informa
healthcare

REVIEW

Issues in the use of visual supports to promote communication in individuals with autism spectrum disorder

MICHAEL ARTHUR-KELLY[1], JEFF SIGAFOOS[2], VANESSA GREEN[2], BERNICE MATHISEN[1] & RACHEAL ARTHUR-KELLY[1]

[1]*Faculty of Education and Arts, The University of Newcastle, Callaghan, Australia* and [2]*School of Educational Psychology and Pedagogy, Victoria University of Wellington, Wellington, New Zealand*

Abstract

Purpose. Visual supports are widely used and generally regarded as an effective resource for intervention with individuals who function on the autism spectrum. More cross-contextual research into their efficacy is required.
Method and outcomes. In this article, we selectively review the research literature around visual supports based on an original conceptual model that highlights their contribution in the interpersonal social and communicative milieu of classrooms, homes and other daily living contexts. Attention is drawn to a range of practical and research issues and challenges in the use of visual supports as well as evidence of their effectiveness in enhancing participation, learning and social membership in this population.
Conclusions. Areas for further research relating to the introduction and use of visual supports with the autism spectrum disorder population are identified.

Keywords: *Autism spectrum disorder, visual supports, dyads, communication*

Introduction

Becky kisses her mother goodbye and enters her early childhood intervention classroom. Glancing at the notice board as she walks towards Kay, her teacher, Becky frowns. The sequence of six colour photos of her completing the morning routine is missing. Kay immediately realises what the problem is but not before Becky screams and runs out of the room. It was going to be a difficult morning.

Todd is a student with autism spectrum disorder (ASD) in a separate classroom in a secondary school. Having finished 20 min of written work on his self-selected topic of digital engineering, Todd presents a laminated sequence of four black and white photographs describing the activities he has completed to Sue, his teacher. Todd happily receives a voucher allowing him 10 min access to his personal YouTube website and begins to edit it. When the egg timer on the side of the table is empty, he moves to the Velcro array of symbols for class topics on the adjacent cupboard and scans the choices that are available to him. After a few minutes, Todd takes out the symbol for using fractions in everyday life and presents it to Sue, before unpacking the materials box for that topic.

This selective review of the literature provides the reader with a critical discussion of several key issues in the use and evaluation of visual supports for people with ASD. There is an urgency to develop new and more effective rehabilitative efforts to address the needs of individuals with ASD. This urgency stems from two sources. The first is that ASD is associated with a wide range of impairments that affect learning, attention and adaptive behaviour functioning [1]. Although adaptive behaviour deficits have often been targeted in education and rehabilitation [2], there has been less apparent success in addressing other core deficits, such as enabling people with ASD to better understand and cope

with unpredictable and changing environments [3]. A second source of urgency is that there appears to be an increasing number of individuals being diagnosed with ASD. Although in the past, this disorder was considered relatively rare (1 of every 2500 children), it is now estimated to occur in about 1 of every 750 to 1000 children [4]. Thus, rehabilitation professionals will likely be increasingly confronted with individuals with ASD who present with major challenges that are related to deficits in understanding and coping with the change.

As indicated in the introductory vignettes, visual supports can be used in a variety of ways to address individual learning needs, with varying degrees of effectiveness. The following strategic review of the research and practice base for the efficacy of visual supports and people with ASD reflects several implementation issues inherent in the vignettes. Using a simple conceptual model to guide discussion (Figure 1), these issues are analysed in relation to three interacting phenomena: individual needs and communication abilities, dyadic variables and broader socio-cultural variables. Such an analysis, it is hoped, will assist the reader to identify both the challenges and the benefits that can accrue from the use of visual support strategies and resources, leading to a brief agenda for future investigations in this area. First, however, it is vital to define what is meant by the term 'visual supports'.

Visual supports are pictorial and graphic stimuli that enhance comprehension and learning in individuals who may otherwise struggle with communication [5]. Visual supports, often presented in the form of activity schedules [6], highlight a particular meaning, or sequence of meanings and can act to cue the user and their communication partner to shared meanings and expected responses in a given situation. For example, the exchange between Todd and his teacher, Sue, using a laminated strip of photos clarified what Todd had completed and cued what was to happen next for both partners in this interaction.

These resources can play a vital role in improving the social membership and empowerment of people with ASD by providing a framework for meaningful interaction and communication. As the vignettes indicate, however, the effectiveness of visual supports can be either compromised or enhanced by a range of factors. As we will see a little later, critical variables that may influence the effectiveness of visual supports include the specific abilities of the individual person with ASD: for example, sensory preferences, the quality and amount of contextual support available to the person using them and the motivational power of the objects or experiences to which the visual supports refer.

Visual supports can serve to enhance the instructional engagement and connection experienced by individuals with ASD as they interact with members of the augmentative and alternative communication (AAC) team. Typically, collaborative teams of this kind include family members, teachers and health professionals such as speech pathologists and occupational therapists [7]. When used effectively, visual supports have great potential for facilitating and enriching the socio-communicative contexts experienced by people with ASD. In a later section of the article, it will be argued that one of the most powerful potentials in visual supports is the overlay effect. That is, the way in which such supports can be seamlessly integrated with other approaches relevant to the needs and experiences of individuals with ASD. For example, they may represent one strategy that can be used in a variety of applications within a broader set of Positive Behaviour Supports (PBS), to promote and improve pro-social participation in daily activities.

The systematic and thoughtful use of visual supports can assist in the exchange of meanings between communication partners, resulting in improved receptive and expressive language abilities and enhanced social participation in people with ASD. With this human context in mind, Figure 1 places the use of visual supports for individuals with ASD at the centre of three interlinked considerations. This original model and the inter-connections that arise from it will guide discussion in the remainder of this article. Starting from the individual as the unit of focus, the role of interactions amongst individuals with ASD and their various communication partners will be explored, followed by some discussion of issues relating to the broader social and
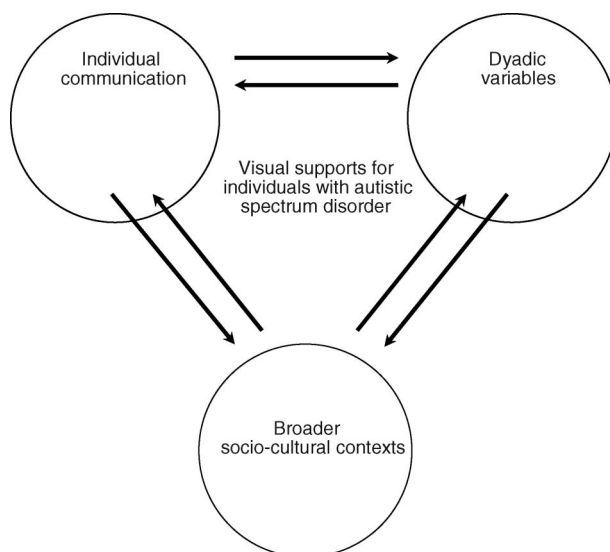

Figure 1. A model highlighting inter-connections in the use of visual supports for individuals with autism spectrum disorder.

cultural contexts experienced by members of this group.

In the following section, the functional role of visual supports will be reviewed to set the scene for later analysis of issues in research and practice involving individuals with ASD. We also briefly describe several of the most commonly used visual support systems.

The functional role of visual supports

Visual supports are aids to learning and communicative interaction that assist in the completion of activities within the person's daily routine. Although they are, perhaps, most commonly used to flag impending changes or transitions for the person with ASD, it is important to note that visual supports can play a variety of roles. These include expressing needs and wants, sensory preferences and emotions (regulatory function), seeking and offering information and reflexive language or self-talk (information-sharing function). In the wider community, visuals of some sort (for example, signposts that incorporate words and pictures, highlighted text in materials we read) assist most people in navigating the complexities of daily life in a busy world. For individuals with ASD, visual supports have a particularly important role to play in improving receptive abilities as well as providing a means of expressing various messages to peers, other family members, friends and other communication partners. Individuals with ASD can be provided with opportunities to initiate and respond appropriately to communicative interactions with those around them, using a symbol system that is individualised and versatile in a range of contexts. Visual supports have enormous practical potential for reducing frustration and repairing trouble when conversational breakdown occurs in situations that may otherwise lead to outbursts of challenging behaviour [5]. They provide motivation for enhanced turn-taking and eye contact and can act as a conduit for the exchange of meanings in contexts that are sometimes necessarily unpredictable, conditions that people with ASD generally find to be unsettling and frequently traumatising [3].

Visual supports can be used to achieve a variety of educational and broader participatory goals for individuals with ASD. First, they can indicate the various choices available to an individual in a given situation and at particular times in the day. Second, they can be helpful in demonstrating in a graphic or other visually centred non-verbal mode the sequence of tasks within an activity or the process of transitioning from one part of an activity to another. A related role may be to signal the need for change including early warnings that one activity is finishing

and another is about to commence. The provision of visual supports for this purpose may have an important preventative role by reducing the possibility of outbursts of challenging behaviour when circumstances change. Third, visual supports can assist individuals with ASD to experience success in expressing emotions appropriately or convey other communicative messages such as requesting, rejecting or a desire to initiate interactions with others. Fourth, visual supports can highlight the behavioural choices available to the person with ASD along with the contingent consequences that will follow those particular choices. Finally, visual supports may allow others to better understand and feel comfortable with the individual who has ASD, and more particularly, assist the partner to identify ways of bridging any gaps in communicative exchanges.

The visual support system used is invariably determined by careful assessment of the individual person with ASD, and especially, their abilities and needs in relation to the successful use of symbols. As demonstrated in Figure 1, a close articulation between the system used and the immediate and wider socio-communicative and socio-cultural contexts surrounding each individual is necessary if their interactions with important people in their world are to be meaningful and empowering. Table I provides some descriptions of common visual support systems.

Table I. A range of common visual support systems.

Type of visual support	How it works
Picture Exchange Communication Systems (PECS) [8]	The focus here is on the social exchange of meanings, with symbols used as the currency of transaction and an emphasis on following the lead of the person with ASD
Activity schedules	A pictorial or graphic sequence that may describe the specific steps within a learning activity or between activities is provided, using symbols such as picture communication symbols [9] used in the Boardmaker programme
Contingency maps	A visual indication of what will happen if the person follows positive expectations is displayed in one pathway or sequence, and can be compared with an alternative pathway if behavioural expectations are not met
Personalised real objects, miniatures, photos or line drawing sequences	Customised sequences of real objects or symbols act as a cue for the target individual to complete each step in a sequence

Figure 1 was introduced earlier as a means of organising discussion about a range of relevant issues in the research and practice base for visual supports and learners with ASD. Implicit in this arbitrary arrangement is the importance of recognising the linkages that exist among individual communicative factors, dyadic (or paired) situations and wider socio-cultural contexts. To commence this discussion, it will be helpful to briefly review the theoretical base for the use of visual supports with this population.

Individual communication needs and abilities

Challenges in mastering the complex nuances of interpersonal communications are among the most obvious hallmarks of autism [1]. Although the precise reasons for this are unclear from an etiological perspective, for practitioners and researchers, the challenge is to find the most effective means of supporting the development of functional receptive and expressive language abilities in people with ASD by using visual supports, therefore, enhancing their social participation, autonomy and quality of life.

In the past few decades, researchers [10–12] as well as individuals with autism [13] have highlighted the way in which human verbal exchanges are transient and can be difficult to follow, especially for individuals with ASD. In contrast, stimuli that are visual in nature have a more tangible and permanent referent and can be more readily used to trigger memory and links between concepts (symbols) and actions. In other words, for many individuals with ASD, the visual pathway is generally regarded as a preferred sensory modality. The use of visuals to guide interactions can produce improvements in various aspects of receptive and expressive language performance and provide a platform for improved pro-social and psycho-emotional abilities. However, it is crucial to understand that the visual modality is only one of the sensory integrative routes available to enhance learning in people with ASD. A complete picture of the person's sensory preferences needs to be considered before programme implementation, as other sensory routes (for example, the tactile, olfactory, auditory, kinesthetic or vestibular senses) may be preferred modalities. With this point in mind, the focus of discussion now turns to the central importance of individualised instructional design for individuals with ASD.

Addressing individualised instructional needs using visual supports

One of the strongest recommendations in the evidence base for visual supports is the need to explore flexibility and customised design in the identification of individually appropriate visual supports [14]. This means that speech pathologists and teachers need to avoid selecting a symbol system and accompanying presentation format (for example, flip photo book, communication board, elevated photographic display) simply because everyone else is using it. Rather, through careful observation, assessment and trialing a system that meets the needs of the individual and that can be used within and across contexts and activities is recommended [15]. One major consideration will be the iconicity of the symbol set.

The strength of the connection between the level of iconicity in various visual (and other) communication supports, and learner proficiency and achievement using such systems continues to fuel debate in clinical and research forums. In one well-known study [16], five visual symbol systems were compared, demonstrating that symbols that were more iconic (those that more closely represented the referent) were attained more efficiently by learners with ASD than those that were more abstract. This phenomenon relates to their learning style and to the fact that nearly half of the children with ASD function in the intellectually impaired range [17]. Although it is not appropriate to explore this complex topic in detail here, the critical point for practitioners is the central importance of rigorously and continually evaluating the effectiveness of selected visual symbols and delivery systems for the individuals with whom they work and all members of the supporting AAC team.

Having identified individually appropriate visual supports, the next step for practitioners is to connect intensive instruction with naturalistic opportunities for AAC use. Again, the main advantage of a unified approach to symbol use is the potential to embed opportunities into each and every learning opportunity and to avoid confusion for the student. This implies appropriate and timely responsivity by all communication partners in the various social and cultural contexts of the learner. Visual supports are situationally relevant, and therefore it is very likely that familiar communication partners will need fewer or at least different visual supports than those who are unfamiliar communication partners.

The question of how to most effectively deliver instructional trials and appropriate levels of assistance in the use of visual supports is reflected in the extant AAC literature. One specific area of research and practice that is currently gaining momentum involves the use of various assistive technology supports to enhance the use of notebooks and other materials that contain activity schedules. In recent

studies using such approaches, the symbols that are unique to a particular student are typically presented in a video or frame by frame format on a computer, allowing the student to self-regulate their progress through the images [6]. The more conventional notebook or other photo/symbol format is still used in other contexts. One exploratory study [18] described how a young student with ASD first mastered a schedule of photographs on the computer, accompanied by the voice of his teacher labelling the various images. The researchers were especially interested in and concerned for the child's ability to initiate play with his peers and so they embedded several video models of appropriate social exchanges in the activity schedules he was familiar and competent with, using the keywords 'Let's play'. By deliberately avoiding additional teacher instruction and delivering only a minimal cue, the researchers [18] discovered that the target student displayed some important improvements in the ability to approach peers and maintain an interaction, although the generalisation and maintenance of these skills was only moderate. Nevertheless, their work highlighted the potential value of assistive technology when accompanied by sound instructional design and a supportive social and communicative environment [19–21]. Regardless of the technology supports used, a central educational goal for persons with ASD will be the expansion of receptive and expressive language abilities in age-appropriate and inclusive contexts.

Enhancing understanding and expressive abilities using visual supports

A theme that characterises much of the literature on visual supports is the positive contribution to understanding of spoken language by people with ASD, accompanied by improved and contextualised expressive language abilities. One recent study [12] compared the use of verbal requests alone with verbal requests combined with picture symbols in a sample of five children with ASD in the age range 5–7 years. Using an alternating treatments design, this researcher included maintenance and generalisation checks to explore the retention and adaptive use of learnt skills in following directions and concluded that 'all participants were more successful in maintaining acquired verbal directives in the presence of pictures than they were when shown no visual supports' (p. 219). Such a finding is consistent with the evidence that individuals with ASD prefer tactile stimuli (where there are no major sensory issues such as tactile defensiveness) and visual types of stimuli rather than auditory–verbal based ones [10].

Integration of visual supports with other intervention strategies

Visual supports utilised for an individual can be overlaid into that person's individual educational plans and programmes, providing a naturalistic opportunity to promote the seamless use of visuals alongside other strategies or preferred sensory modalities. An integrated approach in the use of visual supports also enhances the possibility of maintenance and generalisation in the use of such pro-social and communication skills. Two pertinent examples of approaches that embed the use of visual aids are PBSs and social stories.

Visual supports and PBS

Visual supports are perhaps best considered as an important component in a multi-element, ecologically valid approach to positive behaviour support for people with ASD. PBS is a comprehensive, strengths-based approach to facilitating positive participation by individuals who experience behavioural challenges, and emphasises contextual validity and sustainability for changed repertoires. Leading figures in this area [22] have discussed visual schedules as a type of PBS intervention and noted the inherent value in assisting people with ASD to better understand social conventions, rules, expectations and routines using such resources and interactions. These authors presented a summary of relevant studies that have investigated PBS and visual supports and evaluated the relative strength of the design and findings for each published article.

Through the established strategies of functional assessment, practitioners can identify the particular areas of need for an individual, examples of which may typically include transitions to different activities, the particular rules governing a certain social situation or the nuances of movements within activities [22]. Specifically, data collected using scatterplots, rating scales and other direct or indirect techniques may pinpoint particular people, times of day or activities during which problems are more likely to occur. Specific interventions such as changed partner behaviours, alternate curriculum and other accommodations that include visual schedules or stimuli of some sort can then be introduced. The collection of ongoing data assists in the evaluation of the effectiveness of this intervention for targeted behaviours. Clearly, reductions in distress and/or anti-social behaviours and increases in functional adaptive behaviour in natural environments represent the core goals of the PBS approach.

Along these lines, a contingent mapping strategy was introduced as part of an intervention with an adolescent boy with ASD enrolled in a regular classroom, who was dependent on prompts from others to initiate his set work [5]. As a complement to functional equivalence training, the boy was presented with several contingent pathways using Picture Communication Symbols [9] and the outcomes were compared with an intervention that relied on verbal contingencies only. The focus of the behaviour support plan was self-initiated work on a range of tasks including keyboard and maths, and a central goal for the student was an understanding of the relationships between the antecedent, several behavioural alternatives and the consequences associated with each behaviour. The authors [5] demonstrated that, for this student, the visual pathways describing the 'if-then' choices available to the student, in concert with verbal explanations, were clearly and quickly more effective than verbal information alone. Along with pleasing indexes of procedural fidelity and social validity, this investigation generated new evidence that visual supports can be usefully integrated into positive support plans with good outcomes.

Visual supports and social stories

Another example of an intervention strategy that articulates easily with positive behaviour and visual supports is social stories. Originally described by Gray [23], social stories can assist individuals with ASD to better understand particular social conventions, the perspectives of others and ways to conduct themselves when interacting with others in various situations [24]. The original methodology [23] outlined four specific types of sentences (descriptive, directive, perspective and control), although anecdotally, practitioners working with children on the autism spectrum report that they sometimes focus on only one or two types of sentences in the stories they develop in their educational programmes. In addition, visual aids in the stories were not a feature of the original approach described by Gray but they have gained increasing prominence in her later work [25] and in general practice in educational settings.

A social story contextualises and individualises critical messages about social situations for learners with ASD and provides a stimulus to reflection about the central tenets of interaction: who do I communicate with, why, where, when and how? The context is necessarily authentic because the social story embeds people, activities, settings and other features that are unique to the social experience of the learner. In the same way, the social messages are conveyed using symbols and sequences that are meaningful to the individual and his or her communication partners.

Although the amount and the quality of research into the efficacy of social stories continues to attract some discussion in the research literature [26–29], a small number of studies have nevertheless yielded promising results. Interestingly, social stories have often been used in combination with other strategies, and so although this is typical of applied situations, it has been difficult to isolate the effectiveness of social stories as a stand-alone intervention. One study that sought to address this problem [30] used an ABAB design to investigate the impact of introducing two social stories to a young boy with autism who escalated to tantrums when verbally interruptive behaviours (for example, loud utterances) were not reinforced by attention. The research was conducted at home, where the participant displayed reduced precursors to tantrums and similarly, a lower level of tantrums, following the use of social stories that centred on the conventions around talking with adults (including recruiting attention), and waiting to engage with others. These domains had been identified as critical areas of need in a prior functional assessment of the situation. Both social stories incorporated Picture Communication Symbols [9] with which the child was familiar, and both parents and therapists introduced the social stories as appropriate during sessions and informally.

One of the most interesting points made in this study [30] relates to the potential multiplier effects that were observed during the study. A mini-schedule for the child had been in place before this study, as well as a clock that allowed him to track time in each component activity. Both appeared to be ineffective in preventing verbal outbursts or subsequent tantrums. However, following work on the social stories, including their informal use when necessary *in situ*, the authors [30] noted that the target child was observed to refer to the mini-schedule and the clock more frequently once they had been incorporated in the social stories employed in the study. This spill-over effect suggests that social stories hold potential for enhancing and improving the effect of tailored visual supports that address the particular needs and perspectives of individuals with ASD.

More recently, investigators have provided evidence supporting the argument that social stories can act as a positive unilateral intervention for individuals with autism [31]. Three students with autism were paired with a non-disabled peer in an attempt to use a series of individually relevant social stories to target positive interaction and engagement skills in the participants with autism. In the context of a multiple baseline design, social stories were presented along with checks of language comprehension and play

sessions. In short, the observational data reported in this study indicated important changes in all three participants in relation to their use of specific social skills. Most impressively, gains in generalised usage of the skills were noted, although maintenance effects were somewhat less evident.

Potential for over-dependence on visual supports

Whether it be in the form of planned paraprofessional support in the classroom, teacher use of instructional prompts or the specific provision of a visual aid, the possibility of over-reliance by the learner on additional supports is a complex and challenging consideration for practitioners. Although there is little, if any, specific published research available on this topic, it is possible to identify several potential areas for consideration by educators and related personnel working with students who have ASD. First, a plan is necessary for occasions when the resource or some part of it is lost or misplaced. Components of the plan may include storage of replica visuals, communication with all partners regarding these back-up materials and discussion with the student about how to cope with such an event. Second, educational and support teams will need to actively review the question of whether the selected symbol set is functioning to perpetuate a need for sameness in the students' daily schedule or within activities across the day. If this is the case, it will be vital for communication partners to follow a plan to promote flexibility whilst still assisting the student to participate using visual systems. For example, the team may agree to systematically use time delays to improve the ability of a student to attend to natural cues to transition to another event in the form of peers packing up materials, before the provision of more intrusive assistance such as visual and auditory–verbal prompts.

An underlying issue for practitioners and researchers alike, therefore, is the long-term role of visual supports in educational and lifestyle planning for people with ASD. Green et al. [32] have highlighted the insistence on sameness and resistance to change as defining features of autism, challenges that can be addressed through systematic attention to the development of the skill of behavioural flexibility.

By adjusting the ways in which visual supports are introduced into (and withdrawn from) educational and other interventions, it should be possible to assist individuals with ASD to better cope with and tolerate change. The range and placement of photos on a visual schedule, for example, may be strategically varied daily to enable changes (or choice-making opportunities) in the routine to be signalled, thereby reducing the problems related to insisting on sameness. Teachers, speech pathologists and others working directly with students who have ASD may need to specifically plan to reduce the amount of time and the number of exchanges built upon visual supports by pairing them with verbal interactions while maintaining pro-social behavioural repertoires. In this context, there appears to be little reported research connecting variability in the provision of visual supports to the improvement of coping skills in people with ASD when faced with change. Rather, attention has been paid to investigating the effectiveness of visual supports, and more recently, identifying ways in which such supports can be integrated with other interventions such as social stories and contingent pathways, discussed earlier. Clearly, well-controlled research into the efficacy of strategies that promote the capacity of individuals to cope with change in the milieu of daily life will contribute to the extant autism database.

In summary, visual supports are generally accepted in research and practice as an effective strategy that can be combined with other sensory modalities and interventions to promote the amount and quality of communicative exchange and pro-social behaviour in people with ASD. However, such supports need to be individually appropriate and monitored closely and continually to meet specific needs, including recognition of the potential for over-reliance on them, and planning to enhance or maximise independent functioning. Implicit in such a conclusion is an acceptance that systematic instruction and the provision of contextual supports are critical to the successful use of these augmentative strategies.

If research is to focus on the role of visual supports in relation to addressing some of the central characteristics and needs of individuals with ASD, the role of communication partners, and specifically, how they function in dyadic exchanges, represents a critical area of focus. This aspect is now explored.

Dyadic variables

Following the ecological systems approach pioneered by Bronfenbrenner [33], researchers [34] have drawn attention to the central importance of dyads in the understanding of quality interactions. Writing in terms of their work with individuals who have multiple disabilities and their carers, the authors [34] noted that '... it is especially important that the partner in interaction is sensitive and well aware of the importance of a qualitatively successful interaction ...' (p. 560). Their argument for the achievement of 'goodness of fit' between the individual

communicator and their immediate and wider environment emphasises both the contribution and the responsibility of partners in the achievement of successful communicative interactions [35].

With this concept of ecological complexity in mind, there appears to be little published research that has focussed specifically on the amount or the quality of partner responsivity or initiation of communicative activity involving people with ASD. Typically, partner responding has been embedded within interventions such as the introduction of social stories, contingency maps, PECS (Picture Exchange Communication System) [8,36] and other communication-based supports. In a review of the research base for several AAC techniques, a leading authority [37] made the salient point that, in relation to PECS, more research was needed to investigate the contribution of the specific exchange process (when compared to the selection of symbols using pointing in other approaches) to the overall effectiveness of the system. With reference to Figure 1, discussion now turns to the question of how particular partner behaviours may serve to elicit communicative continuity using PECS and other systems, and conversely, the nature of partner characteristics that may serve to produce an unsuccessful interaction.

Partner responsivity and initiation of communicative exchanges

An implicit feature in the use of visual supports for individuals with ASD is the process of communicative exchange. In a typical scenario, Person A initiates, Person B responds and so on [38]. Clearly, if a communication partner cues the person with ASD (perhaps using a combined gesture such as a point, verbal directive and visual aid) and there is no response, the communication breaks down and no repair strategy is put in place. Similarly, if a person with ASD initiates an exchange and no one responds, it is possible that they may repeat the verbal effort before escalating certain (challenging) behaviours to get their needs met. Alternatively, they may withdraw altogether having experienced 'learned helplessness', making future exchanges less likely.

Careful timing with respect to the delivery of instructional prompts, including the strategic use of delays and an ability to extend and develop the communicative functions of students with ASD beyond simplistic requests and/or negation, activity steps, routines and transitioning to the more complex realms of emotional expression represent important skills for communicative partners. Some authors [12] have suggested that teachers who introduce visual supports for their students usually follow a general sequence of:

- conducting a task analysis of the particular schedule or activity for an individual child
- selecting individually appropriate visual supports for each step
- delivering explicit instruction in the use of visual supports, accompanied by appropriate prompting, fading and reinforcement procedures (p. 28).

Clearly, the ability of the teacher and other communication partners to isolate and take account of the idiosyncratic needs and abilities of each student will be central to the success of any communication intervention. Anecdotally, practitioners report that reading the intent in their student's pre-verbal and verbal behaviours as well as their construction of meaning using various symbols is a central feature of their instructional programmes. Similarly, systems such as PECS mandate a connection amongst participants as a feature of the exchange of meaning.

Although there appears to be quite a range of advice available to practitioners in the literature, there is relatively little data reported to isolate best practice by dyads in the use of visual supports with this population. Future investigations could usefully explore (a) the observed abilities of communication partners including parents, siblings, peers, teachers and therapists in relation to initiating exchanges involving visual supports with individuals with ASD, and maintaining them once they have commenced, and (b) factors that promote or impede the process of communication partner support in the use of visual communications with individuals who have ASD. One such issue that may emerge as critical to the successful use of visual supports is the degree of portability and inclusivity that they achieve in daily interactions between people with ASD and their communication partners.

Portability and inclusivity in the use of visual supports

Anecdotally, practitioners working with children who have ASD report difficulties in ensuring that visual supports used with individuals are portable and transfer easily and inclusively to different settings and partners. Increasingly, studies into the use of visual supports with this population are incorporating generalisation phases to explore the success or otherwise of such supports under different conditions. Research designs of this kind should necessarily include the impact of transferring the visual

system to varying contexts to maximise the role of peers, siblings, friends and other important communication partners in all of the everyday situations typically experienced by individuals with ASD. Difficulties in integrating and extending prior learning experiences into new contexts may be a defining feature of individuals with ASD in terms of their communicative competence [39]. Visual supports may serve as a bridge to facilitate access and participation for individuals with ASD in novel situations, if appropriate preparation and scaffolding is provided to all participants in those human contexts.

One recent investigator [40] utilised the Photovoice strategy described in an earlier study [41] in a manner that supported the development of rich human ecologies for students with ASD in regular classrooms. The most innovative aspect of this action research was the way in which photos were used to achieve two goals: improvements in the quantity and quality of student communicative interactions and the professional development of teachers supporting the students with ASD in the general classroom. Briefly, the target students and their teachers took photos of items or activities that represented aspects of their involvement in an inclusive learning environment. Some teachers, for example, took photos of their children with autism participating in the classroom activities. These photos were then shared with colleagues and formed the basis of discussions about themes such as group membership and belonging and how the participation of particular children in the classroom presented challenges and benefits to the teacher and the whole class. Likewise, the target students with autism were encouraged and supported to photograph preferred items, activities and foods that were personally meaningful to them. The photos were then used as a catalyst to enhance the social memberships and peer interactions of the students through paired and whole group activities.

The author [40] notes that two themes emerged in the student photovoice sessions. First, the importance of using structured activities to increase participation of children with autism and integrating the use of topics selected by the student in order to assist them to engage with peers (p. 46). Second, teachers indicated that the photovoice activities provided valuable opportunities to be reflective on how best to include students with ASD in the social and communicative milieu of the regular classroom.

In summary, current research and practice highlight several clear implications for communication partners who are trying to maximise engagement and participation in people with ASD. First, all personnel, including peers, teachers, speech pathologists, siblings and family members, play a vital role in ensuring that visual supports are effective in enhancing the comprehension of oral and written language and increasing the likelihood of appropriate socialisation. Second, interactions using visual supports involve the skills of sensitive and timely initiation and response and a clear understanding of the importance associated with dyadic processes. Finally, all communicative partners need to utilise a reflective, systematic and co-ordinated approach to their role in dyads, as a central part of planning for learning support.

To this point, discussion of visual supports has centred on the individual needs of people with ASD and the nature of their interactions with specific communication partners (dyads). As Figure 1 indicates, individuals and dyads cannot be viewed in isolation. Rather, they function in larger socio-cultural contexts and it is to this area that attention now turns.

Broader socio-cultural contexts

Programming across settings and people

The SCERTS Model [42] is an exemplar of modern data-based approaches to assessment and programming for the whole of life experiences of people with ASD. SCERTS takes a family-centred, transactional approach to prioritising learning targets and designing programmes that address the communicative and socio-emotional needs and abilities of individuals with ASD. Recognition of the importance of ecological validity and an understanding of the complex interdependencies that influence each person with ASD (and those around them) are hallmarks of this contemporary approach. Within SCERTS priority goals, visual supports are identified as part of the larger transactional scaffolds that are critical to educational and learning experiences for people with ASD. These types of goals recognise both emerging developmental abilities and principles of effective instruction that have a basis in applied behaviour analysis.

Building on the seminal work of people such as Strain [43], the authors of SCERTS [42] argue that 'most children with ASD are capable of learning in natural activities and inclusive environments, as long as the environmental and interpersonal contexts are modified to match their unique learning style and social-communicative needs of the child' (p. 302). There are several implications of such an approach for the successful use of visual supports. Perhaps, the most compelling is the argument for further research into the effectiveness of visual supports with same-aged peers in inclusive educational situations. Strain [43], amongst others, has underlined the veracity of

data pointing to the positive outcomes that are available to individuals with ASD when they are full members of the classrooms to which they would normally belong in the absence of a finite and possibly stigmatising diagnosis. This article has reviewed several studies involving students with ASD who are participating in regular settings, involving a variety of visual applications. The emphasis in those discussions was upon the individual needs and the dyadic processes and opportunities experienced by students with ASD. However, it is also important to note the broader socio-communicative and socio-cultural possibilities that become available in inclusive programmes, and to pose questions that can inform future research agendas.

For example, what is the impact of peer-cued use of visual supports for children with ASD in incidental learning activities? Is there evidence of a relationship between what happens in the more structured environment of the classroom and the regular school playground? Does structured peer-tutoring have a role to play in promoting the use of visuals supports for this group? How do visual supports influence the participation of individuals with ASD in other settings such as sporting activities and culturally diverse whole-school activities?

Moving beyond educational settings, more investigation of the variables that impact family dynamics and, especially, the use of visual supports in the home and community is needed. Consistent with their emphasis on support for the family as well as the child with ASD, the SCERTS team [42] note that '..the crucial role played by all caregivers and partners is recognized, with specific efforts directed to development of mutually satisfying and effective social–emotional experiences based on an understanding of a child's and family's needs' (p. 313). With this in mind, family-centred investigations could usefully explore (a) the degree to which siblings play a role in cueing and extending the communicative engagement of family members with ASD using visual supports, (b) the nature of specific communication opportunities and routines that exist in the context of family life and the effectiveness of interventions that seek to enhance these processes and (c) the potential role of visual supports in relation to the participation of the family and the person with ASD in recreational, cultural and other life activities in the wider community.

Generalised and sustained supports in wider contexts

There appears to be a need for interventions and accompanying research designs that include thorough attention to the various aspects of skill maintenance and generalisation by individuals who use visual supports and those they engage with. A review of this issue in relation to the AAC data base more generally [44] stated that 'generalization and maintenance must be actively promoted through the application of appropriate strategies from the onset of the intervention process rather than merely assessed post facto' (p. 534). In other words, as reflected in several studies reviewed in this article, planning for how generalisation will be measured and promoted, as well as the identification of strategies for checking on whether social and communicative gains are retained following intervention, needs to become an integral part of intervention processes.

Effectively, a plan to extend the number and quality of the social and communicative contexts experienced by people with ASD should be a core component of individual education and support protocols. In addition, family and community life activities represent an ideal milieu for the generalised and maintained the use of visual supports, and regular checks for effectiveness and partner responsivity should be carried out.

Research implications

To date, research efforts have centred on the efficacy of visual supports such as schedules and pictorial sequences for individuals with ASD. Members of this group typically prefer stimuli other than verbal inputs, and predictable, reasonably static learning situations. In discussion to this point, it has become clear that a considerable body of evidence supports the effectiveness of visual supports in improving understanding and expressive ability in this group. Likewise, visual supports appear to have a significant role in increasing emotional resilience and in decreasing the possibility of challenging behaviours in individuals with ASD by providing a means of decreasing frustration and improving communicative engagement with others.

Recently, some researchers have begun to explore the construct of behavioural flexibility as a desirable positive goal for educational and other interventions designed to assist individuals with ASD [32,45]. As noted earlier, visual supports, although integral to the understanding of routines during and across daily activities, may also actually function to inhibit such flexibility by reinforcing set patterns of anticipating, responding to and controlling daily events. That is, individuals with ASD may develop an inappropriate over-reliance on particular sequences of activities cued by visual aids and find themselves unable to cope when these supports are not available

(as reflected in one of the opening vignettes). This is neither to condemn the role nor the effectiveness of visual supports. Rather, more research is needed to identify intervention guidelines that reflect the value-added features of visual supports and identify appropriate counter-balances to reduce or eliminate dependence issues.

Further research is needed to establish whether it is possible to retain the use of visual supports for people with ASD whilst also increasing the ability to flow with changes as they arise throughout and across activities. To answer this question, it is first necessary to have appropriate instrumentation with which one can measure the 'ability to change' in members of the population with ASD. Green et al. [32] have contributed a scale that allows the collection of data about individual abilities in relation to change. This instrumentation is a valuable starting point for research into interventions designed to foster this skill of flexibility and reduce adherence to the need for sameness. As they note [32], the potential outcome of an over-reliance by individuals with ASD on orderly events and sequences of events is a restriction in life quality, sometimes driven by outbursts of anti-social, challenging behaviours. In other words, an inability to cope with even minor changes or unexpected aspects of stimuli present in a given situation instead finds expression in a class of behaviour that is destructive and violent at worst and repetitive and stereotypic at best [32].

The Behaviour Flexibility Rating Scale (BFRS) [45] comprises 15 items that explore change situations or events relevant to individuals with autism and other developmental disabilities. Using a four-point Likert Scale to describe the severity of the problem (not a problem/mild/moderate/severe), informants such as teachers and parents rate a target individual in relation to items in five areas. These are (1) changes to preferred items, (2) alterations to desired events or activities, (3) unexpected sensory stimulation, (4) failure on a task and (5) an unfinished task. Following a period of trialing and development, the BFRS has recently been subjected to a factor analysis that yielded several key findings [45]. Most importantly, individuals with autism were described in the scale in terms of two factors: interruption/disruption (how to react to or deal with unexpected changes to plans) and position/location (alterations to some aspect of the person's physical environment). Future studies are planned to explore the properties of the BFRS, and in due course, to examine the degree to which interventions that teach specific skills related to these factors (for example, waiting to see what possibilities emerge in a dynamic situation, rather than withdrawing or externalising frustration) can achieve sustainable improvements in life experiences for this complex group.

A final comment about the focus of current and future research is necessary before we conclude. The vast majority of published research has targeted young children with ASD and this is admirable in the face of extant data about the role of early intervention in preventing or ameliorating later difficulties. However, the whole-of-life experience that is the phenomenon of ASD means that many individuals continue to experience many challenges to participation and self-actualisation throughout their adolescence and adult years. Areas that could usefully be addressed in future research programmes include (a) the maintenance and generalisation of visual aids (and other sensory modalities) and PBS strategies by people with ASD across the life span, (b) the perceptions of families and others who live with and care for members of this group with a focus on issues in the use of visual supports and (c) the nature of socio-communicative and socio-cultural demands and opportunities present in the varied contexts in which adults with ASD function.

Conclusion

In this article, issues of research and practice in the use of visual supports for people with ASD have been explored in the context of a conceptual model that focusses on the complex nature of human socio-cultural ecologies. Perspectives from both the research base and the insights of practitioners working in this area of educational and therapeutic support have been explored. Moving from a focus on the individual, their connection with specific communication partners and the broader socio-communicative contexts that impact each person in this group, it became apparent that visual supports hold much promise for the enhancement and extension of communication and language abilities in people with this complex and lifelong disability.

However, more research is needed in the areas of behavioural flexibility and aspects of generalisation relating to the introduction of visual supports for people with ASD. Questions that were explored included the potential role of visual supports in addressing executive functioning deficits and enhancing the ability to cope with change, the importance of practitioners minimising over-dependence on visual supports in children with ASD and the issue of how broader social, cultural and communication contexts typically experienced by individuals with ASD can most effectively serve as instructional environments in the promotion of pro-social and adaptive skills.

In sum, then, the challenge of fostering the communicative engagement of individuals with ASD is both complex and vital, a point made elegantly by Mirenda [37]. 'In the end, the combination of

individualised modality selection, excellent instruction and ''goodness of fit'' ... with regards to environments, communication partners and communication needs are all needed to maximize the possibility of successful communication for individuals with autism' (p. 213). Visual supports have a central role to play in achieving such a goal.

Acknowledgements

References

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington, DC: Author; 2000.
2. Lovaas OI. Teaching individuals with developmental delay: Basic intervention techniques. Austin, TX: Pro-Ed; 2003.
3. Green VA, Sigafoos J, Pituch K, Itchon J, O'Reilly M, Lancioni GE. Assessing behavioral flexibility in individuals with developmental disabilities. Focus Autism Other Dev Disabl 2006;21:230–236.
4. Chakrabarti S, Fombonne E. Pervasive developmental disorder in preschool children. J Am Med Assoc 2001;24:3093–3099.
5. Brown K, Mirenda P. Contingency mapping: Use of a novel visual support strategy as an adjunct to functional equivalence training. J Positive Behav Interv 2006;8:155–164.
6. Stromer R, Kimball J, Kinney E, Taylor B. Activity schedules, computer technology, and teaching children with autism spectrum disorders. Focus Autism Dev Disabl 2006;21: 14–24.
7. Balandin S, Sweep A, Hand L. Communicating together: Functional communication in the classroom. In: Foreman P, editor. Inclusion in action. 2nd ed. Melbourne: Thomson; 2008. pp 344–387.
8. Bondy AS, Frost LA. The picture exchange communication system. Focus Autistic Behav 1994;9:1–19.
9. Mayer-Johnson Co. Picture communication symbols combination book. Solana Beach, CA: Author; 2000.
10. Hermelin B, O'Connor N. Psychological experiments with autistic children. Elmsford, NY: Pergamon Press; 1970.
11. Mirenda P, Schuler A. Augmenting communication for persons with autism: Issues and strategies. Top Lang Disord 1988;9:24–43.
12. Preis J. The effect of picture communication symbols on the verbal comprehension of commands by young children with Autism. Focus Autism Dev Disabl 2006;21: 194–210.
13. Grandin T. Thinking in pictures and other reports from my life with autism. New York: Doubleday; 1995.
14. Rao S, Gagie B. Learning through seeing and doing: Visual supports for children with Autism. Teaching Exceptional Children 2006;38:26–33.
15. Wilkinson KM, McIlvane WJ. Considerations in teaching graphic symbols to beginning communicators. In: Reichle J, Beukelman DR, Light JC, editors. Exemplary practices for beginning communicators: Implications for AAC. Baltimore: Paul. H. Brookes; 2002. pp 273–321.
16. Kozleski EB. Visual symbol acquisition by students with autism. Exceptionality 1991;2:173–194.

17. Nation K, Norbury C. Why reading comprehension fails: Insights from developmental disorders. Top Lang Disord 2005;25:21–32.
18. Kimball JW, Kinney EM, Taylor BA, Stromer R. Video enhanced activity schedules for children with Autism: A promising package for teaching social skills. Educ Treat Child 2004;27:280–299.
19. Delano M. Video modeling interventions for individuals with Autism. Remedial & Special Education 2007;28:33–42.
20. Hine J, Wolery M. Using point-of-view video modeling to teach play to preschoolers with Autism. Top Early Child Spec Educ 2006;26:83–93.
21. Maione L, Mirenda P. Effects of video modeling and video feedback on peer-directed social language skills of a child with autism. J Positive Behav Interv 2006;8:106–118.
22. Bopp KD, Brown KE, Mirenda P. Speech–language pathologists' roles in the delivery of positive behavior support for individuals with developmental disabilities. Am J Speech Lang Pathol 2004;13:5–20.
23. Gray C. The original social stories book. Austin, TX: Future Horizons; 1993.
24. Gray C, Garand J. Social stories: Improving responses of students with autism through accurate social information. Focus Autistic Behav 1993;8:1–10.
25. Gray C, White AL. My social stories book. London: Jessica Kingsley; 2002.
26. Ali S, Frederickson N. Investigating the evidence base of social stories. Educ Psychol Pract 2006;22:355–377.
27. Reynhout G, Carter M. The use of social stories by teachers and their perceived efficacy. Res Autism Spectr Disord 2009;3:232–251.
28. Reynhout G, Carter M. A pilot study to determine the efficacy of a social story intervention for a child with autistic disorder, intellectual disability and limited language skills. Austral J Special Educ 2008;32:161–175.
29. Rust J, Smith A. How should the effectiveness of social stories to modify the behaviour of children on the autistic spectrum be tested? Autism: Int J Res Prac 2006;10:125–138.
30. Lorimer P, Simpson R, Myles B, Ganz J. The use of social stories as a preventative behavioral intervention in a home setting with a child with Autism. J Positive Behav Interv 2002;4:53–60.
31. Delano M, Snell M. The effects of social stories on the social engagement of children with Autism. J Positive Behav Interv 2006;8:29–42.
32. Green VA, Sigafoos J, Pituch KA, Itchon J, O'Reilly M, Lancioni GE. Assessing behavioral flexibility in individuals with developmental disabilities. Focus Autism Dev Disabl 2006;21:230–236.
33. Bronfenbrenner U. The ecology of human development: Experiments by nature and design. Cambridge, MA: Harvard University Press; 1979.
34. Wilder J, Granlund M. Behaviour style and interaction between seven children with multiple disabilities and their caregivers. Child: Care, Health Dev 2003;29:559–567.
35. Siegel-Causey E, Bashinski S. Enhancing initial communication and responsiveness of learners with multiple disabilities: A tri-focus framework for partners. Focus Autism Dev Disabl 1997;12:105–120.
36. Ganz JB, Simpson RL, Corbin-Newsome J. The impact of the Picture Exchange Communication System on requesting and speech development in preschoolers with autism spectrum disorders and similar characteristics. Res Autism Spectr Disord 2008;2:157–169.
37. Mirenda P. Toward functional augmentative and alternative communication for students with Autism: Manual signs, graphic symbols, and voice output communication aids. Lang Speech Hear Serv Schools 2003;34:203–216.

38. Butterfield N, Arthur M. Shifting the focus: Emerging priorities in communication programming for students with a severe intellectual disability. Educ Train Ment Retard Dev Disabl 1995;30:41–50.

39. Frith U. Autism. 2nd ed. Oxford, UK: Blackwell; 2003.

40. Carnahan CR. Photovoice. Engaging children with Autism and their teachers. Teaching Exceptional Child 2006;39: 44–50.

41. Kroeger S, Burton C, Comarata A, Combs C, Hamm C, Hopkins R, Kouche B. Student voice and critical reflection: Helping students at risk. Teaching Exceptional Children 2004;36:50–57.

42. Prizant BM, Wetherby AM, Rubin E, Laurent AC. The SCERTS model: A transactional, family-centered approach to enhancing communication and socioemotional abilities of children with autism spectrum disorder. Infants Young Child 2003;16:296–316.

43. Strain P. Empirically based social skill intervention: A case for quality-of-life improvement. Behav Disord 2001;27:30–36.

44. Schlosser RW, Lee D. Evidence-based strategies for promoting generalization and maintenance. In: Schlosser RW, editor. The efficacy of augmentative and alternative communication: Toward evidence-based practice. San Diego: Academic Press; 2003. pp 533–552.

45. Pituch KA, Green VA, Sigafoos J, Itchon J, O'Reilly M, Lancioni GE, Didden R. Factor structure of the Behavior Flexibility Rating Scale (BFRS). Res Autism Spectr Disord 2007;1:55–66.