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Effects of a problem-solving strategy on the independent completion of vocational tasks by adolescents with autism spectrum disorder

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Individuals with autism spectrum disorder (ASD) often have few employment opportunities and a lower job quality than individuals of typical development. Social deficits and lack of independence may contribute to underemployment and unemployment of individuals with ASD. The ability to solve problems might ameliorate some of these barriers. We taught four adolescents with ASD a problem-solving strategy (i.e., use of a textual activity schedule) to assist with independent completion of vocational tasks in the face of three types of problems (e.g., missing or broken items) and nonproblem situations. Following introduction of the problem-solving strategy, all four participants independently completed the tasks when a problem was presented and responding generalized to untaught vocational tasks.

Key words: activity schedule, autism spectrum disorder, employment, problem solving

Autism spectrum disorder (ASD) is characterized by deficits in social functioning and communication, and by the presence of stereotypic and/or repetitive behaviors (American Psychiatric Association, 2013). Although deficits in these areas vary widely across individuals diagnosed with ASD, research indicates that many adults with ASD, regardless of IQ scores, remain underemployed or unemployed after completing high school (Howlin, Goode, Hutton, & Rutter, 2004). In addition, when these individuals are employed, job quality is often lower than that of their peers of typical development (Howlin, 2000; Howlin et al., 2004; Jennes-Coussens, Magill-Evans, & Koning, 2006). Maintaining employment allows individuals to financially support themselves and pursue their own interests and has been shown to significantly increase the independence of individuals with ASD (García-Villamisar, Wehman, & Navarro, 2002; Persson, 2000).

Factors that contribute to underemployment and unemployment of individuals with ASD include social deficits (e.g., asking too many questions, difficulty understanding facial expressions and tone of voice, difficulty "reading between the lines"; Müller, Schuler,

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Burton, & Yates, 2003), difficulties performing tasks independently (Hendricks, 2010), and maladaptive behavior (e.g., problem behavior, off-task behavior; Shattuck et al., 2007). Past research has focused primarily on overcoming social deficits and decreasing maladaptive behavior of children and adolescents with ASD (e.g., Barnhill, Cook, Tebbenkamp, & Myles, 2002; Davis, Boon, Cihak, & Fore, 2010; Gantman, Kapp, Orenski, & Laugeson, 2012) and more recent research has focused on assessing and teaching job-related social skills to adults with ASD (Grob, Lerman, Langlinais, & Villante, 2019). Few researchers have evaluated strategies for increasing independence (e.g., Burke et al., 2013; Hill, Belcher, Brigman, Renner, & Stephens, 2013; Mechling, Gast, & Seid, 2009). Hendricks (2010) noted that some adults with ASD have difficulty working independently; therefore, they require prompts and reminders to complete vocational tasks. An individual who requires prompts and reminders to complete a task might not be valued as an employee or potential hire; thus, it is important for individuals with ASD to increase their independent vocational skills.

Hume, Loftin, and Lantz (2009) identified characteristics associated with a diagnosis of ASD that might be barriers to the development of independence. These include challenges with initiations, prompt dependence, and generalization. Initiating tasks or social interactions (e.g., seeking assistance when needed) can be particularly challenging for individuals with ASD for a variety of reasons including: (a) difficulty planning the steps required to complete an activity, (b) difficulty attending to relevant stimuli in the environment that indicate when to initiate new behavior, (c) lack of motivation, and (d) unclear expectations of behavior that may be required. Individuals with ASD may also have difficulties with independence due to prompt dependence (Stahmer & Schreibman, 1992). Prompt dependence occurs when a person responds to prompts from others instead of responding to naturally occurring cues that are expected to evoke a target response (Cameron, Ansleigh, & Bird, 1992). It is not always feasible for someone to be available to prompt behavior and it is unlikely an employer will provide these resources. In addition, because job retention requires independent work performance under a wide range of job-related circumstances, performance of employees (including individuals with ASD) must generalize across people, tasks, and situations not associated with training (Berg, Wacker, & Flynn, 1990).

Activity schedules have increased independence of individuals with ASD across a variety of activities including leisure (MacDuff, Krantz, & McClannahan, 1993), social (Krantz, MacDuff, & McClannahan, 1993; Krantz & McClannahan, 1998), academic (Kinney, Vedora, & Stromer, 2003), and vocational tasks (Sances, Day-Watkins, & Connell, 2018; Wacker & Berg, 1983). Activity schedules include pictures or words that cue an individual to engage in a sequence of tasks or activities independently. Activity schedules might help circumvent problems related to prompt dependence because the individual learns to respond to word or picture cues and not prompts provided by another person (e.g., vocal prompts, manual guidance).

Another factor that likely contributes to poor employment outcomes for individuals with ASD is a lack of problem-solving skills (Hume et al., 2009). Problem solving occurs when an individual is presented with a problem for which he has no immediately available solution; thus, he must engage in mediating or precurrent responses (e.g., looking in a variety of places when keys are missing, obtaining a new light bulb to replace a broken one) that increase the likelihood of emitting a successful response (e.g., finding the keys, lighting a dark space; Skinner, 1984). Mediating behavior is termed precurrent behavior if it results in a successful response. Skinner (1968) noted that once an individual acquires precurrent responses, they are maintained because of their effectiveness in evoking responses that are subsequently reinforced. Problem-solving skills increase the likelihood of identifying a correct response and might decrease the occurrence of maladaptive behavior by individuals with ASD (e.g., engaging in stereotypic behavior, aggression, disruption, property destruction, self-injury). Because it is difficult to contrive and teach all possible situations that an individual might encounter, a generalized repertoire of problem-solving skills might be beneficial (Axe, Phelan, & Irwin, 2018).

Past problem-solving research taught (a) adolescents with autism to approach an experimenter, describe a problem, and request assistance (Dotto-Fojut, Reeve, Townsend, & Progar, 2011), (b) typically developing children to problem solve by stating rules or visual imagining to answer categorization questions (Kisamore, Carr, & LeBlanc, 2011; Sautter, LeBlanc, Jay, Goldsmith, & Carr, 2011), (c) individuals with intellectual disabilities to problem solve through common workplace problems via self-instructions (Hughes, Hugo, & Blatt, 1996; Hughes & Rusch, 1989), (d) adolescents with intellectual disabilities rules for problem solving during social situations in the workplace (Park & Gaylord-Ross, 1989), and (e) a child with autism analytical thinking skills for reading comprehension and math task completion (Ferris & Fabrizio, 2009). Several of the strategies evaluated to date involved complex vocal–verbal behavior (e.g., rules), which may be difficult for individuals with limited vocal–verbal skills to acquire, or did not teach skills for independent problem solving (e.g., Dotto-Fojut et al., 2011). Thus, research is needed on other types of problem-solving strategies.

The purpose of the current study was to evaluate the efficacy of errorless teaching, prompt delay, reinforcement, and multiple exemplar training on the acquisition, generalization, maintenance, and independent use of a problem-solving strategy that involved a textual/pictorial activity schedule with four adolescents with ASD.

METHOD

Participants

Participants included three males and one female who ranged in age from 12 to 16 years old. All participants met the criteria for a diagnosis of ASD (American Psychiatric Association, 2013) and verification of the diagnosis was confirmed for all participants through the Gilliam Autism Rating Scale (Gilliam, 1995). Alex, Jacob, Kristina, and Travis scored 71, 82, 81, and 84, respectively, indicating that a diagnosis of autism was very likely. All participants (a) attended a small, private school that provides behavior analytic services for children and adolescents with ASD; (b) were enrolled in the school for 9 to 15 years; (c) received 5.75 hours of instruction per day, 5 days per week; and (d) had prior experience following textual and pictorial activity schedules to complete academic and/or leisure programs. Teachers noted that the participants occasionally requested assistance during vocational tasks, but often walked away from the task without requesting any assistance. Additionally, teachers reported that at times, the participants engaged in problem behavior (i.e., tantrums, aggression, self-injury) if they encountered problems that prohibited them from completing tasks. The Adaptive Behavior Assessment System-Second Edition (Harrison & Oakland, 2003) was used to gather information about participants' adaptive behaviors. Alex, Jacob, Kristina, and Travis scored 62, 42, 44, and 52, respectively, indicating their adaptive functioning was in the extremely low range compared to their peers.

Settings and Materials

Baseline, teaching, generalization, and maintenance sessions were conducted in various locations throughout the participants' school (e.g., classrooms, offices). Teachers and students not involved in the study were present in these rooms throughout the study. Items present in these settings included desks, chairs, tables, computers, bookshelves, and a variety of other classroom and office stimuli (e.g., copier, printers, fax machine). An iPad was used to record all sessions. The list of vocational tasks and the activity schedule binder were presented throughout baseline, teaching, generalization, and maintenance sessions to prompt responses that made solving a problem more likely.

List of vocational tasks. A list of 12 vocational tasks was typed, double-spaced in Times New Roman in 12-point font on a 22 x 28 cm sheet of paper. The list included a series of vocational tasks (e.g., stuff envelopes, take out garbage) to be completed in each 30-min session (see the task column in Table 1). The participant crossed the task off the list after completing it.

Activity schedule. A 6.5 x 4 cm binder with plastic sleeves was used to present the steps required to solve the problems. The activity schedule contained textual stimuli that cued the participant to engage in a sequence of mediating responses. The schedule contained dividers with pictures and written words that corresponded to each item in the list. Response 1 involved identifying the item in the binder needed to complete the task and flipping to the corresponding tab with the picture and written word on it. The first page after the tab prompted Response 2: "Go to [location]" where the item was located. When the page was flipped, a prompt to do Response 3: "Get (item)" was presented. When that page was flipped, a prompt to do Response 4: "Go to classroom" was presented on the next page. When that page was flipped, a prompt to do Response 5: "Finish work" was presented on the page.

Reinforcement systems. Reinforcement systems similar to those previously established for each participant by the participants' school (i.e., a token economy) were used. The experimenter delivered tokens for correct responses and on-task behavior. Because each reinforcement system was individualized for each participant, the number of tokens required to access the back-up reinforcer varied. Once the participants earned a predetermined number of tokens, they had the opportunity to exchange the tokens for a preferred item/activity previously identified by the participants' teachers.

Table 1
Tasks, Categories, and Scenarios

Category	Task to Complete	Typical Scenario	Problem Scenario	Locations
Missing item	Erase board	Eraser present	Eraser missing	Office cabinet
	Clip papers	Paper clips present	Paper clips missing	Copy room
	Refill pen basket	Pens present	Pens missing	Supply closet
	*Clean garbage	Bag present	Bag missing	Office cabinet
Broken item	Staple papers	Stapler	Stapler broken	Supply closet
	Highlight zeros	Highlighter intact	Highlighter broken	Copy room
	Rubber band	Rubber bands	Rubber bands	Office cabinet
	*Cut papers in half	Scissors intact	Scissors broken	Copy room
Mismatched item	Add papers to binder	Binder correct size	Binder too small	Copy room
	File index cards in a box	Box correct size	Box too small	Office cabinet
	Bind papers together	Binder clips correct size	Binder clips too small	Supply closet
	*Stuff envelopes	Envelopes correct size	Envelopes too small	Supply closet

Note. Asterisk denotes generalization tasks.

Scenarios

Similar to Dotto-Fojut et al. (2011), three categories of problems that can arise during vocational tasks were targeted: missing items, broken items, and mismatched items. To teach discrimination of problem versus nonproblem scenarios in each category, all tasks had a typical problem-free scenario and a problem scenario.

Problem-solving categories and scenarios. The experimenter arranged four problem-solving scenarios within each of the three problem categories (i.e., missing items, broken items, mismatched items) for a total of 12 problem-solving scenarios (see Table 1). During problem scenarios, the experimenter arranged the environment such that an establishing operation (EO) was in effect (i.e., an item was missing, broken, or mismatched) which increased the reinforcing value of the item needed to complete a task as well as increased the likelihood of behavior (i.e., problem solving) that had produced the item in the past. Three of the four problem-solving scenarios from each of the three respective problem categories (i.e., nine scenarios) were targeted during teaching trials, and the remaining problem-solving scenarios (i.e., one from each category for a total of three) were presented as generalization probes. During teaching trials and generalization probes, the experimenter presented problem-solving scenarios using a controlled randomization procedure such that each participant was randomly assigned three training stimuli and a generalization probe stimulus from each of the three respective categories. All four participants were exposed to a different set of training and probe stimuli across the three categories.

Typical scenarios. For each of the 12 problem-solving scenarios, a typical problem-free scenario was presented to teach discrimination of problems versus nonproblems. During typical scenarios, the environment was arranged such that an abolishing operation (AO) was in effect (i.e., all items were present, unbroken, or matched), which decreased the reinforcing value of a particular item as well as decreased the likelihood of problem-solving actions that had produced the item in the past. One typical scenario from each of the three categories (i.e., a total of three) was interspersed with the nine problem-solving scenarios during each session. A controlled randomization procedure (i.e., typical scenarios occurred no more than two times in a row) was used to ensure each scenario was presented an equal number of times across sessions and conditions throughout the study.

Experimental Design

A concurrent multiple baseline across participants design (Baer, Wolf, & Risley, 1968) was used to evaluate the efficacy of errorless teaching, prompt delay, reinforcement, and multiple exemplar training on the acquisition, generalization, and independent use of the problem-solving strategy.

Response Measurement and Reliability

The dependent variable was the percentage of trials (i.e., scenarios) with a correct response during each session. The experimenter collected data on correct and incorrect responses using paper and pencil. A response was scored as correct if the participant independently: (a) identified the missing/broken/mismatched item within 5 s of encountering a problem, (b) initiated going to the correct location to obtain the item within 5 s of identifying the missing/broken/mismatched item and arrived at the correct location within 30 s, (c) obtained the item within 5 s of arriving at the location, (d) brought the item back to the work area within 30 s of obtaining the item, and (e) initiated completion of the task within 5 s of returning with the item *or* if the participant independently completed the task within 30 s during a typical scenario. A response was scored as incorrect if the participant: (a) did not do any of the components of a correct response within the specified time, (b) required experimenter prompts to correctly complete any of the components, or (c) incorrectly completed any of the components *or* if the participant completed any of the problem-solving components during a typical scenario. The mastery criterion was 100% of the trials with a correct response across two consecutive sessions.

A second independent observer collected data during at least 36% of sessions across conditions for each participant and agreement was calculated on a trial-by-trial (i.e., scenario) basis. An agreement was defined as any time the primary and secondary observers scored the same trial identically. A disagreement was defined as any time the primary and secondary observers scored the same trial differently. The percentage of agreements was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying the resulting ratio by 100. Throughout the study, interobserver agreement (IOA) data were collected during 36%, 37%, 39%, and 36% of sessions, respectively, for Alex, Jacob, Kristina, and Travis. Across all conditions for all participants, IOA was 100%.

Procedures

Preteaching. Participants' correct completion of all tasks, in problem-free form, was assessed. During baseline, all tasks were presented in a list for a total of 12 trials. If performance was below 100% for a particular task across two consecutive sessions, the experimenter taught the response using an errorless teaching procedure. Errorless teaching occurred in two steps. During Step 1, the experimenter manually guided the participant to orient to the vocational task presented textually in the list, gather the materials, and complete the tasks at a 0-s prompt delay. The experimenter delivered praise and tokens on a fixed ratio (FR) 1 schedule for correct responses. Following two sessions at the 0-s prompt delay, the experimenter introduced Step 2 procedures. During Step 2, the experimenter gave the participant 10 s to initiate a target response. If the participant completed the task with no more than a 10-s pause, the experimenter delivered tokens and scored a + on the datasheet. If the participant did not respond within 10 s or responded incorrectly, the experimenter scored a - on the datasheet and the experimenter manually guided the participant to complete the response. The tasks were considered mastered following two consecutive sessions at 100% correct responding (data available from second author upon request).

Baseline. During baseline, the experimenter gave each participant access to the list of vocational tasks and the activity schedule. Each session began with the presentation of the list of vocational tasks (e.g., stuff envelopes, make invitations, staple papers) and the experimenter's direction to complete the tasks (e.g., "Start your work"). Nine problem scenarios and three typical scenarios were interspersed during each session for a total of 12 trials. The experimenter remained in the room and engaged in a nonrelated task (e.g., writing notes in a notepad). The experimenter was about 0.61-0.91 m from the participant throughout baseline sessions. The experimenter did not provide prompts or feedback for correct or incorrect responses during problem and typical scenarios. If at any point during problem scenarios the participant approached the experimenter and attempted to seek assistance (e.g., "Help me," "The stapler isn't working"), the experimenter made a nonspecific vocal response (e.g., "OK") and resumed what she was doing prior to the participant's approach. The experimenter gave the participant 10 s to initiate a correct response (e.g., standing up to get a new item, locating the item in the activity schedule). If the participant did not respond to the problem scenario within 10 s, the experimenter said, "You are all done with that task, let's clean up" and prompted the next task on the list. If the participant completed a component of the correct response within 10 s (e.g., located item in the activity schedule) and did not initiate the next component of the correct response within 10 s, the experimenter provided a vocal prompt (e.g., "Complete your work"). If 10 s elapsed with no responding, the experimenter ended the task and assessed the next task on the list. None of the participants responded correctly to the tasks in the activity schedule when presented with a problem; thus, no scenarios were eliminated from the study. During all baseline sessions, the experimenter delivered praise and tokens once per task presentation for either completing the task correctly or for 10 s of on-task behavior (i.e., the absence of disruptive or stereotypic behavior) if the participant did not complete the task correctly.

Problem-solving training. Problem-solving training was conducted to teach participants how to respond when there was a problem (i.e., EO scenario) and when there was not a problem (i.e., AO scenario). All procedures during problem-solving training were identical to baseline except for the following.

During EO scenarios, the experimenter taught the participant to use the activity schedule with errorless teaching. Errorless teaching occurred in two steps. During Step 1, the experimenter manually guided all components of a correct response at a 0-s prompt delay. The experimenter delivered praise and tokens for compliance with manual guidance. Following two consecutive sessions with 100% compliance with manual guidance at a 0-s delay, the experimenter introduced Step 2. During Step 2, the experimenter increased the prompt delay to 5 s (with the exception of walking to and from the location). If the participant responded correctly within 5 s (or 30 s for walking), the instructor provided tokens and praise. If the participant did not respond or completed a component of the response incorrectly within 5 s, the instructor manually guided the participant to obtain the activity schedule or complete the step. The instructor provided praise for manually guided responses during Step 2.

During AO scenarios, the instructor prompted the participant to complete the task without the activity schedule. Errorless teaching occurred in two steps. During Step 1, the instructor manually guided the participant to complete the task and provided feedback (i.e., "You have the right envelopes, so you can finish your job"). The experimenter provided praise and tokens contingent on compliance with manual guidance. Following two consecutive sessions with 100% compliance with manual guidance at a 0-s prompt delay, the experimenter introduced Step 2 procedures in which the experimenter increased the prompt delay to 5 s. If the participant responded correctly within 5 s, the instructor provided praise and tokens. If the participant did not respond or responded incorrectly within 5 s, the instructor manually guided the response and provided feedback. The instructor provided tokens and praise for manually guided responses during Step 2.

Generalization probes. We programmed for generalization through the presentation of multiple exemplars across the three problem categories (i.e., missing items, broken items, and mismatched items). The experimenter withheld training for one problem scenario from each of the three categories and assessed responding to this scenario during generalization probes (See Table 1 for generalization probe targets). The experimenter conducted generalization probes after every second baseline or training session. The three generalization targets were interspersed with the nine problem scenarios and three typical scenarios for a total of 15 trials in a generalization probe session. The experimenter presented the activity schedule during generalization probes and remained at a 0.61-0.91 m distance from the participant.

The experimenter responded as described in the baseline condition.

Maintenance. Performance was assessed for each participant 2 and 4 weeks after the mastery criterion was met. Tasks and settings were identical to those during baseline, problem-solving training, and generalization. During maintenance sessions, the experimenter gave each participant access to the list of vocational tasks and the activity schedule. Both problem and typical scenarios were presented each session. The procedures during the maintenance condition were identical to those in baseline.

Procedural Integrity

An observer independently scored at least 36% of all baseline, training, generalization, and maintenance sessions to assess procedural integrity. Each session was evaluated using a checklist of experimenter behaviors that were required for proper implementation. To implement the procedures accurately, the experimenter needed to (a) provide the correct stimulus and question, (b) provide praise and a token for correct responses during training sessions, (c) provide no differential consequences for responses during baseline and maintenance sessions, and (d) implement the correction procedure for trials when an incorrect response occurred during teaching sessions. If the experimenter made one error on a trial, that trial was considered incorrect. Procedural integrity was 100% across all participants.

A second trained observer independently collected IOA data on procedural integrity for 100% of the sessions with procedural integrity. An agreement was defined as the two observers scoring the same experimenter behaviors as either correct or incorrect for each trial. Interobserver agreement data for procedural integrity were computed on a point-by-point basis by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying that by 100. Procedural integrity IOA was 100% across all participants.

Social Validity

We distributed a modified version of the Treatment Acceptability Rating Form – Revised (TARF-R; Reimers & Wacker, 1992) to 12 school instructors, some of whom worked directly with the participants. A written section on the modified TARF-R described the teaching procedures and components. The questionnaire included 10 Likert-type questions regarding the appropriateness, practicality, and usefulness of the procedures used in the study. The instructors were asked to rate each from 1 (strongly disagree) to 6 (strongly agree).

RESULTS

Figure 1 separately depicts the percentage of correct responses during problem scenarios, typical scenarios, generalization, and maintenance sessions for all participants. During baseline, Alex's correct responses (top panel) to problem scenarios ranged from 0% to 2% and his correct responses to typical scenarios ranged from 67% to 100%. Following the first two 0-s prompt delay sessions during problem-solving training, Alex's correct responses increased, and his behavior reached mastery level within two sessions. Alex's problem solving also generalized to novel problem scenarios and he responded differentially to the problem and typical scenarios during intervention. Alex maintained mastery level performance for generalization and typical trials at the 2- and 4-week maintenance probes.

During baseline, Jacob's correct responses (second panel) to problem scenarios ranged from 0% to 2% and his correct responses to typical scenarios ranged from 67% to 100%. Following the first two 0-s prompt delay sessions during problem-solving training, Jacob's correct responses increased, and his behavior reached mastery level within five sessions. Jacob's problem solving generalized to novel problem scenarios and he responded differentially to the problem and typical scenarios

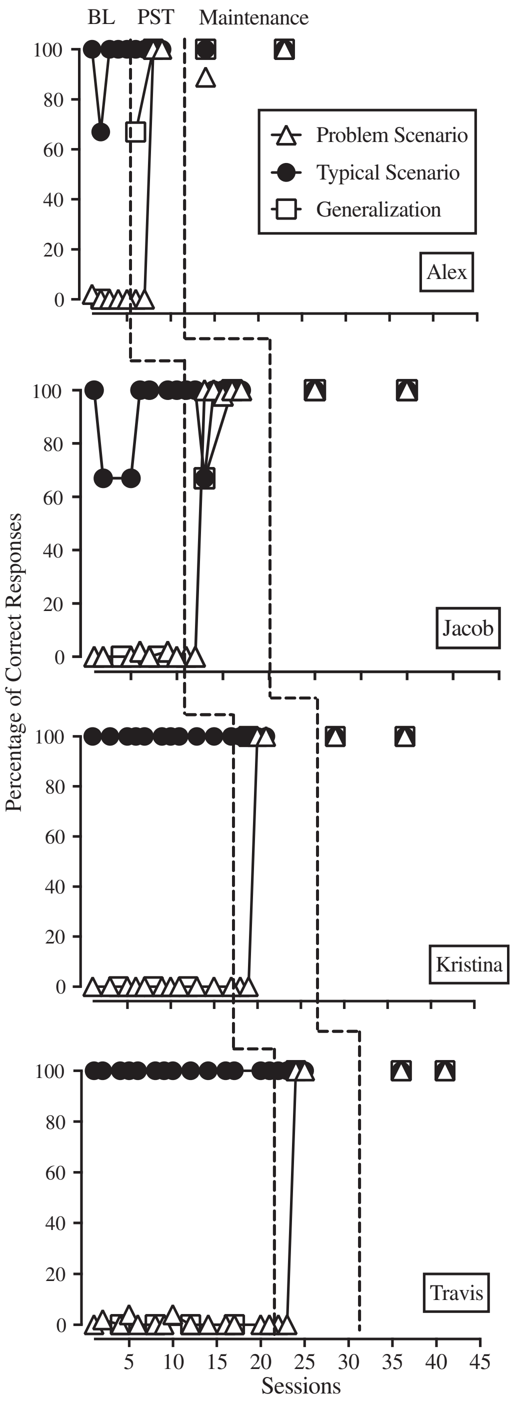

Figure 1. Percentage of correct responses during problem scenarios, typical scenarios, and generalization probes across sessions. Note: BL = baseline, PST = problem-solving training.

during intervention. Jacob maintained mastery level performance at the 2- and 4-week maintenance probes.

During baseline, Kristina's correct responses (third panel) to problem scenarios was 0% and her correct responses to typical scenarios was 100%. Following the first two 0-s prompt delay sessions during problem-solving training, Kristina's correct responses increased, and her behavior reached mastery level within two sessions. Kristina's problem solving generalized to novel problem scenarios and she responded differentially to the problem and typical scenarios during intervention. Kristina maintained mastery level performance at the 2- and 4-week maintenance probes.

During baseline, Travis's correct responses (fourth panel) to problem scenarios ranged from 0% to 4% and his correct responses to typical scenarios was at 100%. Following the first two 0-s prompt delay sessions during problem-solving training, Travis's correct responses increased, and his behavior reached mastery level within two sessions. Travis' problem solving generalized to novel problem scenarios and he responded differentially to the problem and typical scenarios during intervention. Travis maintained mastery level performance at the two- and four-week maintenance probes.

The results of the social validity measure are shown in Table 2. Overall, the raters agreed with the procedures used in the study (6.0), the extent to which they would recommend the use of the procedures (6.0), the importance of teaching problem-solving skills (6.0), and their willingness to implement those procedures (5.8 - 6.0).

DISCUSSION

Prior to the introduction of problem-solving training, all four participants attempted to complete the vocational tasks with items that were broken (e.g., attempting to staple documents with broken stapler), mismatched by size (e.g., stuffing letters into envelopes that were too small), or missing (e.g., leaving garbage bin with no bag when bag was missing). All participants also requested help (e.g., "Can you help me, please?") from the experimenter when a problem was encountered, but then continued to complete items on the list of vocational tasks when the experimenter did not provide assistance. Performance for all participants quickly increased to mastery level following introduction of problem-solving training, indicating that errorless teaching, prompt delay, and reinforcement was effective for teaching adolescents with ASD to use an activity schedule to solve common vocational task problems.

All participants responded differentially during problem (EO) and typical problem-free (AO) scenarios. That is, when presented with problems (i.e., missing, mismatched, or broken items), all four participants learned to complete

Table 2
Social Validity Questionnaire Results

Question	Response Average
1. This would be an acceptable training method for teaching adolescents to solve problems	6.0
2. I would suggest the use of this intervention to others looking to teach adolescents to solve problems related to vocational tasks	6.0
3. This training method was not overly intensive	6.0
4. This training method is suitable for teaching individuals with ASD problem solving skills related to a variety of tasks (e.g., self-help, home-living)	6.0
5. This training method is likely to *not* have any negative side effects	5.8
6. I think it is important to teach problem-solving skills to individuals with an ASD	6.0
7. This intervention would be appropriate for a variety of individuals with an ASD	6.0
8. I thought the procedures used in this intervention were appropriate and effective	6.0
9. I would be willing to use this intervention in a classroom setting	6.0
10. I would be willing to use this intervention in a vocational setting	5.8

Note: The scale was from 1 (strongly disagree) to 6 (strongly agree).

the components of problem solving as cued by the activity schedule. Also, during typical scenarios, three of the four participants did not engage in problem-solving at all, demonstrating discriminated responding. During two trials of the third session, Jacob initiated using the activity schedule (i.e., problem solving), although the item was working properly. Specifically, upon encountering the typical scenarios of stapling papers and highlighting zeros in the list of vocational tasks, Jacob initiated using the activity schedule without attempting to complete the task using the stapler and highlighter present. As a result, the experimenter manually guided Jacob to complete the task. The data indicate that during the remaining sessions, he responded correctly during both typical and problem scenarios.

Concurrent multiple exemplar training was used (Stokes & Baer, 1977; Wunderlich, Vollmer, Donaldson, & Phillips, 2014) to increase the likelihood that the problem-solving strategy generalized to problem scenarios that were similar to, but not associated with, teaching trials. Problem solving generalized to novel problems, indicating that the incorporation of concurrent multiple exemplar training was effective. School instructors reported that Alex generalized the problem-solving strategy to a task not associated with the current investigation (i.e., he independently found missing paper to print a document). Alex's behavior indicates that perhaps he learned a set of rules to follow and did not necessarily need to keep using the activity schedule to prompt problem solving.

The setting for the vocational tasks in this study was the participants' educational program. It is possible that participant behavior might not come under the contingencies as quickly or generalize as well in a completely novel vocational setting. Future researchers should evaluate problem-solving strategies such as this one in actual vocational settings.

At first glance, the problem-solving strategy used in this study might seem over- simplified.

We like to think about it as a low-tech version of using an internet-based search engine. Instead of grabbing a smartphone and pulling up a Google tab when posed with a problem, the participants in this study learned to grab a binder and pull up a relevant picture tab to begin the problem-solving process. Additional research is needed regarding how to teach component problem-solving skills that are necessary for work-place success (e.g., watching a YouTube video when a video model would be useful, social problem solving in the form of learning to recognize social cues), and on teaching more complex problem-solving strategies (e.g., rules, imagining) that involve those component skills. More research is also warranted on the types of responses required to remediate the problems. The participants in the current study only learned to go to three different places to find necessary supplies. Future researchers should incorporate responses beyond search and find, such as asking others, and identify tasks that might have multiple problems associated with them (e.g., pencils might be missing, or lead might be broken).

Research is needed on the use of other devices to prompt problem solving. A binder might not be the most appropriate or discreet way to prompt problem solving. Future researchers should investigate the efficacy of technological devices to prompt problem solving (see Burke et al., 2013; Burke, Anderson, Bowen, Howard, & Allen, 2010; Myles, Ferguson, & Hagiwara, 2007; Odom et al., 2014, for examples of technology in vocational and organization tasks).

Results of this study showed that a problem-solving strategy can be taught to adolescents with ASD, so they learn to solve common problems encountered during vocational tasks independently, thus decreasing reliance on others. In addition, instructors not associated with the study found the procedures to be socially valid, indicating that these procedures might be applicable to and acceptable in real-world work environments.

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