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Increasing Independence in Autism Spectrum Disorders: A Review of Three Focused Interventions

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Abstract The features of autism that inhibit the independent demonstration of skills, as well as three effective interventions for increasing independence, are explored in this review article. Independent performance may prove difficult for individuals with autism spectrum disorders (ASD) due to the core deficits of the disability, as well as executive function deficits that impact initiation and generalization. These difficulties, coupled with intervention strategies that encourage over-reliance on adult support, contribute to poor long term outcomes for adults with ASD in employment, housing, and relationship development. Self-monitoring, video modeling, and individual work systems each emphasize a shift in stimulus control from continuous adult management to an alternative stimulus and have proven successful in addressing executive function deficits and increasing independence.

Keywords Autism · Independence · Executive function · Self-monitoring · Video modeling · Work system

Autism spectrum disorders (ASD) are characterized by challenges in the areas of social functioning, communication, and the presence of stereotypic and repetitive behaviors. Despite difficulties across these developmental domains, with the support of caregivers and interventionists, many individuals with ASD acquire and demonstrate a wide range of skills. A challenge arises; however, as individuals with ASD are often unable to continue to use these skills once professional support fades and independent use of skills is expected. Without continued adult prompts, individuals may not display target skills and spontaneous responses may not generalize or continue over time (MacDuff et al. 1993). Individuals with ASD may continue to rely on the presence of an adult or treatment contingency to remain engaged or to complete activities (Stahmer and Schreibman 1992). The removal of close supervision, adult prompting, or contingencies may lead to a backslide, such as reoccurrence of off-task behaviors or a decline in engagement and productivity across settings (Dunlap and Johnson 1985).

Difficulty with independent functioning impacts the overall outcomes for individuals with ASD. Several studies indicate that adults with autism, despite IQ scores, rely heavily on others for support in employment, living, and relationships. In a study of 68 adults with ASD who had IQs above 50 in childhood, over 50% had outcomes described as poor or very poor (Howlin et al. 2004). Eight of the individuals were independently employed, an additional 14 worked in a sheltered setting, and 36 adults were unemployed. The majority did not have any friends or acquaintances, and only three individuals lived outside of their parent's home with minimal support (Howlin et al. 2004). A more recent study of the outcomes of 48 young adults with ASD indicated similar results, with 50% of respondents across the IQ range indicating poor outcomes (Eaves and Ho 2008). At 24 years old, four of the individuals lived independently, while 44 lived with families or in group homes.

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Only one individual received a competitive salary in an employment setting, while almost half of the group (44%) had never been engaged in any work, including volunteer, part-time, or sheltered work opportunities (Eaves and Ho 2008).

Concerns exist even among individuals who are considered to be among the higher functioning individuals with ASD. One investigation compared 35 individuals with Asperger Syndrome to 32 individuals with higher functioning autism (HFA; i.e., autism without significant overall cognitive deficit) found that individuals diagnosed with Asperger Syndrome had significantly higher verbal IQ scores than a group of individuals with HFA, yet the adaptive functioning of the individuals with Asperger Syndrome was equally impaired (Saulnier and Klin 2007). While significant deficits in cognitive functioning and core deficits in social and communication skills certainly contribute to the concerning outcomes of individuals with ASD, it is likely that other factors, such as limited independent performance and an overreliance on caregiver prompts and feedback, are also significant contributors.

Difficulties in independent functioning also create challenges for young people with ASD in school. In a survey of over 700 school personnel serving students with disabilities in a variety of capacities (teachers, paraprofessionals, administrators), respondents indicated that students with disabilities, including ASD and other impairments, spend more than 86% of their day with a paraprofessional within 3 feet of them (Giangreco and Broer 2005). While the use of a paraprofessional may temporarily remedy issues around student independence by providing additional prompts and support, research has indicated that excessive adult proximity may be detrimental (Giangreco et al. 1997). Constant adult involvement can pose many difficulties for students with ASD, who may rely on the proximity of support staff to complete tasks, and may face great difficulty when the additional staff is not available in residential or employment settings.

Outcomes in both school and in work life highlight the need for a greater understanding of why independent functioning can be arduous for individuals on the spectrum. In this article we explore some of the features of ASD that contribute to difficulty with independent behavior, including initiation, generalization, and prompt dependence. Then, three interventions that promote independent functioning are discussed.

Features of Autism Contributing to Independence Difficulties

Impairments in the social and communication domain, as well as engagement in restricted, repetitive, and stereotypic behaviors contribute to the challenges around independent performance. Deficits in the areas of joint attention and imitation are well documented and may limit an individual's ability to watch others in an effort to learn skills necessary for independent functioning (Thurm et al. 2007). Delayed or limited communication and/or social interest may reduce overall spontaneity in skill demonstration, thus increasing the need for adult prompting and support (Charlop and Haymes 1994). In addition, individuals with ASD often need caregiver assistance and redirection to disengage from repetitive or stereotypic behaviors which may interfere with school or work activities (Zandt et al. 2007). Once this intense level of caregiver support is provided, it may be difficult to fade support over time due to an individual's resistance to change or insistence on sameness, consequently impacting long-term independent functioning.

It is well established that individuals with ASD demonstrate a variety of impairments in executive functioning, which also contribute to independence difficulties. Executive functioning is considered to be the ability to maintain problem-solving set to guide future behavior (Welsh and Pennington 1988). Of particular difficulty for people with ASD are dealing with new situations and processing complex information (Minshew et al. 2002), which are common occurrences when functioning independently in everyday life. Individuals with ASD also perform more poorly than typically developing peers on measures of executive function that require problem-solving through planning and the identification of the steps needed to reach a target goal (i.e., "tower" tasks, for example; Tsatsanis 2005).

It is clear, then, that deficits in executive functioning can contribute to difficulties with independent behavior. Executive functioning certainly relates to the difficulties outlined below. While this list is by no means exhaustive, it is illustrative of the clinical and research information on factors that inhibit independent behavior for individuals with ASD.

Initiation

The ability to regulate or manage behavior is considered to be one subdomain of executive function, which includes initiating, monitoring, and evaluating behavior. Initiation can be particularly challenging for individuals with ASD, whether they are expected to initiate a social interaction, a household chore, or begin a homework assignment. There are a number of internal, as well as environmental, reasons why initiation may be difficult. These include, but are not limited to:

1. Planning: Difficulties in planning, as described above, can contribute to an individual's difficulty with

initiation. Individuals with ASD may have difficulty with both motor planning, such as preparing for or anticipating movement (i.e., Rinehart et al. 2006), planning the steps required to complete an activity, and planning an appropriate response in a given situation.

2. Processing speed: Not all individuals with autism display significant and obvious impairments in processing speed, but many do. Speed of information processing is likely impaired with higher cognitive demands. For example, individuals with ASD have been demonstrated to take longer than typical peers to initiate responses guided by internal representations (Luna et al. 2007). Thus, individuals with ASD may not initiate behaviors simply because they have not yet processed the relevant stimuli in order to generate a response.
3. Attention to relevant environmental stimuli: It is often difficult for individuals with autism to notice and attend to relevant aspects of their environment, which can make it difficult to register cues that it is time to initiate new behaviors. This is discussed in more detail in the generalization section below.
4. Motivation: Positive incentives are often necessary to motivate individuals with ASD to attend to and practice new behavioral routines. Without the provision of extrinsic motivation (e.g., positive reinforcers, motivating activities, etc.), individuals with autism may not be sufficiently stimulated to initiate behaviors.
5. Unclear expectations: When the expectations of others are unclear or ambiguous, individuals with ASD may not understand that they are expected to initiate a particular behavior or that particular qualities are required in an expected behavior. When uncertain about whether a behavior is required or about the details of a behavior, the person with autism may not initiate the behavior at all.

A lack of verbal and nonverbal social initiations is particularly common in ASD, even among individuals with autism who have the skills to respond to other's social overtures (Mundy and Stella 2000). This is particularly concerning because when people with ASD do not initiate, they do not seek out social and verbal learning opportunities and miss opportunities to gain valuable information from the environment (Peck 1985). They may also fail to ask for support or assistance when it is truly needed. People who do not make social initiations fail to get the responses that normally come from such statements and are limited to only the information that others provide to them. Individuals with ASD often lack the learning opportunities and independence that accompanies the ability to seek out information from the environment (Koegel et al. 1999a, b).

Generalization

Difficulties in an individual's ability to demonstrate skills across settings also impacts independent performance. Though people with ASD may master a skill or routine in one location, with one staff member, or while using one material, generalization of that independent skill may be limited (Fein et al. 1979). Challenges in generalization may be present for several reasons, including poor flexibility, difficulty relating new stimuli to past experiences, and lack of responsiveness to cues.

Recent research into cognitive theories in autism identifies the potential impact that poor mental flexibility may have on one's ability to generalize (Hill 2004). Even more than in other disorders that affect executive functioning (e.g., Tourette syndrome), cognitive flexibility is an area of particular impairment in autism (Solomon et al. 2007). Individuals with autism demonstrate difficulties in the ability to shift to a different thought or action according to changes in the environment or situation (Hill 2004). These difficulties may be intensified in individuals with autism due to the conditions in which students are often taught (Billingsley et al. 1984). Students with ASD are frequently taught specific skills with limited stimulus, staff members, consequences, and/or settings, thus limiting the likelihood of generalization due to the impact of existing stimulus control (Horner et al. 1989).

Rimland (1964) suggested that children with autism have extreme difficulty relating new stimuli to past experiences due to a highly specific memory and the inability to integrate experiences. Slight environmental changes, such as a new location in the classroom, a new staff member, or a new manipulative, may be considered major for the child with autism, and individuals with autism may not recognize a stimulus with even minimal alterations. The response of a person with autism to a specific stimulus may depend on the presence or absence of specific features, and individuals may over-generalize if the feature he/she is attending to is present in the new stimulus, or under-generalize if the feature is not present in the new stimulus. Because of this stimulus overselctivity, if a stimulus is altered along one or more dimensions (such as the setting, materials, or person), an individual with autism may respond to it as a novel stimulus, thus requiring additional instruction for successful independent performance (Matthes et al. 2001).

Lack of responsiveness to environmental stimuli is another possible reason that children with autism have difficulty generalizing skills and thus, difficulty performing skills independently in a variety of locations (Koegel and Koegel 1988). Children with autism often fail to respond to environmental stimuli, do not shift from one stimulus to another as typically developing children do, and do not attempt to relate one stimulus to another (O'Neill 1987).

This lack of responsiveness across multiple settings may negatively impact the ability to generalize skills (Koegel and Koegel 1988). Researchers have proposed that cognitive processing deficits may play a role in unresponsiveness or over/under-generalization (Prior 1979; Rutter 1983). Children with autism may be using idiosyncratic or stereotypic strategies to process environmental stimuli, thus precluding functional processing of surroundings or experiences (Prior 1979).

Prompt Dependence

The conditions in which individuals with ASD are taught may also create an overreliance or dependence on adult support, thus inhibiting independence. Prompt dependence is of particular concern in the population of students who have participated in significant amounts of one-on-one instruction. Many teaching strategies for individuals with autism necessitate frequent adult prompting in the presentation of work materials and instructions, as well as the requirement for repeated reinforcement from an adult upon the completion of each directive (Smith 2001). The strict stimulus control that is established during initial teaching phases can reinforce prompt dependency and increase student reliance on adult cues, as students rely on an adult as the discriminative stimulus. Prompt dependence impedes potential success in the independent performance of the skill during maintenance and generalization activities, may reduce the student's level of participation, and can increase overall passivity and learned helplessness (Goodson et al. 2007). Teaching strategies that require repeated adult prompting (e.g., replying to continual adult directives), continuous teacher-management, or high levels of assistance are often effective for the initial acquisition of skills; however, strategies that promote independence should be imbedded in the acquisition instruction. In addition, strategies that allow students to practice a skill without interruption (e.g., requiring learners to pause for the next prompt, correction, or feedback from an adult) are needed to ensure increased success across time and setting (Binder 1993).

Interventions to Increase Independence

Some of the most successful interventions targeting increased independent skills emphasize a shift in stimulus control from continuous adult management (e.g., paraprofessional support) during instruction to an alternative stimulus. The alternative stimulus then provides cues and information about expectations related to academic tasks, behavior, and/or social skills. This shift in stimulus control is vital in increasing student independence across setting. Three focused interventions that incorporate this stimulus shift and have proven effective in increasing student engagement while simultaneously decreasing adult prompting will be explored further. *Self-monitoring, video modeling* and *individual work systems* are interventions targeting independent performance across several domains, including adaptive behavior, socialization, and organizational skills. The rationale for and research support of each of these three antecedent-based interventions follows.

Self-Monitoring

Self-monitoring interventions, in which the individual is taught to discriminate and to make a record of the occurrence or nonoccurrence of a target behavior (Kamps and Tankersley 1996), increases independence because the individual is the agent of the intervention (as opposed to a teacher or another adult). In order to self-monitor, an individual must pay adequate attention to his or her own behavior, the conditions under which these behaviors occur, and the immediate and distal effects that are produced. When individuals self-monitor, they attend to select aspects of behavior on which they may ordinarily not focus which can, in turn, re-focus on the most salient elements of behavior. Self-monitoring interventions can be designed to increase the incidence of desired behaviors or to reduce problem behaviors. Further, several studies indicate that, in addition to increasing positive target behaviors, self-monitoring interventions may also have collateral effects in other, seemingly unrelated areas of functioning (e.g., Stahmer and Schreibman 1992; Pierce and Schreibman 1994).

Self-monitoring is one element of self-management intervention that also may include self-assessment, self-instruction, and self-reinforcement. Self-management interventions require teaching two elements: (a) the target behavior, if the individual has not yet acquired it, and (b) the specific self-management procedure being used (Smith and Sugai 2000). When teaching children with autism to monitor their own behavior, self-monitoring interventions typically include four steps: operationally defining the target behavior(s), identifying reinforcers, designing or choosing a self-management device and method, teaching the individuals to use the devices, and teaching self-management independence (Koegel et al. 1999a).

Self-monitoring strategies have been successful in changing a number of behaviors in autism. When self-monitoring their own behavior, individuals with autism have reduced stereotypic behavior (Koegel and Koegel 1990), increased appropriate play (Stahmer and Schreibman 1992), increased use of daily living skills in the absence of the treatment provider (Pierce and Schreibman 1994), and increased on task behavior (Koegel et al. 1999a, b; Callahan and Rademacher 1999).

Additionally, self-monitoring has been demonstrated to be effective at increasing pro-social behaviors. Morrison et al. (2001) taught students with autism requesting, commenting, and sharing. Students with autism and their typically developing peers were also taught to monitor the behaviors. The intervention resulted in a greater frequency of social interactions between group members and an increase in social initiations by the students with autism. Self-monitoring interventions were also demonstrated to increase varied responding in play and in social language (Newman et al. 2000) and to increase social responsiveness in community settings (Koegel et al. 1992). Other investigations have found that self-monitoring was useful as part of a social skills treatment package. When used in conjunction with adult prompts and reinforcement, self-monitoring led to an increase in the social interaction of children with autism and their siblings and peers (Strain and Kohler 1994). Self-monitoring has also been combined with video modeling (Apple et al. 2005). A handful of studies combined self-monitoring of social behavior with peer training. In a recent study, middle school age students with autism were taught to initiate to their trained peer and to self-monitor their social initiations during their lunch period (Loftin et al. 2008). An increase in both social initiation and sustained social interaction were found.

Findings from various studies such as these indicate that even core features of autism, such as social functioning, can be improved with the use of interventions that incorporate self-monitoring. In addition, increases in positive behavior that occurred because of self-monitoring were often accompanied by collateral reductions in undesired behavior. Reductions in self-stimulatory and repetitive/stereotypic behavior (Stahmer and Schreibman 1992; Pierce and Schreibman 1994; Loftin et al. 2008) and disruptive behavior (Koegel et al. 1992, 1999a, b) were found.

Self-monitoring interventions may not be appropriate for all individuals with autism. Certain methods of self-monitoring may require a greater level of cognitive ability (i.e., systems that require careful calculation, systems that require the individual to monitor the passage of time). However, it is important to note that self-monitoring strategies have been adapted for various levels of functioning (i.e., Pierce and Schreibman 1994: individuals with mental retardation and limited language; Loftin et al. 2008: individuals with fluent language and average and above cognitive functioning). With some creative thinking and consideration of individual characteristics, professionals should be able to create a system that will be appropriate for any given individual.

Self-monitoring makes an excellent addition to autism professional's repertoire of strategies. An understanding of self-monitoring techniques will increase the capacity of school, employment, and assisted living staff who work with individuals with autism to implement effective, time efficient interventions. Increasing the self-management skills of people with autism through self-monitoring increases individual responsibility and autonomy, reducing reliance on prompts from professionals (Kern et al. 1997). Further, because of the potential for collateral reductions in problem behavior, self-monitoring can provide an efficient intervention that addresses multiple areas, without the time consuming process of individually targeting separate behaviors.

Video Modeling

Video modeling intervention can be used to teach skills using minimal adult prompting and interaction. The interventionist first chooses target skills the person with ASD needs to learn. A model then performs the target skill while being videotaped. Professionals or peers can serve as models, or the person with ASD can serve as his or her own model on the video. The latter is referred to as video self-modeling (VSM). In VSM the person with ASD is videotaped during a role-play scenario or in a natural setting. All prompts are edited out of the video so that the person is seen performing the skill *independently*. The short video modeling videos (typically 2–4 min in length) are watched by the person with ASD, often times repetitively. Once the videos are produced, the person with ASD can watch the videos alone and as frequently as necessary to acquire the skill. Then the viewer is given the opportunity to imitate the skill observed on the video in real-life contexts.

Video modeling is particularly well-suited for people with ASD. Many people with ASD are better able to process and remember visual information compared to material presented verbally (Quill 1997). For this reason, visual strategies are often employed with individuals with ASD to help them make better sense of the environment (Heflin and Simpson 1998). Some examples of visual supports include schedules, task organizers, choice boards, and classroom management aids (Hodgdon 1995). Video represents another example of visual strategy; however, it is used less often than static picture supports. For individuals who are not as proficient with visual information, video modeling also can also offer verbal information, such as narration or captions. Video technology is particularly appealing to use with people with autism because it does not require human interaction (some people with autism tend to relate to objects better than people or experience anxiety related to social situations), it utilizes visual learning, it is predictable, and it is easy to control (Buggey et al. 1999). Others have argued that video modeling helps individuals with autism attend to the relevant aspects of the learning situation because the camera focuses directly on the relevant information while blocking out other

distractions (Charlop-Christy and Daneshvar 2003). Finally, watching videos is an enjoyable activity for most children, including those with ASD.

Charlop-Christy et al. (2000) compared the effectiveness of video modeling with in vivo modeling and found that for 4 out of 5 of the children participants, video modeling led to quicker acquisition and better generalization of skills compared to in vivo modeling. The authors noted that video modeling was cheaper and less time consuming than in vivo modeling.

A recent meta-analysis conducted by Bellini and Akullian (2007) supports the effectiveness of video modeling and video self-modeling interventions. The authors included 23 single subject design studies with a total of 73 participants. The results of the meta-analysis suggest that video strategies are effective for teaching social-communication skills and adaptive behavior, as well as for reducing problem behaviors. The largest effects were seen in studies that targeted adaptive behaviors. Moreover, behaviors learned through video modeling procedures were maintained over time and generalized to other settings.

Video modeling techniques can be successfully combined with other intervention approaches. In one study conducted by Wert and Neisworth (2003), videos were made of the children making requests in the home setting and edited to show only appropriate requesting behavior. The children had been initially taught appropriate requesting behaviors using discrete trial training, but none were consistently able to spontaneously request an object or action in natural settings. The videos were viewed at home prior to leaving for school. Data on spontaneous requesting were collected at school during baseline, intervention, and maintenance phases. All participants evidenced a significant increase in spontaneous requesting in the school setting during the intervention phase. Since the videos were made at home, generalization occurred from home to school. Thus, in this case, video modeling helped overcome the problem of generalization and prompt dependency often associated with discrete trial training suggesting that video modeling and discrete trial training can be particularly beneficial when combined. Coyle and Cole (2004) combined video modeling with self-monitoring to increase on-task behavior. The children with autism were shown videos of themselves working on academic tasks. Then the participants were taught how to monitor their on-task behavior using picture cards and a check mark system. This treatment package resulted in an increase in on-task behavior for all participants. In this case, video modeling was used to teach a skill and self-management helped to ensure the skill was performed. One video modeling study included models who explained their problem-solving strategies while answering questions about the perspective of others (Charlop-Christy and Daneshvar 2003). The participants with autism learned the perspective taking tasks quickly after viewing the video model. In addition, they were able to generalize what they had learned to similar tasks.

Video modeling holds promise as a means to promote independent behaviors in individuals with autism. It minimizes the need for instruction delivered by a teacher or interventionist and therefore provides an alternative stimulus for responding. It can reduce the overreliance on prompts from others to learn skills. Furthermore, skills learned through video modeling tend to generalize well to other settings (Bellini and Akullian 2007).

Individual Work Systems

Individual work systems are an element of structured teaching developed by Division TEACCH (Treatment and Education of Autistic and related Communication handicapped Children). Structured teaching, as defined by Division TEACCH is an instructional strategy that emphasizes visual supports, and its aims are to increase and maximize independent functioning and reduce the frequent need for teacher correction and reprimand (Schopler et al. 1995). The four major components of structured teaching are physical structure (the organization of the classroom), schedules (visual information depicting where/when/what the activity will be), work systems (visual information informing a student what to do while in a work area), and task organization (visually clear information on what the learning task is about) (Schopler et al. 1995). The individual work system is defined as a visually organized space where children independently practice skills that have been previously mastered under the direct supervision of an adult. A work system visually communicates at least four pieces of information to the student:

1. The tasks the student is supposed to do
2. How much work there is to be completed
3. How the student knows he/she is finished (progress towards goal)
4. What to do when he/she is finished

The practice of providing visual sequences of activities (i.e., photographs or icon representations) for students with ASD to complete has been proven effective for many years (MacDuff et al. 1993; Pierce and Schreibman 1994). Individual work systems, however, include several unique components that have only recently been explored in the literature. Work systems do not require matching or sequencing skills as are required by most activity schedules or visual schedules described in the literature. Instead, work systems may use a "left-to-right" format where students complete all activities placed to their left (in any order), and move them to a "finished" location on the right

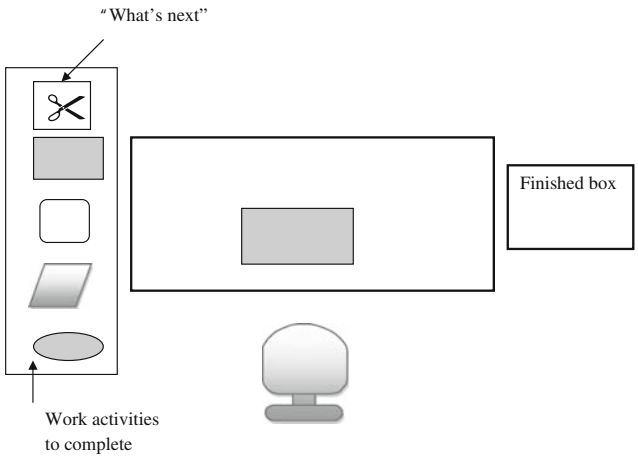

Fig. 1 A left-to-right work system. Tasks are placed on the student's left and a "finished" container is placed to the student's right

(see Fig. 1). Work systems emphasize teaching the concept of "finished" by designating a clear "finished" location and using that concept as a motivational tool. In addition, work systems require a well-organized and structured work space with few distractions that compete for a student's attention. These features differentiate the work system from other empirically based visual strategies designed to increase student independence.

Recent studies demonstrated the efficacy of the work system in increasing on-task behavior in students with autism, while decreasing the number of prompts required from professionals (Hume and Odom 2007, 2009). After implementing an individual work system during independent play and work times with three students with ASD, students increased productivity and engagement (measured by numbers of tasks completed and percentage of time on task) while adult prompts simultaneously decreased (Hume and Odom 2007). The results maintained while the work system was in place and social validity measures indicated the intervention was received favorably by the classroom staff responsible for implementation. In an extension of this study, a work system was implemented for three elementary age students in their special education setting during independent work time (practicing previously mastered academic skills). Their performance on the same academic skills was then measured in the general education setting without the use of the work system (Hume and Odom 2009). All three students demonstrated improved generalization of skills across setting after using the work system in the special education setting. Additionally, the improvements in independent functioning were replicated, as adult support decreased, while time-on task improved across setting. An additional study investigated the efficacy of several of the work system features, including the "finished" box and the visual cues. To reduce transition time and adult promoting, Dettmer and colleagues. Implemented work system components in a study involving three children with autism (Dettmer et al. 2000). The supports were successful in reducing latency between instruction and student response and decreasing adult prompting. Additional studies have shown the effectiveness of the work system as one component of the structured teaching package for promoting the independent performance of children with autism and severe intellectual disability during work sessions and transitions (Panerai et al. 1997, 1998).

The literature identifies several likely reasons for the increases in on-task behavior and decreases in adult prompting after the introduction of the work system in the studies described above. Heflin and Alberto (2001) assert that providing elements of temporal structure to students with ASD assists in increasing attention to task. Visually presenting the sequence of activities, which occurs in the use of the work system, enhances the student's ability to predict upcoming activities, and provides a consistent strategy for gathering information about what will occur during independent work time. The concrete information provided through the work system also may increase on-task behavior by capitalizing on the often apparent visual-spatial processing strengths of many students with ASD (Garretson et al. 1990). The concrete and visual information is also likely to address previously described difficulties with initiation, as expectations are clarified. Studies have indicated that students with autism are likely to attend only to select parts of a verbal message, and often fail to process multicomponent stimuli (Burke and Cerniglia 1990), which may explain why students can have difficulty responding to multiple verbal cues by staff members, and may respond more favorably to the visual cues of a work system. Additionally, the work system was designed specifically to address the organizational limitations of students on the autism spectrum, as well as the reduction of extraneous information (visual or auditory) that may be distracting or inhibiting initiation (Mesibov et al. 2005). Emphasizing the salient information as the work system does (i.e., presenting only the tasks to be completed during the work session) may decrease difficulties in processing environmental stimuli, and increase on-task behavior.

In addition, the shift in stimulus control from adult prompts to visual prompts also likely impacts the stimulus generalization (Hume and Odom 2009). As students begin to respond to a variety of cues in the environment (e.g., work system and tasks) in one setting, they may be more likely to respond to similar cues across setting and person (Heflin and Alberto 2001), thus reducing the need for adult prompts in a different setting. Finally, the deliberate practice of previously mastered skills that occurs through the use of an individual work system is an important step

towards generalization across contexts and provides necessary practice to help students perform tasks automatically, quickly, and independently. An individual work system is likely to aide in the development of automaticity, or a performance that is automatic, fast, and does not require the learner's full conscious attention (Gray 2004). As automaticity develops, individuals are able to focus their attention on the novel or more complex aspects of the task, such as transferring the skill to a new setting or person, and performing the task with fewer adult prompts (Gray 2004).

Conclusion

Best practices for working with students with autism are both positive and proactive and focus on increasing independent functioning (National Research Council 2001). As more individuals are diagnosed with ASD, and as this population ages, interventions that promote independent responding and subsequently lessen the need for support from others are urgently needed. While there are many intervention approaches that have been shown to be quite effective at promoting skill acquisition, fewer interventions also take into account the development of independent functioning or do so too late after patterns of learning and responding are entrenched. This article identified characteristics of ASD that inhibit the development of independence including lack of initiation, prompt dependence, and poor generalization of skills. To some degree these challenges are the result of cognitive differences; however, they can be exacerbated by teaching strategies that rely too heavily on teachers or interventionists providing a discriminative stimulus for a response.

Three interventions that aim to rectify these problems are self-monitoring, video modeling, and individual work systems. These approaches have in common the removal of stimulus control from a teacher or interventionist to an alternative individual-controlled stimulus. We believe that the further development of strategies to promote independence is crucial both for the well-being of individuals with ASD and for the sustainability of systems designed to support them throughout their life-span.

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