Journal of Applied Behavior Analysis

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2019, **9999,** 1–18 NUMBER 9999 ()

Life skills instruction for children with developmental disabilities

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The Preschool Life Skills program is an intervention package designed to teach functional skills to prevent problem behavior in typically developing children. The purpose of the current study was to evaluate the effects of the instructional package (renamed "Life Skills") with children with developmental disabilities. The program involved teaching 12 life skills to nine participants across four instructional units. The units were instruction following, functional communication, tolerance of denial and delay, and friendship skills. Teachers provided instruction through a three-tiered instructional approach, starting with class-wide instruction followed by small group and one-to-one instruction as necessary. We extended previous research by using visual prompts during all three tiers and progressively increasing intertrial intervals during one-to-one instruction. Results indicated that the intervention led to skill acquisition with all nine participants. The skills maintained 4 weeks after instruction ended.

Key words: autism, behavioral skills training, developmental disabilities, functional communication, social skills

Hanley, Heal, Tiger, and Ingvarsson (2007) developed the Preschool Life Skills (PLS) program to increase social and communication skills and prevent problem behavior in typically developing preschool children. They defined PLS as "…desirable responses to commonly occurring and evocative classroom situations…" (p. 278). The study was a response to research suggesting that the amount of time children spent in nonmaternal care correlated positively with occurrence of problem behavior (National Institute of Child Health and Human Development, 2003). Further, more time spent in nonmaternal care was shown to be correlated with increases in the probability of impulsivity and risk-taking extending into adolescence. However, high-quality childcare appears to mitigate these risks to some extent (Belsky et al., 2007; Donaldson & Austin, 2017; Vandell, Belsky, Burchinal, Steinberg, & Vandergrift, 2010).

The PLS program included instruction following, functional communication, tolerance of delays, and friendship skills, based on the relevant literature on school readiness (e.g., Heaviside & Farris, 1993; Lin, Lawrence, & Gorrell, 2003; Piotrkowski, Botsko, & Matthews, 2001), as well as the functional assessment and treatment of problem behavior (e.g., Ala'i-Rosales et al., 2019; Carr & Durand, 1985; Hanley, Iwata, & Thompson, 2001). In the original study, instruction occurred on a class-wide level with 16 preschool children. Classroom instructors repeatedly

This study was conducted in partial fulfillment of the requirements for the first author's master's degree at the University of North Texas. We thank Felicity Gomez, Rebecca Jimenez, Kelly Ho, Claire Cartmel, and Kimberly Fairman for assistance with data collection.

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doi: 10.1002/jaba.602

presented participants with opportunities (i.e., evocative situations) to practice the skills. The inclusion of planned evocative situations was likely to increase instructional efficiency because teachers did not have to wait for naturally occurring teaching opportunities. Further, the intervention involved arranging relevant motivating operations and discriminative stimuli. Examples of evocative situations included arranging the environment such that a child could not reach a preferred item and asking children to wait for needed items for variable periods. During these evocative situations, teachers prompted and practiced appropriate responses (e.g., asking for help or waiting patiently) with the children. Hanley et al. (2007) implemented class-wide behavioral skills training (BST; Ward-Horner & Sturmey, 2012), starting with group instruction during circle time and continuing with dispersed teaching trials throughout the day. The intervention increased the frequency of life skills and decreased errors of omission (i.e., failure to engage in all components of the life skill) and errors of commission (i.e., undesirable behavior) across all participants. However, the intervention did not result in complete acquisition or maintenance for all participants, possibly because teaching ended following a set period (i.e., time-based criterion) and the number of teaching trials per child varied unsystematically as a function of opportunities and participant availability.

Since the original study, several replications and extensions have appeared in the literature (Fahmie & Luczynski, 2018; Luczynski & Fahmie, 2017). Hanley, Fahmie, and Heal (2014) implemented PLS using a consultative model in Head Start classrooms. Compared to the original study, the Head Start setting had a leaner teacher to child ratio (i.e., Classroom A-1:7/Classroom B-1:10 vs. [1:2.5]), and the teachers had less experience in behavior analysis. The experimenters observed a 57% reduction in errors of omission and commission, and skill acquisition occurred when and only when class-wide instruction was implemented. Nevertheless, individual skill acquisition was variable across participants, suggesting the need for additional levels of intervention. In a recent non-U.S. replication, Gunning, Holloway, and Healy (2018) implemented the PLS program with ten 3- to 4-year-old children who attended a preschool classroom in Ireland. Similar to Hanley et al. (2014), the authors used a consultative model to train and assist preschool teachers to implement the program. The intervention resulted in statistically significant increases in PLS and reductions in errors of omission and commission when compared to two control groups: a no-intervention group of nine children, and a second control group that did not receive the intervention, but had the opportunity to observe the intervention group experience the PLS program.

Luczynski and Hanley (2013) evaluated the effects of PLS instruction on requests for attention, materials, and assistance, as well as delay and denial tolerance, with preschoolers who presented with problem behavior, poor self-control, and few communication skills. They provided instruction in a small-group context according to the response-to-intervention (RTI) framework. In RTI, the intensity of services is tiered and dependent on the severity of educational and behavioral challenges (Gresham, 2004). Instruction in an RTI model begins with class-wide instruction (Tier 1) and proceeds to small-group instruction (Tier 2) and one-to-one instruction (Tier 3) if mastery is not achieved in the earlier tiers. Thus, the class-wide instruction provided in Hanley et al. (2007) is considered as Tier 1 intervention, whereas small-group instruction is considered as Tier 2 intervention. Further, Luczynski and Hanley extended the original study by (i) using performance-based mastery criteria, (ii) teaching precursor behaviors, such as stopping and looking at the teacher before making a vocal request (Beaulieu, Hanley, & Roberson, 2012),

and (iii) teaching multiple topographies of vocal requests. The intervention resulted in skill acquisition with all six participants in the treatment group compared to no skill acquisition in the control group. Problem behavior decreased to zero for the treatment group following the intervention, but the control group engaged in more problem behavior in the posttest compared to that in the pretest.

The PLS program has primarily been evaluated with typically developing preschool children. However, research has shown that children with developmental disabilities and delays are at a higher risk for maladaptive behavior than their typically developing peers (Baker et al., 2003; Crnic, Hoffman, Gaze, & Edelbrock, 2004; Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007; Hartley, Sikora, & McCoy, 2008; Lecavalier, 2006). Therefore, families of these individuals can experience more stress and other negative life events (Lecavalier, Leone, & Wiltz, 2006; Neece, Green, & Baker, 2012). Further, children with developmental disabilities often demonstrate deficits with the particular skills targeted in PLS (e.g., Plant & Sanders, 2007). Thus, extension of the program to individuals with developmental disabilities is warranted.

Falligant and Pence (2017) conducted the only application of PLS with a full classroom of children with developmental disabilities of which we are currently aware. The participants were eight children between the ages of 4–6, four of whom were diagnosed with autism spectrum disorder (ASD), two with Down syndrome, and two with developmental delays. The experimenters targeted five skills (responding appropriately to name, requesting adult assistance, requesting adult attention, delay tolerance, and denial tolerance) using the RTI model. The researchers found that the targeted skills increased when and only when all three intervention tiers were implemented. Seven of the eight participants acquired all skills for which they received instruction, but four required procedural modifications during one-to-one instruction at some point. Of the seven children who received instruction on all five skills, three acquired the majority of skills in class-wide teaching, whereas two children needed one-to-one instruction with procedural modification for all of the skills. These modifications included simplified response requirements, changes to the target response topography, arbitrary reinforcement (edibles), and in one case a textual prompt.

The results of Falligant and Pence (2017) suggest that a tiered PLS model holds promise as an instructional approach for children with developmental disabilities, but additional procedures are likely needed to facilitate reliable skill acquisition across individuals. One procedure that might be beneficial is progressively increasing intertrial intervals (PITIs). Francisco and Hanley (2012) evaluated the effects of PITIs on the acquisition and generalization of social skills (e.g., responding to name, saying "excuse me" and "thank you") with two preschool children, one typically developing and one with Down syndrome. The results suggested that shorter ITIs facilitated rapid acquisition, while longer ITIs facilitated maintenance and generalization. Thus, the current study incorporated PITIs during one-to-one instruction.

Another procedural modification that might improve acquisition for children with developmental disabilities is the use of visual prompts. Visual cues in the form of pictures can facilitate acquisition and generalization with children with ASD (Ingvarsson & Hollobaugh, 2011; Phillips & Vollmer, 2013; Pierce & Schreibman, 1994; Quill, 1995). While auditory stimuli (e.g., verbal instructions) are often variable and fleeting, visual stimuli are relatively static and permanent. Thus, picture prompts offer an additional source of stimulus control that may facilitate acquisition. There is a long history of successful implementation of picture prompts and other visual cues for individuals with ASD to facilitate comprehension, augment

communication, and aid with complex routines, difficult transitions, and other challenging situations (Simmons, Lanter, & Lyons, 2014).

The purpose of the current study was to evaluate the effectiveness of the PLS program in a classroom for children with ASD and other developmental disabilities. Similar to Falligant and Pence (2017), the current study involved class-wide, small-group, and one-to-one instruction according to the RTI approach. This study extends previous research by using visual prompts during all tiers of instruction and incorporating PITIs during one-to-one instruction. Because most of the participants in this study were above preschool age, we refer to the skills as "life skills" rather than "preschool life skills" throughout the manuscript.

METHOD

Participants

Six boys and three girls, ranging in age from 3 to 9 years from three different classrooms within a private school for children with developmental disabilities, participated in the study (see Table 1). Participants attended school from 8:30 am to 3:00 pm Monday through Friday. Their diagnoses included ASD, Down syndrome, speech apraxia, oppositional defiant disorder, and global developmental delay. All participants were diagnosed by clinicians unaffiliated with the study. Although all participants demonstrated deficits in their vocal verbal repertoires (e.g., echolalia, difficulty with articulation, pronunciation, and prosody), six participants demonstrated functional speaker skills such that novel individuals in the general community understood them relatively easily. Three participants—Tony, Macy, and Zane—had more significantly impaired vocal verbal repertoires, such that unfamiliar people might not understand them. The experimenters accepted approximations to target vocal responses throughout the study for these three participants. Zane had a diagnosis of speech apraxia and used an augmentative and alternative communication (AAC) device to communicate during the study. All of the children exhibited listener skills in the form of receptive identification and compliance with single-step instructions.

Table 1
Participant Age, Sex, and Diagnosis

Participant	Age	Sex	Diagnosis
Alan	7	M	ASD
Charlie	7	M	ASD
Alexis	3	F	Oppositional defiant disorder
Macy	7	F	ASD
Brandon	6	M	Global developmental delay
Tony	9	M	Down syndrome
Sean	6	M	ASD
Saxon	6	M	ASD
Zane	8	F	ASD and speech apraxia

Note. M = male; F = female; ASD = autism spectrum disorder.

Setting

All sessions occurred in one classroom with a teacher-to-participant ratio of 1:2.5. Prior to each session, a lead teacher picked up the participants from other classrooms and then returned them to their home classroom following the session. The lead teacher (first author) was a senior graduate student in behavior analysis and each assistant teacher had a bachelor's degree in psychology. All of the teachers had at least 3 years of experience working with children with developmental disabilities. All sessions occurred in the academic area of the classroom. The academic area was carpeted, with one desk, one double-sided toy shelf, two computers on a rectangular table against the back wall, one bookshelf, and cubbies for the participants to store their belongings. All opportunities to observe children during evocative situations occurred during 30-min play centers. Play centers consisted of six simultaneously available, highly preferred activities. Participants had access to play centers during

baseline probes, postteaching unit probes, and the final maintenance probe. Activities that were regularly available included Play-Doh, kinetic sand, art supplies, Lego® bricks, pretend play sets (doll house, kitchen, tool set, baby dolls with a crib, etc.), figurines, and an iPad®. Preferred toys were identified via informal observations of participant requests and play.

Dependent Measures and Data Collection

The program included 12 life skills divided evenly across four units (see Table 2). Skill units included instruction following, functional communication, tolerance of denial and delay, and friendship skills. Observers collected data using paper data sheets and pen. Observers scored a correct life skill if the participant emitted the targeted skill independently (i.e., without prompting) within 2 or 3 s of the presentation of the evocative situation. The observers scored an error of omission if the participant failed to complete all components of the skill or did not initiate completion within 3 s of the presentation of the evocative situation. The observers scored an error of commission if the participant engaged in problem behavior or emitted a behavior other than the target response. Problem behavior included physical or verbal aggression, property destruction, and vocal and motor disruptions.

Table 2
Life Skills and Instructional Units

Unit	Skill number	Description
Instruction following	1	Responds, "Yes" within 2 s of name being called
	2	Complies with single-step instruction within 3 s
	3	Complies with multi-step instruction within 3 s
Functional communication	4	Requests assistance with difficult task within 45 s by saying, "Help me, please"
	5	Requests attention by saying, "Excuse me" and tapping on shoulder 1-3 times
	6	Recruits attention appropriately and follows up with a framed request
Tolerance of denial and delay	7	Says, "Okay" and waits for duration of 30–90 s when delay is imposed
	8	Says, "Okay" and engages in another task when request is denied but alternative activity provided
	9	Says, "Okay" and continues with classroom routine when preferred activity is terminated
Friendship	10	Says, "Thank you" within 5 s of receiving item
	11	Greets a newcomer within 10 s of his or her arrival
	12	Offers a toy or materials within 10 s of newcomer's arrival

Observers scored vocal approximations as correct for Tony and Macy due to their limited vocal language skills. For example, Tony was unable to clearly say, "Excuse me, can I have the blue playdoh." Therefore, his vocal approximation for excuse me ("excu me") and a simple request ("boo peas" while pointing to the Play Doh) were accepted as a correct life skill. Observers scored target AAC responses as correct for Zane.

Interobserver Agreement

A second observer (assistant teacher) simultaneously and independently recorded participant responding during 58% of baseline observations, 72% of all probe sessions, 71% of class-wide instruction sessions, 80% of small group instruction sessions, and 43% of one-to-one instruction sessions. Agreements were defined as both data collectors scoring the same participant response for the same trial. We calculated interobserver agreement (IOA) by dividing the number of agreements by the total number of trials and multiplying by 100. Mean agreement for all direct measures was 98% (range = 86–100%; see Supporting Information 1 for further detail).

Procedure

Experimental design and overview. We used a multiple probe design across skill units to

determine the effects of life skills instruction on skill acquisition, errors of omission, and commission. Following initial baseline probes, class-wide instruction was introduced with the first skill unit (instruction following), followed by small-group instruction and one-to-one instruction as needed. Once all participants had acquired the skills in a unit, teachers conducted post-unit probes of all skills in that unit the following day. If participants responded below criterion within particular units, teachers implemented booster teaching sessions until the mastery criterion was reached. A final maintenance probe (identical to post-unit probes) occurred 4 weeks after the last post-unit probe.

General procedures. Teachers assessed and taught life skills by contriving evocative situations that entailed opportunities to display the target skills depicted in Table 2. Evocative situations included opportunities to share toys or materials, wait patiently for teacher responses, follow teacher delivered instructions, solicit assistance, greet others, and make requests (see Supporting Information 2 for further detail). When correct life skills occurred in any condition, the teacher delivered descriptive praise. For example, if the teacher called the participant's name and the child looked at the teacher and responded, "Yes," the teacher said, "I love how you looked at me and said yes when I called your name." When relevant, correct life skills were also followed by other naturalistic consequences inherent in each evocative situation (e.g., provision of assistance, access to preferred activities). Consequences for incorrect responses depended on the condition in effect (see below). The lead teacher delivered all instructions, participated in data collection, provided descriptive praise, and implemented error correction for all participants. Assistant teachers participated in data collection, provided descriptive praise, and helped arrange evocative situations during teaching trials.

Sessions occurred at 9:30 am and 1:30 pm daily and were terminated when 30 min had elapsed. When participant absences occurred, the delivery of a sequentially tiered instructional approach could not be guaranteed. For example, if a participant was absent during all class-wide instruction sessions for a particular skill and all the other participants acquired the skill; the absent participants received one-to-one instruction when they returned. Three school-mandated breaks (1 week in fall and spring, and 2 weeks in winter) occurred throughout the study. Otherwise, all of the children participated in each of the class-wide instruction sessions.

All classrooms within the school implemented proactive and reactive behavior management strategies. These strategies continued during all conditions of the experiment. Proactive behavior management strategies included minimizing transition times between activities, providing adequate space and supplies for each activity present, rotating activities regularly, and ensuring activities and items reflected participants' interests. Teachers also implemented two types of reactive behavior management strategies. When desirable behavior occurred, teachers provided descriptive praise. When problem behavior occurred, the teachers implemented consequences according to a school-wide level system (Barbetta, 1990; Cruz & Cullinan, 2001). The level system consisted of three colored cups (blue, green, and red) in which popsicle sticks with the participants' names were placed. The placement of the popsicle sticks in each cup signaled the availability of items and activities in the classroom. The blue cup (highest level) indicated that all preferred items and activities were available to earn. Placement in the green cup indicated that only moderately preferred items were available, and red cup placement indicated that all highly preferred and moderately preferred items were unavailable. The participants always started their day in the green cup and could earn their way up to the blue cup by engaging in appropriate behavior (e.g., compliance,

appropriate social interactions, completing academic activities). Problem behavior resulted in being moved down to a lower level; however, the participants could always earn their way up to higher levels by engaging in appropriate behavior. The contingencies for moving up and down levels were fluid by design, and dependent on the current and historical behavior of the participant.

Baseline and maintenance probes. In baseline and maintenance probe sessions, each participant was given either two or three opportunities to emit each skill. If the participant responded correctly or incorrectly on two consecutive occasions, we did not present the third trial. Otherwise, the teachers conducted three trials. The teachers conducted three types of maintenance probes (post-unit, post-skill, and 4 weeks after the end of intervention). These probes were distinguished by their content and timing, but the procedures were identical. Responding during post-unit probes constituted the primary dependent variable. As noted above, post-unit probes included all three skills in the target unit and were conducted the day after the participants had mastered all skills in the unit. In accordance with the logic of the multiple probe design, post-unit probes occurred for the target skill unit concurrently with baseline probes for skill units still in baseline and previously mastered units. The experimenters conducted post-skill probes the day after acquisition of the first two skills in each unit (skills 1, 2, 4, 5, 7, 8, 10, and 11). Because the final skills taught in each unit (skills 3, 6, 9, and 12) were followed by a post-unit probe, there was no need to conduct post-skill probes for these skills. The purpose of the post-skill probes was solely to bridge the gap from acquisition of these skills until the scheduled post-unit probe, and the data from these probes are not included in the graphs or reported in the manuscript.

Prior to session, teachers arranged each participant's six highly preferred activities within the academic area. Activities were arranged in centers that had enough room for three to four children to participate in each activity. Activities were arranged both at tables and on the floor, spaced at least 30–60 cm apart. The participants then entered the room and selected an activity. When all participants had been engaged for a minimum of 3 min, the teachers started arranging the relevant evocative situations. For example, if the targeted life skill was to say, "Okay" when instructed to wait after requesting a preferred item, teachers would arrange for components of the preferred activities to be missing. If participants engaged in the targeted life skill, the teacher provided descriptive praise. If the participant did not engage in the targeted life skill, the teacher moved on to the next trial with another participant.

Life-skill instruction: Overview. All participants experienced class-wide instruction for each skill across all units. Participants who did not acquire the targeted skill received small group instruction in a group of two to four participants. Participants who did not acquire the targeted skill in a small-group setting moved to one-to-one instruction. The teachers used BST (Himle, Miltenberger, Flessner, & Gatheridge, 2004) to teach all skills. BST consisted of the teacher providing an instruction, modeling the appropriate response, rehearsing with each participant, and delivering feedback. In class-wide and small-group instruction, BST was followed by 10 evocative situations for the current skill. In one-to-one instruction, the evocative situations were presented using the progressively increasing ITIs described by Francisco and Hanley (2012). If participants did not require additional instruction, they were not required to participate in the additional intervention tiers and remained in their home classroom with other teachers to focus on their daily academic goals (unrelated to the experiment). The participants' teachers were made aware of targeted skills following acquisition and

provided praise when they occurred naturally throughout the day. Error correction procedures were not implemented outside of session time for targeted life skills.

Class-wide instruction. Class-wide instruction started with circle time, during which participants sat in a half circle facing the white dry-erase board in the academic area with their backs to the play centers. The teacher first established attending by stating, "Eyes on me" and waiting for all participants to make eye contact. Descriptive praise was provided for eye contact. When attending had been established, the teacher provided a short description of the target life skill while pointing to the corresponding visual prompt presented on the board (see Supporting Information 3). As an example, the visual prompt used for first life skill (child says "yes" when their name is called within 2 s) included three photographs placed side by side. One picture was a stop sign, the other was a pair of eyes, and the third was a cartoon child saying, "Yes." Visual prompts were only present during life skills instruction and were excluded from all probes. The teacher then provided one model of the target skill by recruiting an assistant teacher from the classroom to act as either the child or the teacher. This was followed by one opportunity to role-play the correct response with a teacher. All subsequent instruction occurred in the same sequence (verbal description, model, and role-play). If errors of omission or commission occurred during role-play, the teacher would repeat the instructional sequence until the participant responded correctly.

Following BST, 10 trials each containing one evocative situation were arranged for each participant to engage in the target life skill. For 10 out of the 12 skills, the first three of these trials occurred during circle time with highly preferred items available. For the remaining seven trials, the teacher dismissed the participants to play centers and instructed them to select a preferred activity. For two skills (eight and 11) it was challenging to arrange the relevant evocative situation repeatedly for each participant during circle time. Therefore, all 10 trials occurred in play centers.

After the participants had been directed to the play centers, the teacher waited until they were actively engaged in their selected activities for at least 3 min. The teacher then began arranging trials at the play centers and delivered the consequences described under general procedures. Errors of omission or commission resulted in corrective feedback and practice, which consisted of the teacher repeating the instructional sequence until the participant responded correctly. Thus, the teacher would describe the skill while pointing to the picture prompts, model the skill, and provide another trial. Participants mastered the life skill when they scored 80% correct or higher during the 10 trials.

If all trials were completed prior to the end of the session, the teacher moved on to small-group or one-to-one instruction for the targeted life skill (as dictated by participant performance) or introduced the next life skill in the next session. If all trials were not completed within the 30-min session, the next session began with an abbreviated circle time in which the teacher only provided the first component of BST (i.e., description of the life skill). Thereafter, the teacher conducted the remaining play center trials as described above.

Small-group instruction. Participants proceeded to small-group instruction if they did not meet the mastery criterion during class-wide instruction. Participants also entered small-group instruction if they were absent for the initial class-wide instruction for a particular skill; however, this only happened once (with Tony for skill 11). Small-group instruction was identical to class-wide instruction (circle time, followed by trials within in circle, then a transition to play stations to complete the remainder of trials), with the exception that only two to four participants participated. Participants who

mastered the skill during class-wide instruction did not participate and instead worked on daily academic goals in their home classroom. The mastery criterion for small-group instruction was identical to that of class-wide instruction.

One-to-one instruction. Participants proceeded to one-to-one instruction if they did not meet the mastery criterion in small-group instruction. They were also placed in individual instruction under two other sets of conditions: (i) If they failed or were absent for class-wide instruction and other participants were not available for small-group instruction, or (ii) if they failed post-unit or post-skill maintenance probes for a particular skill (see below). One-to-one instruction was similar to class-wide instruction and small-group instruction, except it was delivered in a one-to-one participant-to-teacher ratio and the evocative situations were presented using PITIs (Francisco & Hanley, 2012). Six one-to-one trials were presented in each session. Each session started with a review of the targeted life skills, which consisted of the teacher describing the life skill while pointing to the visual prompts followed by modeling and role-play. The teacher then instructed the participant to select a highly preferred activity. As in previous phases, we waited for 3 min of active engagement prior to arranging trials for the target life skill. Following the initial trial, evocative situations were initiated at 3, 10, 30 s, 2, 4, and 16 min after termination of the previous trial. Participants reached mastery in individual instruction if they responded correctly during at least 80% of trials in a session. Sessions continued until the participants met the mastery criterion.

Booster teaching. The teachers implemented booster teaching for individual skills if a participant did not meet the mastery criterion during post-skill probes or post-unit probes. When individuals displayed <75% performance on post-unit or post-skill probes, booster teaching was conducted for individual skills using one-to-one instruction procedures. When the majority of the group displayed similar deficits in performance, we implemented class-wide booster teaching.

Procedural Fidelity

Observers collected procedural fidelity data during 48.6% of baseline observations, 89.2% of class-wide instruction sessions, 80.7% of small group instruction sessions, and 58.5% of individual instruction sessions. There were separate checklists for class-wide instruction, small-group instruction, one-to-one instruction, baseline/post-unit probes, and maintenance probes. The checklists evaluated all aspects of instruction, including the presentation of evocative situations, use of prompts and error correction, consequences delivered, and length of ITI (for one-to-one instruction). Procedural fidelity was 100% across all sessions. Observers also collected IOA data for procedural fidelity data during 48.6% of baseline observations, 44.2% of class-wide instruction sessions, 63.7% of small group sessions and 57.2% of individual instruction sessions. The average agreement was 99.8% (range 91–100%; see Supporting Information 1 for further details).

Social Validity

The experimenters administered a brief social acceptability questionnaire (adapted from Hanley et al., 2007) consisting of six questions evaluating the acceptability and feasibility of the intervention to three of the seven home classroom teachers. Of the four teachers who did not complete the survey, two were ineligible due to serving as data collectors for the study, and two were on leave. The teachers were asked to indicate on a scale of 1–7 whether the participants benefitted from the program, whether the social environments in their classrooms improved, whether the skills targeted would be useful if taught to all participants in the classroom, whether addressing life skills with their entire class would be beneficial, and if they

would recommend the program to other teachers.

RESULTS

Figure 1 shows the results of baseline, post-unit, and 4-week maintenance probes for all participants. Each bar represents one participant and each cluster represents one probe session. Bars extending above the horizontal axis show the percentage of correct responding and bars extending below the horizontal axis show the percentage of incorrect responding (i.e., errors of omission and commission). As depicted in Figure 1, all participants' correct responding remained low and variable (M = 24.1%, SD = 19.2%) during baseline for each skill unit. In post-unit probes (including the 4-week maintenance probe), correct responding was high across all skill units and participants (M = 92.3%, SD = 12.5%). Consistently high percentages of correct responding occurred when and only when intervention was implemented for each skill unit, demonstrating experimental control. The improvements maintained 4 weeks after the intervention. During baseline, errors of omission occurred in an average of 57.3% of trials (SD = 26.5%) and errors of commission occurred during an average of 18.1% of trials (SD = 17.6%). Following intervention, errors of omission occurred in an average of 6.1% of trials (SD = 11.0%) and errors of commission occurred in an average of 1.5% of trials (SD = 4.4%). To further evaluate the magnitude of the treatment effects, we calculated percentage of nonoverlapping data (PND; Scruggs & Mastropieri, 2013; Scruggs, Mastropieri, & Casto, 1987). PND was 86.5%, indicating moderate to high effectiveness of the intervention.

The percentage of correct responses and errors of omission and commission during class-wide instruction are shown in the left-most panels of Figures 2 and 3. Alan was not able to attend class-wide instruction for skill 10, and Tony could not attend class-wide instruction for skill 11. Thus, there were 106 total implementations of class-wide instruction across participants and skills. Of these implementations, 81 (76.4%) resulted in acquisition. It is noteworthy that all participants met the mastery criterion during class-wide instruction for skill 4 (requesting assistance with difficult task), skill 7 (waiting for 30-90 s), and skill 10 (saying, "Thank you"). Life skills 1 (responding "Yes", when name is called) and 2 (complying with single-step instruction) also resulted in a high success rate during class-wide instruction, with eight out of nine participants meeting the mastery criterion. However, only four out of nine participants met the mastery criterion in class-wide instruction for skills 8 and 9, both of which targeted tolerance of denial. On an individual-participant level, Sean, Charlie, and Saxon met criterion during class-wide instruction for 11 of 12 skills, Macy and Zane met criterion for 10 of the 12 skills, and Saxon and Brandon met the criterion for nine of the 12 skills. Tony and Alan were the least likely to master skills during class-wide instruction. Tony met mastery criterion for six out of 11 skills, and Alan met mastery criterion for four out of 11 skills. Responding for all nine participants during the post-unit probes was relatively low for skill 5. Therefore, the teachers conducted booster teaching for skill 5 for the entire group using class-wide instructional procedures. This was the only instance in which class-wide instruction was implemented more than once for any of the skills. All nine participants met the mastery criterion during booster teaching session (see Supporting Information 4).

The teachers implemented small-group instruction seven times (see middle panels in Figures 2 and 3). As noted before, this level of instruction was only implemented when two or more participants did not meet the mastery criterion during class-wide instruction. Three

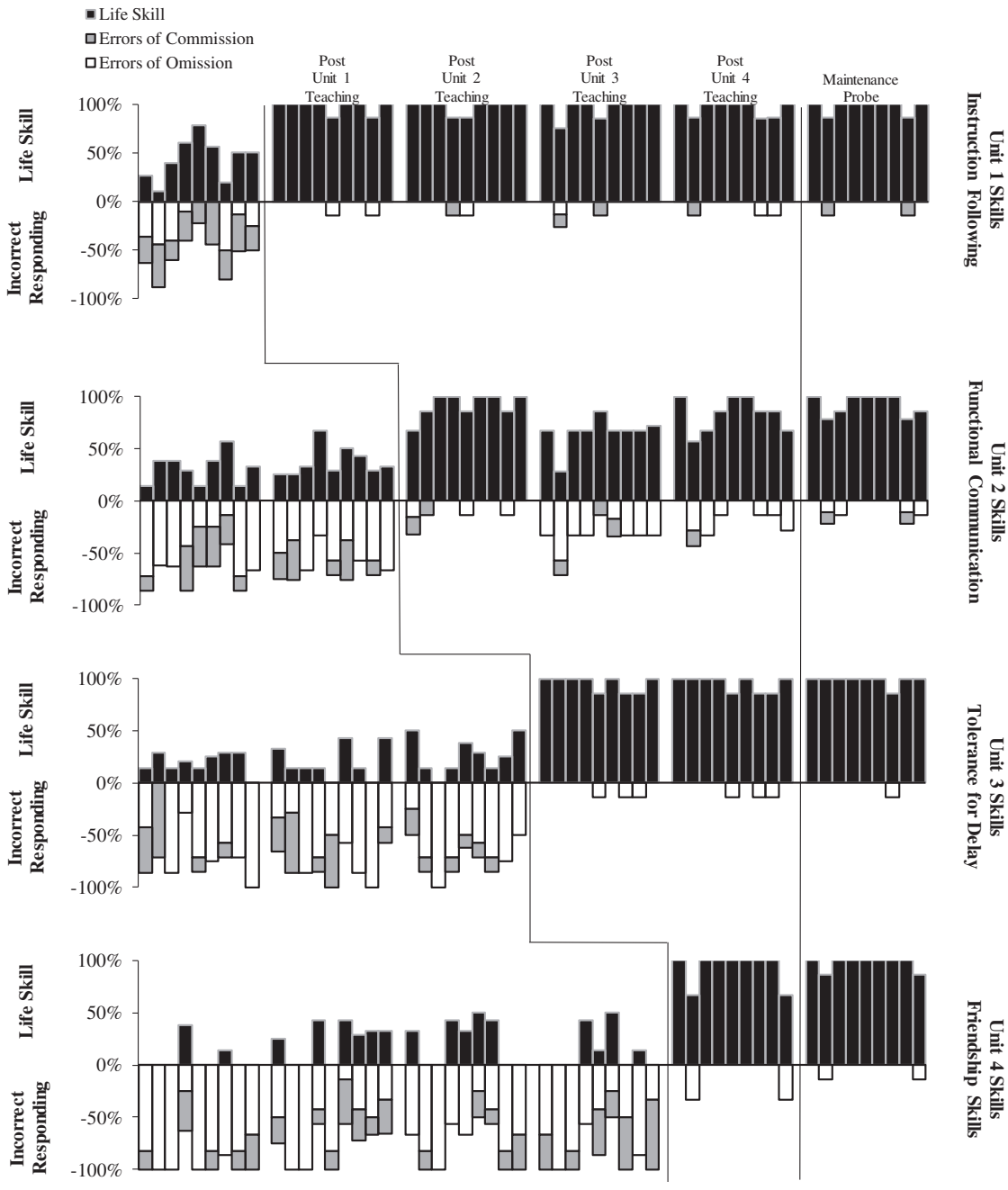

Figure 1. Percentage of correct and incorrect responding (errors of omission and commission) during baseline unit probes, post-unit probes and the 4-week maintenance probes.

children participated in the small-group sessions for skills 3, 5, 11, and 12, while five children participated in the sessions for skills 8 and 9. When analyzing the results by skill, the small-group teaching sessions for life skills 3, 5, 6, and 12 resulted in acquisition for all children

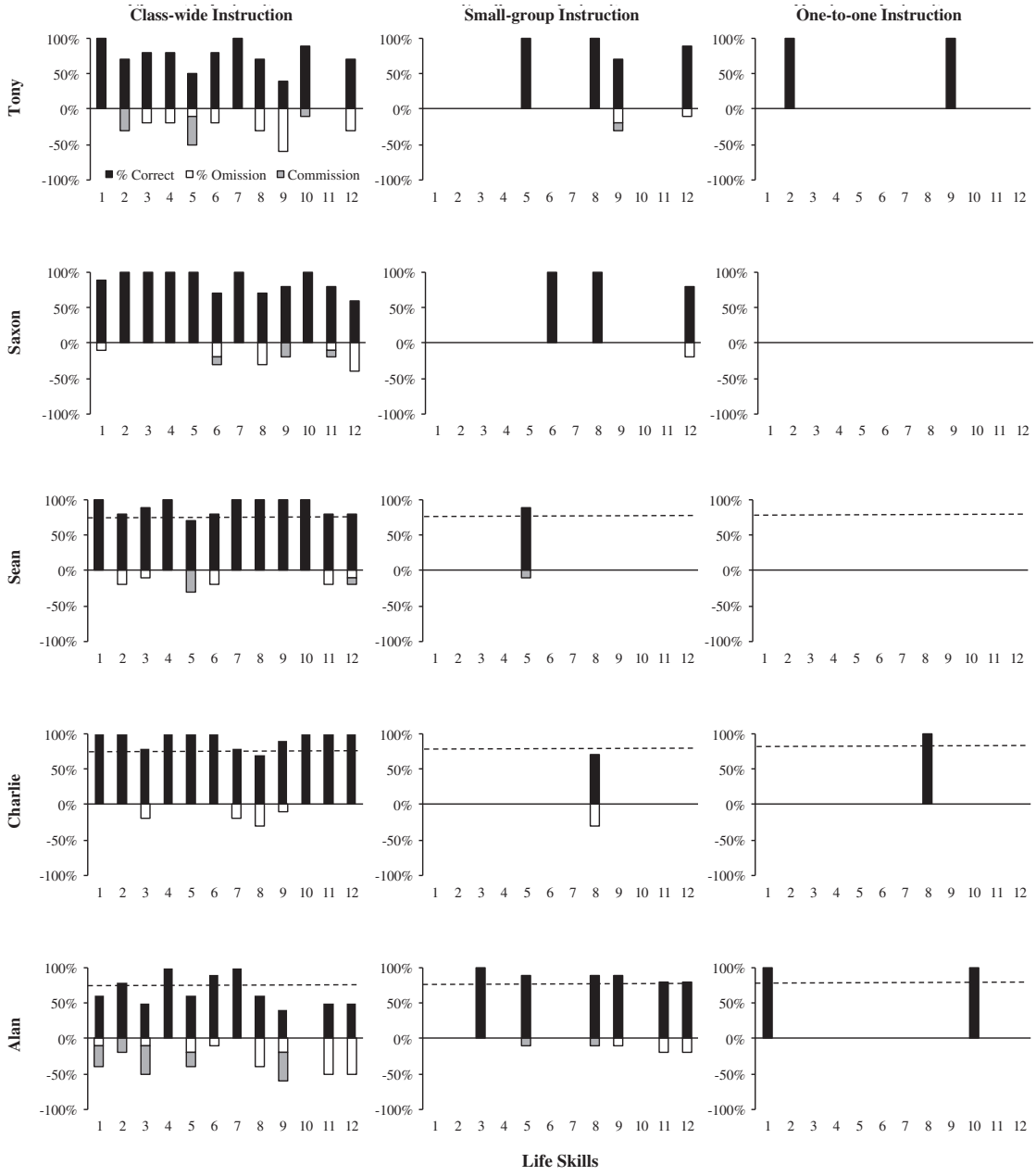

Figure 2. Results of class-wide, small-group, and one-to-one instruction for Tony, Saxon, Sean, Charlie, and Alan.

who participated. The session for life skill 8 resulted in mastery for four out of five participants, the session for skill 9 resulted in mastery for three out of five participants, and the session for skill 11 resulted in mastery for one out of three participants. Of the 24 total implementations of small-group teaching across participants and skills, 19 resulted in acquisition

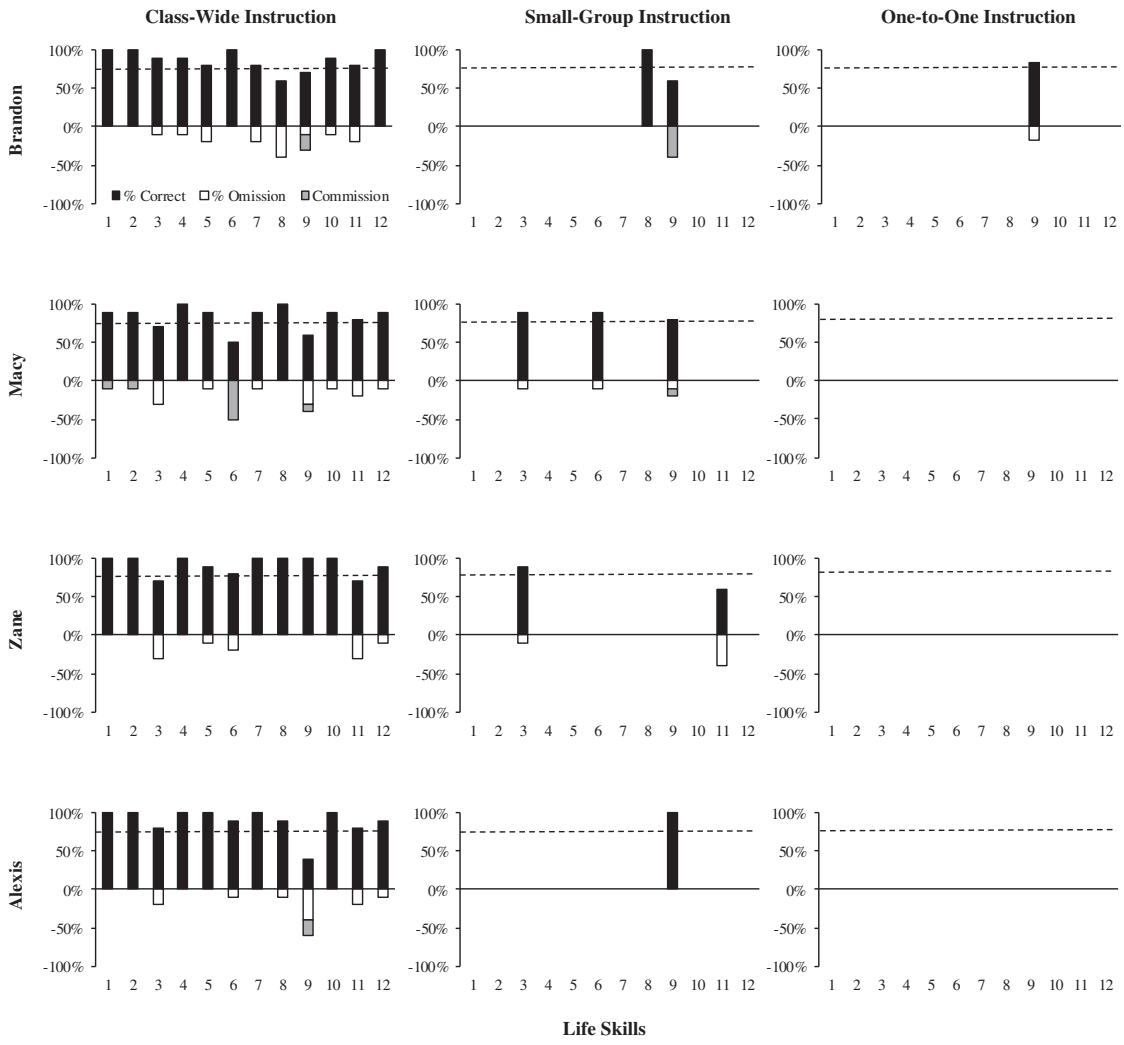

Figure 3. Results of class-wide, small-group, and one-to-one instruction for Brandon, Macy, Zane, and Alexis.

(79.2%). Of the participants who did not acquire all targeted skills in small-group instruction, Tony failed to acquire two skills (out of five), Brandon and Zane failed one skill (out of two), and Charlie failed to acquire the skill in the only session in which he participated. Note that Tony was placed in small-group instruction for skill 11 because he was absent during class-wide instruction for that skill.

The right-most panels in Figures 2 and 3 show the results of one-to-one instruction. As noted above, there were three circumstances under which Tier 3 intervention was implemented: (i) A participant did not acquire a skill during small-group instruction, (ii) a participant failed a skill in class-wide instruction, but there were not sufficient participants to create a small-instruction group, or (iii) booster teaching was necessary because a participant failed a previously mastered skill during post-unit probes or during post-skill probes. One-to-one instruction was implemented 16 times.

Half of these instances (eight) were due to the need for booster teaching after a participant did not meet criteria with a particular skill in post-unit or post-skill maintenance probes, and two instances were due to default placement. The remaining instances were due to participants failing to meet criteria in both class-wide and small-group instruction. Seven of the nine children (all except Alexis and Saxon) participated in one-to-one instruction at some point. Alan experienced one-to-one instruction for five skills, Charlie for two skills, Macy for two skills, Brandon for one skill, Tony for three skills, Sean for two skills, and Zane for one skill. The participants met the mastery criterion in the first 6-trial block in 12 out of 16 implementations. In the remaining cases, the participants met criterion in two or three sessions. Eleven out of the 16 implementations were errorless (see Supporting Information 5 for more detailed information on errors and sessions to mastery during one-to-one instruction).

Social Validity

Overall, social acceptability measures were high across the teachers, with mean ratings ranging from 6.3 to 7.0 (on a scale of 1–7) across all items (see Supporting Information 6). Thus, teachers felt that the tiered intervention would be beneficial for all participants, that the skills lent themselves to success in a classroom setting, and that they would recommend life-skills instruction to other teachers.

DISCUSSION

This study evaluated life skills instruction (Hanley et al., 2007) with nine children with developmental disabilities. Teachers delivered instruction in three tiers, influenced by the RTI approach (Falligant & Pence, 2017; Gresham, 2004). The first tier, class-wide instruction, consisted of large-group instruction followed by a set number of one-to-one teaching trials in the classroom. The second tier was identical to the first, except that teaching occurred in small group. Finally, the third tier consisted of one-to-one instruction, which continued until the mastery criterion was met. The teachers implemented subsequent tiers only if previous tiers did not lead to mastery. Overall, this instructional approach led to mastery of all life skills and reduction in errors of omission and commission for all nine participants.

Class-wide instruction effectively produced skill acquisition in most cases, but was not sufficient to facilitate skill acquisition for all participants across all skills. Some individual differences were found, with Tony and Alan less likely to meet mastery criterion in class-wide instruction. It is possible that these participants lacked prerequisite or component skills necessary to benefit from large-group instruction, but it is also plausible that they were more likely to require multiple learning opportunities to achieve mastery independent of specific prerequisite skills. Additionally, two of the skills were relatively less likely to be acquired during class-wide instruction. These skills targeted denied access to preferred items or activities. It may be that these skills are particularly challenging for this population and might require more learning opportunities.

Small-group instruction also resulted in skill acquisition in most cases. This is consistent with previous research (Luczynski & Hanley, 2013), indicating that higher teacher-to-participant ratios of instruction can be beneficial. However, the design of the current study does not rule out the possibility that additional rounds of class-wide instruction would have produced the same result. Regardless, the small-group format provides a convenient way to provide more learning opportunities to the participants who need it most, consistent with the tenets of the RTI approach. In the remaining cases, one-to-one instruction always resulted in acquisition.

Teachers implemented remedial one-to-one instruction (i.e., booster teaching) if

participants did not display criterion performance during post-unit probes or post-skill probes. However, one-to-one instruction booster teaching was needed only eight times for 12 skills across nine participants throughout the entire study. Additionally, we repeated class-wide instruction for skill 5, due to relatively low accuracy for that skill during the initial post-unit probe. Anecdotally, it seemed that the difficulties with acquiring skill 5 might have been due to slight differences in how two teachers arranged the evocative situations. Overall, the limited need for remedial instruction supports the efficiency of the three-tiered instructional approach.

Falligant and Pence (2017) previously evaluated PLS with a similar population using the RTI approach. These authors found the three-tiered life skills instruction to be effective overall, but outcomes varied across participants. In the current study, class-wide instruction led to mastery in 76.4% of cases, while the comparable percentage was 41.7% (15 of 36) in the study by Falligant and Pence. It is possible that the inclusion of picture prompts in the current study improved the efficiency of class-wide instruction. Additionally, Falligant and Pence implemented procedural modifications for some participants during one-to-one instruction (tier 3), whereas all participants acquired all skills with the original procedures in the current study. It is possible that the inclusion of PITIs (Francisco & Hanley, 2012) improved skill acquisition in one-to-one teaching in the current study. It should be noted that throughout all tiers of instruction in the current study, teachers accepted approximations to correct responses for two participants, and accepted AAC responses as correct for one participant. If Falligant and Pence had done the same, the need for at least one of their procedural modifications (modified response requirements) would have been eliminated during the one-to-one tier. Finally, the participants in the current study were slightly older on average (M = 6.6 years) than the participants in the Falligant and Pence study (M = 5.3 years). While it seems unlikely that the age difference entirely explains the different outcomes, age or skills may have played a role.

Overall, the life skills intervention proved to be an effective method for teaching the 12 life skills to all nine participants. The tiered instructional method allowed us to adapt the quantity and quality of instruction to each participant's learning needs. This approach is designed to increase instructional efficiency by beginning with class-wide instruction in which all participants received the same instructional approach as well as the same dose of instruction, and implementing additional instruction only for those participants who did not master the skills initially. Life skills instruction took a total of 37 days across 6 months, with two 30-min sessions occurring daily. Future research could further explore how the efficiency of instruction might be improved by integrating sessions into ongoing classroom activities.

The current study is limited due to the lack of measures of generalization across people and settings. Falligant and Pence (2017) evaluated generalization during naturally occurring opportunities across a variety of contexts with both adults and peers but found limited generalization. Luczynski, Hanley, and Rodriguez (2014) found that generalization with a novel teacher was enhanced after the teacher was informed of the targeted skills and teaching procedures, suggesting one strategy that could be explored further in future research. Conducting post-teaching observations in school settings after skill acquisition could provide valuable information on the extent to which the life-skills program supports and facilitates school readiness.

The current study is also limited in that our definition of errors of commission did not differentiate between problem behavior and relatively innocuous behavior (i.e., doing

something other than the defined life skill). Thus, the data did not determine the extent to which participants engaged in problem behavior during baseline. Hanley et al. (2007) defined problems of commission in terms of specific undesirable responses (vocal disruption, motor disruption, and aggression). However, their definition of vocal disruptions also included relatively innocuous behavior (saying "no" to an adult instruction). Follow-up studies have either used the exact same definition (e.g., Hanley et al., 2014) or specifically limited the definition to socially inappropriate behavior (e.g., Falligant & Pence, 2017; Luczynski & Hanley, 2013). Future research might be improved by distinguishing between errors of commission that are more or less socially appropriate.

The teachers and assistant teachers who implemented the program in this study had bachelor's degrees in psychology and a minimum of 3 years of experience providing behavior analytic services for children with complex developmental disabilities. Further, the classroom was supervised by a graduate student in behavior analysis with 8 years of experience (first author) who in turn was supervised by two doctoral-level behavior analysts (second and third authors). This level of behavior analytic support is not always available in typical clinical or educational settings. Future research should explore implementation of the life skills program in more typical settings using a consultative model, similar to that modeled by Hanley et al. (2014).

The PLS program was originally created to serve as a preventative intervention for problem behavior in nonmaternal preschool settings (Hanley et al., 2007). The current study sought to expand its application to individuals with developmental disabilities while addressing skills identified as positive indicators for school readiness. Further research on the adaption of this approach to other age groups could prove valuable if the appropriate targets are identified. For example, some adults with developmental disabilities who reside in care facilities engage in various topographies of problem behaviors and demonstrate social skill deficits (Corrigan, 1991; Zarcone et al., 1993). A life skills program aimed at improving functional communication, tolerance, and engagement could significantly improve the quality of life of residents in assistive care facilities and a variety of other settings. Finally, while the literature on life skills has shown that the intervention is effective in establishing important skills, only a handful of studies have directly evaluated prevention of problem behavior (Fahmie, Iwata, & Mead, 2016; Fahmie, Macaskill, Kazemi, & Elmer, 2018; Luczynski & Hanley, 2013). Future research should evaluate the extent to which the life skills intervention might prevent the development of problem behavior over the short- and long term.

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Received March 11, 2018
Final acceptance April 9, 2019
Action Editor, Tara Fahmie

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Additional Supporting Information may be found in the online version of this article at the publisher's website.