspondence. Combined activity schedules and correspondence packages increased positive behaviours more High level consumer acceptability and usability	X	X	
O'Reilly et al. (2005)	Individual schedules Challenging behaviour, self-injury Engagement	1 x m (12 yrs) d	Multiple baseline A-B-A-B design 30-min observations Anecdotal comments	Significantly less self-injury with schedule Increased engagement TA perceptions – easy to implement Child happier, increased seeking of interaction and communication	X	X	
Pierce and Schreibman (1994)	Photo activity schedules, steps in daily living skill On task Inappropriate behaviours	3 x m (6, 8, 9 yrs)	Multiple baseline probe design across behaviours Probes videotaped, scored via continuous 10-s intervals	Increased on-task Decreased challenging behaviour	X	X	

Table A1: Continued

Study	Structured Teaching component & key words	Participants & setting	Design & methods	Findings	PB	LB	LC
Probst et al. (2010)	Object & Picture schedules Work system Choice board	1 x f (7 yrs) 2 x m (34, 30 yrs) 1 x f (23 yrs)	Single-subject Video Observations Informal conversations & semi-structured interviews	Reduced problem behaviours More predictable and less aggressive Reduced uncertainty & less misunderstanding	X		
Schmit et al. (2000)	Photo schedule Verbal cues Tantrum behaviour	1 x m (6 yrs)	Multiple baseline across-settings design	Combined verbal and visual cues reduced tantrum behaviour	X		
Watanabe and Sturmey (2003)	Activity schedules Task engagement Task behaviour Choice Participation Independence Challenging behaviour Self-stimulatory behaviour	Adult service 3 x m (22, 40, 30 yrs)	Multiple baseline across subjects design Observations: on-task behaviour 1 minute momentary time sampling during 30 min periods.	Increased engagement during intervention and maintenance phases; increased time on-task – noted by researchers as antecedent intervention Decrease dependence upon adult prompts Increased on-task behaviour reduced challenging and self-stim behaviour Completed tasks in set time period 40 min.	X	X	
Welterlin et al. (2012)	Structured teaching Families/parents Physical structure (rug, shelf, table, chair, large basket) Home teaching kit: self-contained tasks (fine motor, cognitive, play, problem-solving, communication Task organisation	20 x ch (2–3 yrs) + parents 10 families treatment group 10 families control (wait list) group	Combination single case design & group design	Single subject: increased independent functioning; increased effective prompting from parents Group comparison: no significant results, 12-week timeframe too short		X	
Zimbelman et al. (2007)	Visual schedules Social stories PE Training teachers On-task	PE setting 17 PE teachers in autism training course	Initial survey – Likert scale 5 categories; 3 open ended qs plus 2 additional qs after training seminar Post survey – usage rate over 7 months, satisfaction rates, perceived effectiveness of tools. 5-point Likert plus open ended qs	Initial survey – analysis SPSS version 13.0 Missing data excluded from analysis Non-parametric dependent Wilcoxon t-test post survey – 75% using schedules in teaching, 64% rated effective or very effective. $P > 0.05$ not significant 6% used SS, 100% rated very effective (only one participant) 75% plan to use schedules in future; 79% would recommend to other PE teachers	X	X	

PB, problem behaviours; LB, learning behaviours; LC, learning curriculum.

References

Banda, D. & Brimmett, E. (2008) 'Enhancing social and transition behaviors of persons with autism through activity schedules: a review.' *Education and Training in Developmental Disabilities*, 43 (3), pp. 324–33.

Bassey, M. (1999) *Case Study Research in Educational Settings*. Buckingham, UK: Open University Press.

Bennett, K., Reichow, B. & Wolery, M. (2011) 'Effects of structured teaching on the behavior of young children with disabilities.' *Focus on Autism and Other Developmental Disabilities*, 26 (3), pp. 143–52.

Betx, A., Higbee, T. & Reagon, K. (2008) 'Using joint attention activity schedules to promote peer engagement in preschoolers with autism.' *Journal of Applied Behavior Analysis*, 41 (2), pp. 237–41.

Biesta, G. (2012) 'Mixed methods.' Chapter 30 In J. Arthur, M. Waring, R. Coe & L. Hedges (eds), *Research Methods & Methodologies in Education*, pp. 147–52. London: Sage.

Bryan, L. & Gast, D. (2000) 'Teaching on-task and on-schedule behaviors to high-functioning children with autism via picture activity schedules.' *Journal of Autism and Developmental Disorders*, 30 (6), pp. 553–67.

Burgess, A. & Gutstein, S. (2007) 'Quality of life for people with autism: raising the standard for evaluating successful outcomes.' *Child and Adolescent Mental Health*, 12 (2), pp. 80–6.

Buschbacher, P., Fox, L. & Clarke, S. (2004) 'Recapturing desired family routines: a parent–professional behavioural collaboration.' *Research and Practice for Persons with Severe Disabilities*, 29 (1), pp. 25–39.

Callahan, K., Shukla-Mehta, S., Magee, S. & Wie, M. (2010) 'ABA versus TEACCH: the case for defining and validating comprehensive treatment models in autism.' *Journal of Autism and Developmental Disorders*, 40 (1), pp. 74–88.

Chiak, D. & Ayres, K. (2010) 'Comparing pictorial and video-modeling activity schedules during transitions for students with autistic spectrum disorders.' *Research in Autism Spectrum Disorders*, 4 (4), pp. 763–71.

Clarke, S., Dunlap, G. & Vaughn, B. (1999) 'Family-centered, assessment based intervention to improve behavior during an early morning routine.' *Journal of Positive Behavior Interventions*, 1 (4), pp. 235–41.

Dauphin, M., Kinney, E. & Stromer, R. (2004) 'Using video-enhanced activity schedules and matrix teaching to teach sociodramatic play to a child with autism.' *Journal of Positive Behavior Interventions*, 6 (4), pp. 238–50.

Dettmer, S., Simpson, R., Smith Myles, B. & Ganz, J. (2000) 'The use of visual supports to facilitate transitions of students with autism.' *Focus on Autism and Other Developmental Disabilities*, 15 (3), pp. 163–9.

Dooley, P., Wilczenski, F. & Torem, C. (2001) 'Using an activity schedule to smooth school transitions.' *Journal of Positive Behavior Interventions*, 3 (1), pp. 57–61.

Ganz, J. & Flores, M. (2008) 'Effects of the use of visual strategies in play groups for children with autism spectrum disorders and their peers.' *Journal of Autism and Developmental Disorders*, 38 (5), pp. 926–40.

Hall, L., McClannahan, L. & Krantz, P. (1995) 'Promoting independence in integrated classrooms by teaching aides to use activity schedules and decreased prompts.' *Education and Training in Mental Retardation and Developmental Disabilities*, 30, pp. 208–17.

Hume, K., Loftin, R. & Lantz, P. (2009) 'Increasing independence in autism spectrum disorders: a review of three focused interventions.' *Journal of Autism and Developmental Disorders*, 39 (9), pp. 1329–38.

Hume, K. & Odom, S. (2007) 'Effects of an individual work system on the independent functioning of students with autism.' *Journal of Autism and Developmental Disorders*, 37 (6), pp. 1166–80.

Hume, K., Plavnick, J. & Odom, S. (2012) 'Promoting task accuracy and independence in students with autism across educational setting through the use of individual work systems.' *Journal of Autism and Developmental Disorders*, 42 (10), pp. 2084–99.

Jones, G., English, A., Guldberg, K., Jordan, R., Richardson, P. & Waltz, M. (2008) *Education Provision for Children and Young People on the Autism Spectrum Living in England: A Review of Current Practice, Issues and Challenges*. London: Autism Education Trust.

Jordan, R. & Jones, G. (1999) 'Review of research into educational interventions for children with autism in the UK.' *Autism: International Journal of Research and Practice*, 3 (1), pp. 101–10.

Kimball, J., Kinney, E., Taylor, B. & Stromer, R. (2004) 'Video enhanced activity schedules for children with autism: a promising package for teaching social skills.' *Education and Treatment of Children*, 27 (3), pp. 280–98.

Krantz, P., MacDuff, M. & McClannahan, L. (1993) 'Programming participation in family activities for children with autism: parents' use of photographic activity schedules.' *Journal of Applied Behavior Analysis*, 26 (1), pp. 137–8.

Kurt, O. & Parsons, C. (2009) 'Improving classroom learning: the effectiveness of time delay within the TEACCH approach.' *International Journal of Special Education*, 24 (3), pp. 173–85.

Lequia, J., Machalicek, W. & Rispoli, M. (2012) 'Effects of activity schedules on challenging behavior exhibited in children with autism spectrum disorders:

a systematic review.' *Research in Autism Spectrum Disorders*, 6 (1), pp. 480–92.

MacDuff, G., Krantz, P. & McClannahan, L. (1993) 'Teaching children with autism to use photographic activity schedules: maintenance and generalization of complex chains.' *Journal of Applied Behavior Analysis*, 26 (1), pp. 89–97.

Machalicek, W., Shogren, K., Lang, R., Rispoli, M., O'Reilly, M., Hertlinger Franco, J. & Sigafoos, J. (2009) 'Increasing play and decreasing challenging behavior of children with autism during recess with activity schedules and task correspondence training.' *Research in Autism Spectrum Disorders*, 3 (2), pp. 547–55.

Massey, N. & Wheeler, J. (2000) 'Acquisition and generalization of activity schedules and their effects on task engagement in a young child with autism in an inclusive preschool classroom.' *Education and Training in Mental Retardation and Developmental Disabilities*, 35 (3), pp. 326–35.

Mavropoulou, S., Papadopoulou, E. & Kakana, D. (2011) 'Effects of task organization on the independent play of students with autism spectrum disorders.' *Journal of Autism and Developmental Disorders*, 41 (7), pp. 913–25.

Mesibov, G. (2001) 'Interview with Professor Gary Mesibov.' *Lookingupautism*, 2 (10), pp. 18–23. <http://www.lookingupautism.org/Articles/GaryMesibov.html> (accessed 12 September 2013).

Mesibov, G., Browder, D. & Kirkland, C. (2002) 'Using individualized schedules as a component of positive behavioral support for students with developmental disabilities.' *Journal of Positive Behavior Interventions*, 4 (2), pp. 73–9.

Mesibov, G. & Howley, M. (2003) *Accessing the Curriculum for Pupils with Autistic Spectrum Disorders: Using the TEACCH Programme to Help Inclusion*. London: David Fulton.

Mesibov, G. & Shea, V. (2010) 'The TEACCH program in the era of evidence-based practice.' *Journal of Autism and Developmental Disorders*, 40 (5), pp. 570–9.

Mesibov, G. & Shea, V. (2011) 'Evidence-based practices and autism.' *Autism: The International Journal of Research and Practice*, 15 (1), pp. 114–33.

Mesibov, G., Shea, V. & Schopler, E. (2005) *The TEACCH Approach to Autism Spectrum Disorders*. New York: Springer.

Morrison, R., Sainato, D., Benchaaban, D. & Endo, E. (2002) 'Increasing play skills of children with autism using activity schedules and correspondence training.' *Journal of Early Intervention*, 25 (1), pp. 58–72.

Norgate, R. (1998) 'Reducing self injurious behaviour in a child with severe learning difficulties: enhancing predictability and structure.' *Educational Psychology in Practice*, 14 (3), pp. 176–82.

Odom, S., Brown, W., Frey, T., Karasu, N., Smith-Canter, L. & Strain, P. (2003) 'Evidence-based practices for young children with autism. Contributions for single-subject design research.' *Focus on Autism and Other Developmental Disabilities*, 18 (3), pp. 166–75.

O'Reilly, M., Sigafoos, J., Lancioni, G., Edrisinha, C. & Andrews, A. (2005) 'An examination of the effects of a classroom activity schedule on levels of self-injury and engagement for a child with severe autism.' *Journal of Autism and Developmental Disorders*, 35 (3), pp. 305–11.

Ozonoff, S. & Cathcart, K. (1998) 'Effectiveness of a home program intervention for young children with autism.' *Journal of Autism and Developmental Disorders*, 28 (1), pp. 25–32.

Panerai, S., Ferrante, L. & Caputo, V. (1997) 'The TEACCH strategy in mentally retarded children with autism: a multidimensional assessment. Pilot study.' *Journal of Autism and Developmental Disorders*, 27 (3), pp. 345–7.

Panerai, S., Ferrante, L., Caputo, V. & Impellizzeri, C. (1998) 'Use of structured teaching for treatment of children with autism and severe and profound mental retardation.' *Education and Training in Mental Retardation and Developmental Disabilities*, 33 (4), pp. 367–74.

Panerai, S., Ferrante, L. & Zingale, M. (2002) 'Benefits of the treatment and education of autistic and communication handicapped children (TEACCH) programme as compared with a non-specific approach.' *Journal of Intellectual Disability Research*, 46 (4), pp. 318–27.

Panerai, S., Zingale, M., Trubia, G., Finocchiaro, M., Zuccarello, R., Ferri, R. & Elia, M. (2009) 'Special education versus inclusive education: the role of the TEACCH program.' *Journal of Autism and Developmental Disorders*, 39 (6), pp. 874–82.

Pierce, K. & Schreibman, L. (1994) 'Teaching daily living skills to children with autism in unsupervised settings through pictorial management.' *Journal of Applied Behavior Analysis*, 27 (3), pp. 471–81.

Preece, D., Lovett, K., Lovett, P. & Burke, C. (2000) 'The adoption of TEACCH in Northamptonshire, UK: a unique collaboration between a voluntary organization and a local authority.' *International Journal of Mental Health*, 29 (2), pp. 19–31.

Probst, P., Jung, F., Micheel, J. & Glen, I. (2010) 'Tertiary-preventive interventions for Autism Spectrum Disorders (ASD) in children and adults: an evaluative synthesis of two TEACCH based outcome studies.' *Life Span and Disability*, XIII (12), pp. 129–67.

Rutter, M. & Bartak, L. (1973) 'Special educational treatment of autistic children: a comparative study.' *Journal of Child Psychology and Psychiatry*, 14 (3), pp. 161–79.

Schmit, J., Alper, S., Raschke, D. & Ryndak, D. (2000) 'Effects of using a photographic cueing

package during routine school transitions with a child who has autism.' *Mental Retardation*, 38 (2), pp. 131–7.

Schopler, E. (2005) 'Cross-cultural program priorities and reclassification of outcome research methods.' In F. Volkmar, R. Paul, A. Klin & D. Cohen (eds), *Handbook of Autism and Developmental Disorders* (vol. 2, 3rd edn), pp. 1174–89. Hoboken, NJ: Wiley.

Schopler, E., Brehm, S., Kinsbourne, M. & Reichler, R. (1971) 'Effect of treatment structure on development in autistic children.' *Archives of General Psychiatry*, 24 (5), pp. 415–21.

Schopler, E., Mesibov, G. & Hearsey, K. (1995) 'Structured teaching in the TEACCH system.' In E. Schopler & G. Mesibov (eds), *Learning and Cognition in Autism*, pp. 243–68. New York: Plenum.

Siaperas, P. & Beadle-Brown, J. (2006) 'A case study of the use of a structured teaching approach in adults with autism in a residential home in Greece.' *Autism: The International Journal of Research and Practice*, 10 (4), pp. 330–43.

Tsang, S., Shek, D., Lam, L., Tang, F. & Cheung, P. (2007) 'Brief report: application of the TEACCH program on Chinese pre-school children with autism – does culture make a difference?' *Journal*

of Autism and Developmental Disorders, 37 (2), pp. 390–6.

Van Bourgondien, M. & Schopler, E. (1996) 'Intervention for adults with autism.' *Journal of Rehabilitation*, 62 (1), pp. 65–71.

Van Bourgondien, M. E., Reichler, N. & Schopler, E. (2003) 'Effects of a model treatment approach on adults with autism.' *Journal of Autism and Developmental Disorders*, 33 (2), pp. 131–40.

Watanabe, M. & Sturmey, P. (2003) 'The effect of choice-making opportunities during activity schedules on task engagement.' *Journal of Autism and Developmental Disorders*, 33 (5), pp. 535–8.

Welterlin, A., Turner-Brown, L., Harris, S., Mesibov, G. & Delmolino, L. (2012) 'The home TEACCHing program for toddlers with autism.' *Journal of Autism and Developmental Disorders*, 42 (9), pp. 1827–35.

Wolf, M. (1978) 'Social validity: the case for subjective measurement or how applied behavior analysis is finding its heart.' *Journal of Applied Behavior Analysis*, 11 (2), pp. 203–14.

Zimbelman, M., Paschal, A., Hawley, S., Molgaard, C. & St.Romain, T. (2007) 'Addressing physical inactivity among developmentally disabled students through use of visual schedules and social stories.' *Research in Developmental Disabilities*, 28 (4), pp. 386–96.