Journal of Early Intervention
2017, Vol. 39(4) 339–358

DOI: 10.1177/1053815117725693
journals.sagepub.com/home/jei
SAGE

Using Visual Activity Schedules for Young Children With Challenging Behavior

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Abstract

Young children with challenging behavior may require individualized interventions to facilitate improved outcomes. Visual activity schedules (VAS) have been well documented for improving engagement, transition, and recreation behaviors with children with autism spectrum disorder (ASD) and intellectual disabilities (ID). However, children exhibiting challenging behavior in inclusive preschool settings do not necessarily have an ASD or ID diagnosis. This study evaluated the use of constant time delay (CTD) to teach three children without ASD or ID to use VAS. Engagement and challenging behavior were measured in the context of A-B-A-B withdrawal designs. Children learned to use the VAS and levels of engagement and challenging behavior matched levels similar to typical peers. However, children did not generalize schedule use to novel contexts. Results suggested that CTD+VAS may be a feasible individualized intervention to increase engagement in young children with challenging behavior who do not have ASD or ID.

Keywords

visual activity schedule, challenging behavior, engagement, at-risk, intervention, preschool, constant time delay

Introduction

Approximately 5 million young children are at-risk for or currently exhibit challenging behavior (CB; Powell, Fixsen, Dunlap, Smith, & Fox, 2007). This can impact access to instruction and social relationships in preschool (Campbell, 1995; Dunlap et al., 2006; Gilliam, 2005). Fifty percent of preschool children with externalizing CB continue to exhibit CB into their school-aged years (Campbell, 1995), especially if CB is not addressed prior to the school-age transition (Stormont, Beckner, Mitchell, & Richter, 2005). Preschool expulsions occur at 3.2 times the rate of K-12 schools—further indicating that CB is a substantial concern in early childhood (Gilliam, 2005).

Although preschool teachers recognize that CB can prohibit access to quality instruction (Quesenberry, Hemmeter, & Ostrosky, 2011), they may be unable to identify individualized interventions to support children with CB (Snell, Berlin, Voorhees, Stanton-Chapman, & Hadden, 2012). To decrease suspension and expulsion rates in preschools, teachers must implement research-based, individualized behavior plans. Multiple resources available for teachers (Center on the Social

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Emotional Foundations for Early Learning [CSEFEL], National Association for the Education of Young Children [NAEYC], The National Center on Quality Teaching and Learning [NCQTL], and Technical Assistance Center for Social Emotional Interventions [TACSEI]) identify visual supports as an intervention for improving prosocial behaviors and decreasing the likelihood of CB (Blagojevic, Logue, Bennett-Armistead, Taylor, & Neal, 2011; Lentini, Vaughn, & Fox, 2008; The National Center on Quality Teaching and Learning, 2012; Ostrosky, Jung, Hemmeter, & Thomas, n.d.).

Visual activity schedules (VAS) are photographs, pictures, symbols, or drawings that provide information about a sequence of activities or events (MacDuff, Krantz, & McClannahan, 1993; Wong et al., 2014). VAS are often printed and laminated symbols presented to students in a specific order to indicate the sequence of a task or series of activities. VAS interventions include providing children with a VAS and using systematic teaching strategies to teach children how to use the materials. VAS interventions can be used to increase independence, acquisition, and engagement (Heflin & Simpson, 1998; McClannahan & Krantz, 1999) and provide clear expectations for routines or activities (Wong et al., 2014). They have been used to improve outcomes in school, home, and community settings (Lequia, Machalicek, & Rispoli, 2012). Beginning in early childhood, VAS can be used to improve acquisition, maintenance, and generalization of a variety of behaviors (Knight, Sartini, & Spriggs, 2014) during transitions (Dettmer, Simpson, Myles, & Ganz, 2000), recreation and leisure activities (Whatley, Gast, & Hammond, 2009), vocational tasks (Carson, Gast, & Ayres, 2008), classroom or academic activities (Bryan & Gast, 2000; Duttlinger, Ayres, Bevill-Davis, & Douglas, 2013; Pierce, Spriggs, Gast, & Luscre, 2013; Spriggs, Gast, & Ayres, 2007), and play (Machalicek et al., 2009).

In extant research for VAS, on-schedule and on-task behaviors served as dependent variables (Bryan & Gast, 2000; Krantz, MacDuff, & McClannahan, 1993; MacDuff et al., 1993; Spriggs et al., 2007). *On-schedule* referred to engagement with tasks or activities that corresponded with the current page of the VAS (MacDuff et al., 1993) or correctly completing steps of a task analysis for correct use of the VAS (Bryan & Gast, 2000; Spriggs et al., 2007). *On-task* referred to visually attending to or appropriately manipulating scheduled materials, visually attending to or manipulating the VAS, and transitioning between scheduled tasks or activities (Bryan & Gast, 2000; MacDuff et al., 1993; Spriggs et al., 2007).

While VAS interventions have been implemented in various contexts (i.e., play, leisure, academics) and settings (i.e., home, community, and school), one shared characteristic of VAS interventions is that they usually include systematic prompting procedures to teach correct use of the materials (Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007; Whatley et al., 2009). Graduated guidance procedures (Wolery & Gast, 1984) have been used most often (Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007) and have been successfully implemented by indigenous implementers such as parents (MacDuff et al., 1993) and school staff (Bryan & Gast, 2000). Graduated guidance procedures require an adult to be in physical proximity to a child from the initiation of a task or activity until the conclusion of the activity (Wolery & Gast, 1984). As there are no criteria for when or how to prompt a child using graduated guidance, teachers must consistently evaluate a child's behavior to determine (a) whether a prompt is needed and, if so, (b) the level of prompt needed to assist children in correctly completing a task (Wolery & Gast, 1984).

Although graduated guidance has been demonstrated as an effective procedure for teaching VAS use, it may not be feasible for use in inclusive early childhood classrooms as close adult vigilance and continuous close physical proximity are required to implement the procedure with fidelity. Teachers in inclusive early childhood settings may be less likely to use individualized, intensive one-on-one prompting procedures due to a lack of training (Hemmeter, Santos, & Ostrosky, 2008; Reinke, Stormont, Herman, Puri, & Goel, 2011) or higher child-to-teacher ratios than those in special education classrooms (Odom, 2000). Moreover, procedures requiring adults to be in close physical proximity to a child for the duration of an activity may not be normative in early childhood settings.

VAS should be systematically taught to children in early childhood classrooms (Gauvreau & Schwartz, 2013). Time delay procedures like graduated guidance are effective methods to systematically transfer stimulus control from response prompts to stimulus prompts (Cooper, Heron, & Heward, 2007; Wolery & Gast, 1984). Constant time delay (CTD; Wolery, Ault, & Doyle, 1992) is an alternative prompting procedure in which teacher prompting occurs only after a designated delay interval with a single prompt. CTD procedures may be more feasible for early childhood teachers as the times to prompt and ways to prompt are determined prior to initiating the procedure rather than in response to a child's minute-by-minute performance (Wolery, Ault, & Doyle, 1992). CTD has been used to teach a variety of skills to children in inclusive environments (Wolery, Ault, & Doyle, 1992) and in early childhood contexts (Wolery, Anthony, Caldwell, Snyder, & Morgante, 2002), which suggests it also may be effective for teaching children to use visual schedules. However, additional evidence is needed to support the use of CTD to teach children to use VAS before recommendations are given to practitioners to support the procedure's use in early childhood classrooms.

The literature supporting the use of VAS interventions to increase student engagement almost exclusively includes participants with autism spectrum disorder (ASD) and intellectual disabilities (ID; Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007). One study examined the use of a VAS intervention for one typically developing male (Watson & DiCarlo, 2015). However, classroom engagement is often a concern for children exhibiting CB who do not have ASD or ID (Dunlap et al., 2006; Hall, Williams, & Hall, 2000). Environmental antecedent manipulations such as VAS interventions may decrease CB by increasing opportunities to display appropriate behaviors and contact reinforcement (Dunlap et al., 2006), thus potentially improving long-term outcomes. Studies are needed that investigate the use of individualized VAS interventions to increase engagement in children with CB or social delays, but who do not have ASD or ID.

Given a dearth of research on VAS interventions in early childhood, including lack of research including CTD and with children without ASD or ID, additional research is needed to determine efficacy before evaluating use by typical agents. The purpose of this study was to systematically replicate previous research (Bryan & Gast, 2000) and extend the use of VAS to young children with CB who do not have ASD or ID. The current study specifically attempted to extend the use of VAS intervention to young children identified as at-risk for social delays due to CB in inclusive preschool settings. As the only published investigation of VAS intervention with a child without ASD or ID did not utilize a systematic prompting procedure (Watson & DiCarlo, 2015), the use of CTD, a widely used procedure in early childhood settings, was assessed. Specific research questions were as follows: (a) Does a VAS intervention increase the engagement of preschoolers at-risk for social delays with CB who do not have ASD or ID? (b) Will engagement behaviors generalize to novel activities in an inclusive preschool setting when VAS are present but no instruction is provided? (c) Is CTD an effective procedure for teaching young children with CB to use VAS?

Method

Participants and Implementers

Participants included three children at-risk for social delays who engaged in CB and two peers who were reported to have average engagement in classroom activities (see Table 1). Classroom teachers nominated target participants for participation. A 30-min observation and teacher report were used to determine whether target participants met the following criteria: (a) CB that interferes with classroom tasks, (b) low levels of engagement, (c) consistent school attendance (no more than one absence per month on average), (d) teacher report child could match 2-D pictures

Table 1. Participant Characteristics.

Name	Age[a]	Ethnicity	Disability	Challenging behavior	SSIS standard score[b]	
					Problem behavior	Social skills
Target participants						
Jacksen	43 (male)	White Hispanic	None	NC Elopement Screaming Throw materials	116	74
Noel	51 (female)	Black	SLI	NC Hitting Screaming Elopement	128	79
Julia	52 (female)	White	DD	NC Elopement Screaming Throw materials	130	53
Comparison peers						
PC 1	50 (female)	White	SLI	Jacksen Noel		
PC 2	48 (female)	White	None	Julia		

Note. SSIS = Social Skills Improvement System; NC = noncompliance; SLI = speech and language impairment; DD = developmental delay in speech, language, and social development.
[a]Age in months.
[b]Average range of standard scores across both domains: 85-115. Higher scores indicate elevated levels of problem behavior and greater social skills competence.

to 3-D objects, and (e) above average rate of CB on the *Social Skills Improvement System Rating Scales* (Gresham & Elliott, 2008). Participants were excluded if they met one or more of the following criteria: (a) diagnosis of ASD, ID, or developmental delay in cognitive development, (b) use of a VAS intervention in a current support plan, (c) teacher report of independent completion of classroom tasks, or (d) aversion to physical prompting by an adult. All target participants qualified for the study as children at-risk for social delays due to CB.

Three children identified by teachers as at-risk for social difficulties participated; teachers reported no concerns of a referral for ASD or ID for any participant. Jacksen was a 43-month-old White Hispanic male without a diagnosed disability who was identified as at-risk due to CB and family socioeconomic status. He frequently engaged in noncompliance, elopement, screaming, and throwing materials during nonpreferred activities. He did not require adult support to navigate the classroom, used spoken language to communicate with adults and peers, and did not have an individualized education program (IEP).

Noel was a 51-month-old Black female with a speech and language impairment who was eligible for speech therapy through an IEP. Noel frequently engaged in noncompliance, hitting, screaming, and elopement during free play, centers, and adult-directed activities. She could navigate the classroom independently, but required adult prompting to maintain engagement and complete multistep tasks.

Julia was a 52-month-old White female with a seizure disorder who received special education services as a student with a developmental delay in speech, language, and social development. The classroom teacher reported primary concerns related to language and CB. She received speech therapy, occupational therapy, and preacademic support in the classroom. She frequently

engaged in noncompliance, elopement, screaming, and throwing materials when asked to complete classroom routines such as hand-washing. Jacksen's teacher reported he refused to engage with art materials, Noel's teacher reported she did not engage with blocks, and Julia's teacher reported she did not complete the classroom sign-in routine.

Teachers independently ranked all children in their class based on engagement and ability given the following prompt: *Please list in rank order the highest performing to lowest performing students, on average, based upon their ability to correctly complete classroom tasks, follow directions, pay attention to instruction, make friends, and contribute to your classroom discussions and activities*. Classroom teachers each ranked 12 children. The researcher randomly selected peer participants from the middle third of the teacher engagement rankings for the purposes of normative comparisons to evaluate the social validity of the changes in target participants' behavior. Peers were excluded if they met one or more of the following criteria: (a) diagnosis of a developmental disability or (b) teacher report of CB that interfered with classroom tasks. Peer comparisons were 48- and 50-month-old White females in the same classrooms as target participants. One comparison peer was diagnosed with a speech and language impairment, and one did not have a diagnosed disability. Neither engaged in frequent CB.

The first author, a doctoral student in special education, served as the primary implementer. Two master's students in special education were trained by the first author and conducted sessions when the first author was unavailable. Parental consent was obtained prior to the study, and child assent (agreement to participate in the session) was assessed daily before each session, consistent with approved Institutional Review Board procedures.

Setting and Materials

All sessions occurred in one of two inclusive preschool classrooms attended by participants at a university-affiliated, NAEYC-accredited childcare center in the southeastern United States. Sessions were 10 min in duration and occurred during morning free play centers. Four adults, including the researcher, and four to 12 children were present during sessions for Jacksen and Noel. Three to four adults, including the researcher, and three to 12 children were present during sessions for Julia. Two to three children were present in the designated intervention area (i.e., blocks center, art center, sign-in center) during sessions for all participants. Typical classroom materials (i.e., markers, paint, blocks) were used during baseline, intervention, and generalization sessions. Jacksen and Julia's sessions occurred at a table; Noel's occurred in the blocks center on a large carpet. Each child's teacher selected intervention and generalization activities in collaboration with the researcher. Teachers identified activities children were capable of completing but did not complete daily in the classroom.

Although sessions occurred during free choice centers, Jacksen and Noel's teacher requested that intervention target low-preference activities available at that time (see Table 2). Julia's teacher requested that intervention target a classroom routine that Julia did not complete after a verbal task direction from the teacher. Each activity displayed on Jacksen and Julia's schedules was selected based on the steps all children were expected to follow when completing the activity or routine. The teacher and researcher collaboratively selected the steps required to complete Noel's routine (building a house with blocks) after observing her peers.

Visual schedules were displayed on a rectangular 30.4 cm by 7.6 cm laminated piece of cardstock with a single strip of Velcro horizontally along the middle. A single activity broken down into four steps was displayed on the visual schedule with 5 cm × 5 cm white squares depicting each step, created using Boardmaker© software (see Table 2). The number of icons was selected based on previous literature indicating six to eight icons were appropriate for a kindergarten student without a disability (Watson & DiCarlo, 2015). A 7.6 cm × 5 cm plastic bucket was placed to the right of the schedule with a 2 cm × 2 cm "all done" symbol placed on the front.

Table 2. Intervention Components by Participant.

	Intervention (generalization)	VAS type	Activity steps[a]	Materials[a]	Materials presentation[a]	Choice[a]	Controlling Prompt
Jacksen	art play (independent book reading)	abstract symbol	(1) pick creature (2) color (3) cut name (4) glue name	(1) 15 cm x 10 cm black line creature pictures (2) markers, crayons, 1cm paint cups (3) scissors column 3 "Jacksen" printed 24 pt font separated by yellow dotted line (4) glue stick	(1) 3 choices on art table (2-4) 6 qt. clear bin with 2 7.6 cm icons of color material choices	(1) monster, jungle animal, cartoon character (2) material to color	Full physical (Hand over hand)
Noel	block play (transition to circle time)	photograph	(1) get blocks (2) brown bottom (3) make walls (4) put roof on	LEGO© Juniors Family House 70 piece set	6 qt. clear bin with 7.6 cm icon of LEGOs©	(3) blocks to construct walls	Partial physical (guidance at wrist)
Julia	morning sign in routine (nap wake up transition routine)	abstract symbol	(1) get paper (2) marker (3) write name (4) put away	(1) teacher created handwriting sheet 2 cm height upper and lowercase letters (2) classroom markers (4) classroom magnet on paper	(1) sheet hung on board with magnets beside all sheets for class (2) 4 cm diameter metal cup	(2) marker color (4) location on chalkboard to put away paper	Full physical (Hand over hand)

Note: Jacksen and Noel were in the same classroom; Julia was in a different classroom. [a]Numbers in parentheses correspond to the activity numbers for each participant.

Table 3. Response Definitions.

Behavior	Definition
Engaged	a. Visually attending to target materials
	b. Looking at visual activity schedule
	c. Manipulating target materials, (i.e., as they were designed to be used)
	d. Transitioning between target activities on visual activity schedule
	e. Visually attending to adult statements about target materials
Unengaged	a. Visually attending to any nontarget materials
	b. Visually attending to adult statements about nontarget materials
	c. Manipulating nontarget work materials appropriately
	d. In transition from one nontarget activity to another with any target or nontarget materials
	e. Using materials in a manner other than that for which they were designed
	f. Manipulating but not visually attending to the materials (i.e., engaging in tactile self-stimulatory behavior with an object)
	g. Engaging in an inappropriate behavior (e.g., refusals, tantrums, stereotypical behaviors)
	h. Not engaging in activities or using materials
Challenging behavior	a. Noncompliance (failing to independently initiate a task within 10 s of task directive)
	b. Elopement (moving at least 61 cm from a designated location without permission after a task directive)
	c. Throwing materials (throwing an item, nondirectional or aimed at a person or target, out of hand in contextually inappropriate way)
	d. Hitting (open or closed hand coming into contact with another individual's body from a distance of 12 cm or greater; excluding high fives)
	e. Screaming (using a voice volume above the level of talking, with or without crying, as indicated by the participant's voice being heard over the typical classroom noise by an independent listener)
Time engaged with target materials	a. Total time (min) children engaged with materials in the target activity or center selected for intervention
	b. Jacksen: Art center materials
	c. Noel: Blocks center materials
	d. Julia: Morning sign-in materials

Note. Engaged and unengaged definitions are a systematic replication of Bryan and Gast (2000, p. 556). Participants may exhibit any of the behaviors a-d to meet criteria for engaged or unengaged. Challenging behavior definitions created after classroom observations of each participant; challenging behavior definitions are not a replication of previous studies and are individually defined.

Response Definitions and Data Collection

Response definitions. The percentage of intervals engaged served as the primary variable. In addition, the amount of time during which children were engaged with target materials, number of instances of CB, and prompted and unprompted use of the VAS were measured (see Table 3 for operational definitions and examples). Definitions for percentage of intervals engaged were based on the "on-task with scheduled materials" definition from Bryan and Gast (2000). On-schedule behavior (Bryan & Gast, 2000) was not measured directly because play behaviors can often occur in a variety of sequences and additional behaviors can be added to planned sequences while the child remains engaged. Because our procedure allowed for appropriate engagement with *nontargeted* materials following completion of the targeted activity, we also measured the time engaged with target materials. For example, if Jacksen completed all of the steps in his art activity in 8 min and then immediately and appropriately engaged in another classroom activity, researchers would code 100% of intervals engaged (data paths in Figure 1) and 8 min engaged with target materials

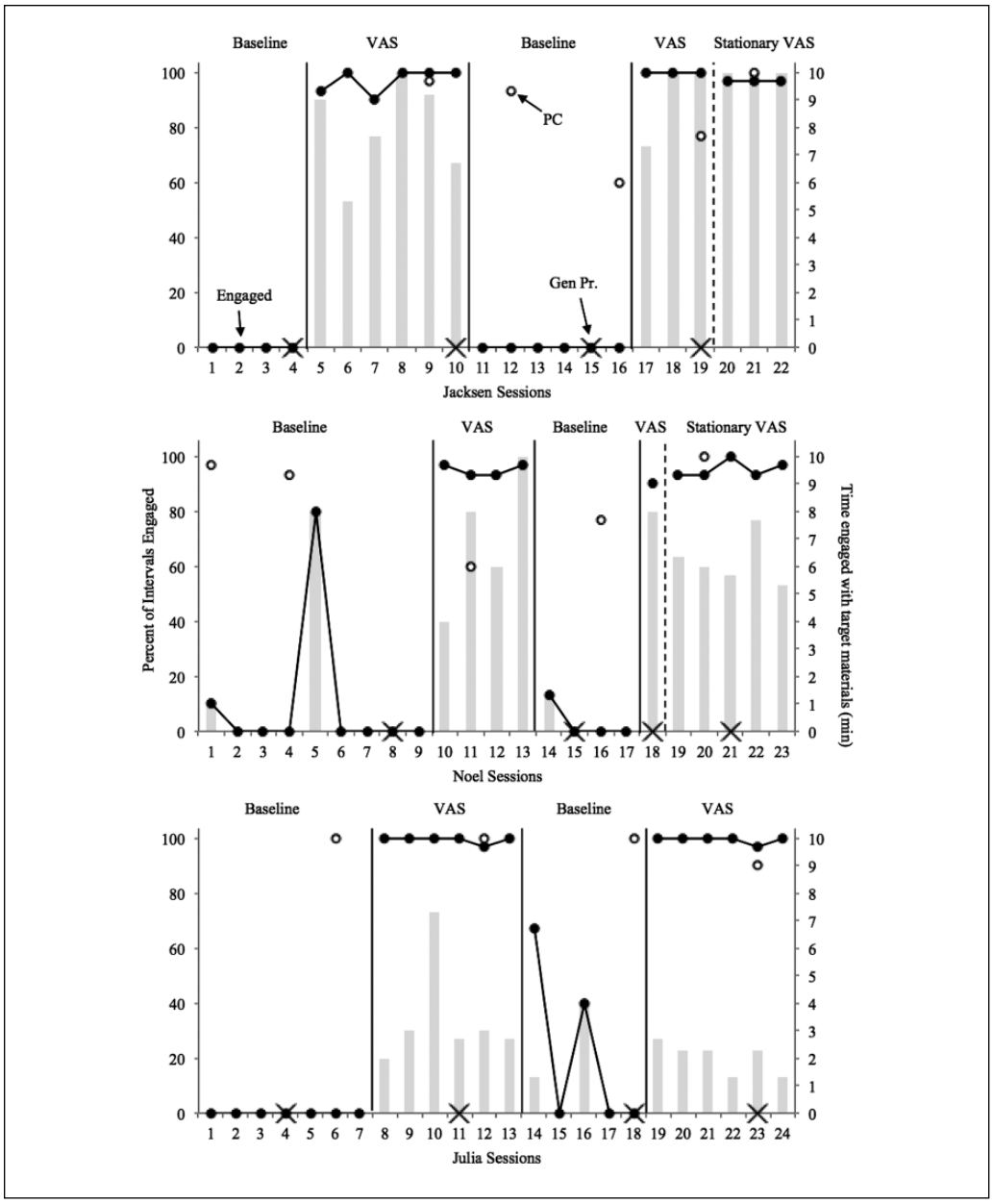

Figure 1. Engagement behaviors, time engaged with target activities, and peer comparisons across participants.
Note. VAS = visual activity schedules; PC = peer comparison; Gen Pr. = generalization probe.

(bars in Figure 1). In addition, behaviors related to using and manipulating the VAS in an appropriate manner were measured via correct completion of each step of the task analysis (see Table 4). Each step was recorded as unprompted correct (UPC), prompted correct (PC), unprompted error (UPE), or prompted error (PE; Collins, 2012). Correct and incorrect responses occurring before a prompt were coded as unprompted corrects (UPC) or unprompted errors (UPE), respectively; those occurring after a prompt were coded as prompted corrects (PC) or prompted errors (PE).

Table 4. VAS Task Analysis.

Step	Task	Wait interval
1	Walk to VAS after task direction to initiate centers	10 s
2	Locate and remove current task icon	3 s
3	Locate and walk to designated location	3 s
4	Initiate task	10 s
5	Return completed task icon to "all done" bucket	5 s

Note. Steps 2 to 5 repeated for each activity step on schedule. If participant does not initiate step within wait interval, use constant time delay procedures. VAS = visual activity schedules.

Data collection. Primary response data, reliability data, and procedural fidelity data were collected via video using paper and pencil data recording forms. *Normative comparison* data were collected in vivo using paper and pencil data recording forms. *Engagement behaviors* were estimated using a 20-s momentary time sampling procedure. *CB* was estimated using a 20-s partial interval recording procedure. Engagement was calculated as a percentage of intervals for each session (number of intervals with engaged performance / total number of intervals in session × 100). The number of intervals including CB was transformed (using a Poisson-correction procedure) to produce an estimate of the number of instances of CB emitted by participants during each session (Yoder, Ledford, Harbison, & Tapp, in press).

Procedures

General procedures. Sessions occurred for 10 min during a daily 60-min morning free play block. Sessions across baseline and intervention conditions began with the teacher saying, "[Child's name], it's time for [activity]." Jacksen and Noel were given the task direction from the classroom teacher after finishing breakfast; Julia was given the task direction after washing her hands at classroom entry. All materials except for the visual schedules were present in all sessions across all conditions, and regular classroom staff and peers were in the classroom engaging in typical activities (e.g., breakfast or play centers). Noncontingent social attention was delivered by the researcher in the form of verbal comments about play (i.e., "You are painting.") every 3 min; the researcher responded appropriately to bids for attention across all conditions. Verbal prompts were not provided to participants by the researcher in any session in any condition.

Baseline sessions. Baseline sessions started when the teacher gave the task direction. The wait interval for the first step of the task analysis began at the end of the teacher's task directive. The participant was given no verbal, gestural, or physical prompts to complete the required activity. The visual schedule was not present during baseline sessions. Teachers were instructed to conduct free play and interact with the participant per the typical classroom routine (e.g., if the participant entered a center where the teacher was located she could respond to participant bids for attention or play with materials alongside the participant). All target materials (i.e., art materials, blocks, and sign-in materials) were present during baseline. Nontarget materials (i.e., other centers) available for selection after completion of targeted activities were also present during baseline sessions. Classroom center materials such as toy foods, writing materials, blocks, and table toys were present. Peers were occasionally in close proximity to the target participant throughout baseline sessions. The researcher stood at least 30 cm away from the child, provided no prompts to the child, and videoed the child for 10 min. If the child asked the researcher to play, she said, "I'm doing work for [teacher name]." Classroom teachers ignored instances of screaming and throwing materials. Instances of elopement and hitting were redirected by classroom teachers

with a verbal prompt per their typical classroom routine, and instances of noncompliance received no planned consequence per typical classroom procedures.

Intervention sessions. Prior to session initiation, the video camera was placed at the target center location. The visual schedule was placed on the table in the target activity center for Jacksen and Julia and on the side of the carpet in the blocks center next to the wall for Noel. Icons were placed on the schedule to indicate the steps of the activity to be completed. The classroom teacher gave the participant a task direction, indicating the start of the session. The wait interval for the first step of the task analysis began at the end of the task directive. Task directions were given at the snack table for Jacksen and Noel and at the classroom sink for Julia, requiring each participant to transition to the correct center for their target activity and locate the VAS (Step 1). The researcher prompted the child to complete each step of the VAS task analysis during the first intervention session following a 0-s delay. The researcher used a delay interval for all subsequent intervention sessions (see Table 4). Wait times varied for each procedural step because the expected latency to begin and complete each step varied. The expected latency for each step was determined by the researcher in consultation with the classroom teacher after observing children in the classroom transition between activities (Steps 1, 3, and 4) and select visuals from a board during a circle time song (Steps 2 and 5). Verbal prompts were not used during sessions. If a participant did not complete a step of the task analysis within the designated wait interval, or initiated a task out of sequence, the researcher provided the controlling prompt (Table 2) for the participant to complete the appropriate step. All controlling prompts were variations of physical prompts because previous research used physical prompts to teach schedule use (Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007). The researcher consulted the classroom teachers to select an appropriate physical prompt for each participant (Table 2). After initiating a task (Step 4), any movement away from task materials while engaging with target activities between Steps 4 and 5 (i.e., painting, placing blocks together, or tracing letters) for less than 30 s did not result in a consequence from the researcher. Any movement away from task materials during other steps of the VAS task analysis was redirected following the delay for each task analysis step (see Table 4). CB was ignored. Provision of a terminal reinforcer after independent completion of VAS task analysis steps was not provided, although the child was permitted to choose to engage with target or other materials after completing the required tasks, which may have served as a reinforcer.

Data recording was terminated after 10 min, regardless of whether or not the participant completed the target activity, although the researcher continued prompting the child to engage in the sequence if activities were not complete. If the participant completed the activity prior to 10 min, the researcher provided the participant a choice of center activities by saying, “let’s play” while holding a strip with 2.5 cm × 2.5 cm icons depicting each center open during free play. During play activities, the researcher did not prompt play behaviors. Engagement with target materials was then designated by the center icon selected by the participant (i.e., the participant was considered to be engaged with target materials if he or she finished the target activity, chose a classroom center, and remained appropriately engaged in that center). If participants completed the targeted activity prior to 10 min, measurement of the total time engaged with target materials stopped when the participant completed the last step of the activity.

Generalization probes. Generalization probes were conducted at least once per condition for each participant. Activities for generalization probes were selected by classroom teachers as additional activities in which the target participants exhibited CB and included transition routines (Noel and Julia) and an independent free choice center (Jacksen; see Table 2). The visual schedule was placed adjacent to the bookcase for Jacksen (book center play), adjacent to Noel’s picture on the circle time rug (transition to circle time), and next to Julia’s cot (nap wake up routine) prior to the

session starting for all generalization probes, regardless of the condition in which the session occurred. The session started with a teacher task directive to begin the activity or transition (i.e., "Let's start morning circle!"). Participants did not receive any prompting or directions to use the VAS during generalization probes; materials associated with each activity were present. Peers were occasionally in close proximity to the target participant during sessions, and teachers were instructed to conduct the typical classroom routine. The researcher stood at least 30 cm away from the child and video recorded for 10 min as indicated by a timer on the camera. The researcher delivered noncontingent social attention and responded to participant bids for attention in the same manner as in baseline and intervention conditions. If the child asked the researcher to play, she said, "I'm doing work for [teacher name]."

Normative comparisons. Normative comparison data were collected during naturalistic observations once per condition on average for each participant. The researcher observed the peer comparison from an observation booth or inside the classroom for 10 min during the free choice period and recorded engagement and CB using the same data-sampling procedures used for target participants. Observers did not interact with participants. A random number generator was used to determine the day in which an observation was conducted for peer comparisons during each condition. Primary and secondary observers collected comparison peer data in vivo using an interval timer during reliability sessions on clipboards that prohibited each observer from seeing the data; each observer marked the data sheet regardless of the presence or absence of a behavior to ensure coders did not cue each other to instances of behavior.

Experimental Design

A single-case A-B-A-B withdrawal design (Gast & Baekey, 2014) was used to assess the presence of a functional relation between the VAS intervention and engagement. Experimental control was established when changes in responding occurred when and only when condition changes occurred. Visual analysis was used to assess level, trend, overlap, and variability within and across conditions (Gast & Spriggs, 2014). The study met What Works Clearinghouse (2014) design standards *with reservations* because—although data were stable—there were four data points rather than five in some conditions; all other standards were met.

Interobserver Agreement (IOA) and Procedural Fidelity

IOA and procedural fidelity data were collected for a minimum of 33% of sessions in each baseline and intervention condition for all participants. IOA data were collected during 40% of baseline, 38% of intervention, 42% of generalization, and 43% of normative comparison sessions. IOA data were collected via video for target participants and in vivo for normative comparisons. IOA was calculated using point-by-point agreement for each dependent variable [(agreements / (agreements + disagreements)) × 100)] (Ayres & Ledford, 2014). The mean percent agreement across all interobserver reliability sessions was 94% (range = 89%-96%) for engagement behaviors, 96% (range = 96%-96%) for CBs, and 97% (range = 94%-98%) for VAS task completion.

Procedural fidelity data were collected via video during 49% of baseline, 35% of intervention, and 42% of generalization sessions. No procedural fidelity data were collected for normative comparisons as these data were collected during naturalistic observations. Procedural fidelity measurement occurred in every condition across implementers for each participant. Six behaviors remained constant across baseline and intervention conditions: session length, session initiation within 10 s of task directive to start centers, absence of verbal prompts, absence of gestural prompts, and delivery of noncontingent social attention. Two behaviors were designed to occur only during intervention conditions: visual schedule setup and use of physical prompts to

complete VAS steps. Overall fidelity was calculated by dividing the number of correct steps completed by the sum of correct and incorrect steps then multiplying the result by 100 ([correct / (correct + incorrect)] × 100) (Ledford, Wolery, & Gast, 2014). Mean procedural fidelity for each participant was 100% for baseline sessions, 98% for intervention sessions, and 100% for generalization probes.

Social Validity

Social validity data were collected via normative comparisons of target participants to typically developing peers in the same classroom (Ledford et al., 2014). Two peer participants were observed to assess whether behavior levels of participants during intervention approximated those of "average" peers. One peer participant was used as a comparison for Jacksen and Noel, and a different peer participant was used as a comparison for Julia (see Table 1).

Results

Engagement

Figure 1 displays the percentage of intervals of engaged behaviors for each participant across conditions as well as the total time participants engaged with target materials. During initial baseline sessions, Jacksen and Julia did not engage with target activity materials (i.e., art materials and sign-in materials). Noel engaged with blocks during 80% of intervals during a single session, but her level of engagement returned to zero and remained stable during subsequent baseline sessions. When the VAS intervention was implemented, participant engagement with target activity materials immediately increased in level and remained stable at 90% to 100% of intervals. When the intervention was withdrawn, engagement immediately decreased to near zero levels for Jacksen and Noel. Engagement immediately decreased in level and had a decreasing trend as the baseline withdrawal condition continued for Julia. Julia went to the sign-in table, located her name worksheet, and sat at the sign-in table drawing circles on the paper during initial baseline withdrawal sessions. When the intervention was reintroduced, participant levels of engagement immediately returned to intervention levels, indicating a functional relation between the VAS intervention and participant engagement that was replicated across all participants with consistent, stable, and high levels of responding. There was no overlap between baseline and intervention conditions, which was consistent for each participant. The total time engaged with target activity materials also increased as a function of the VAS intervention for Jacksen and Noel. Julia's total time with target materials increased during the first intervention condition but decreased during the second intervention condition during independent completion of target activities as she became more efficient at completing the sign-in routine.

Challenging Behavior

During the initial baseline condition, Jacksen and Noel had variable rates of CB and Julia engaged in CB for approximately 10% of intervals across sessions (Figure 2). When VAS intervention was implemented, participant levels of CB immediately decreased to near zero levels and remained stable. Participant rates of CB increased when the VAS intervention was removed, and were consistent with previous baseline levels. When VAS intervention was reintroduced, Jacksen and Noel immediately returned to stable, near zero levels of CB. Julia's percentage of intervals with CB did not immediately change at intervention onset, but displayed a decreasing trend, with some between-condition overlap.

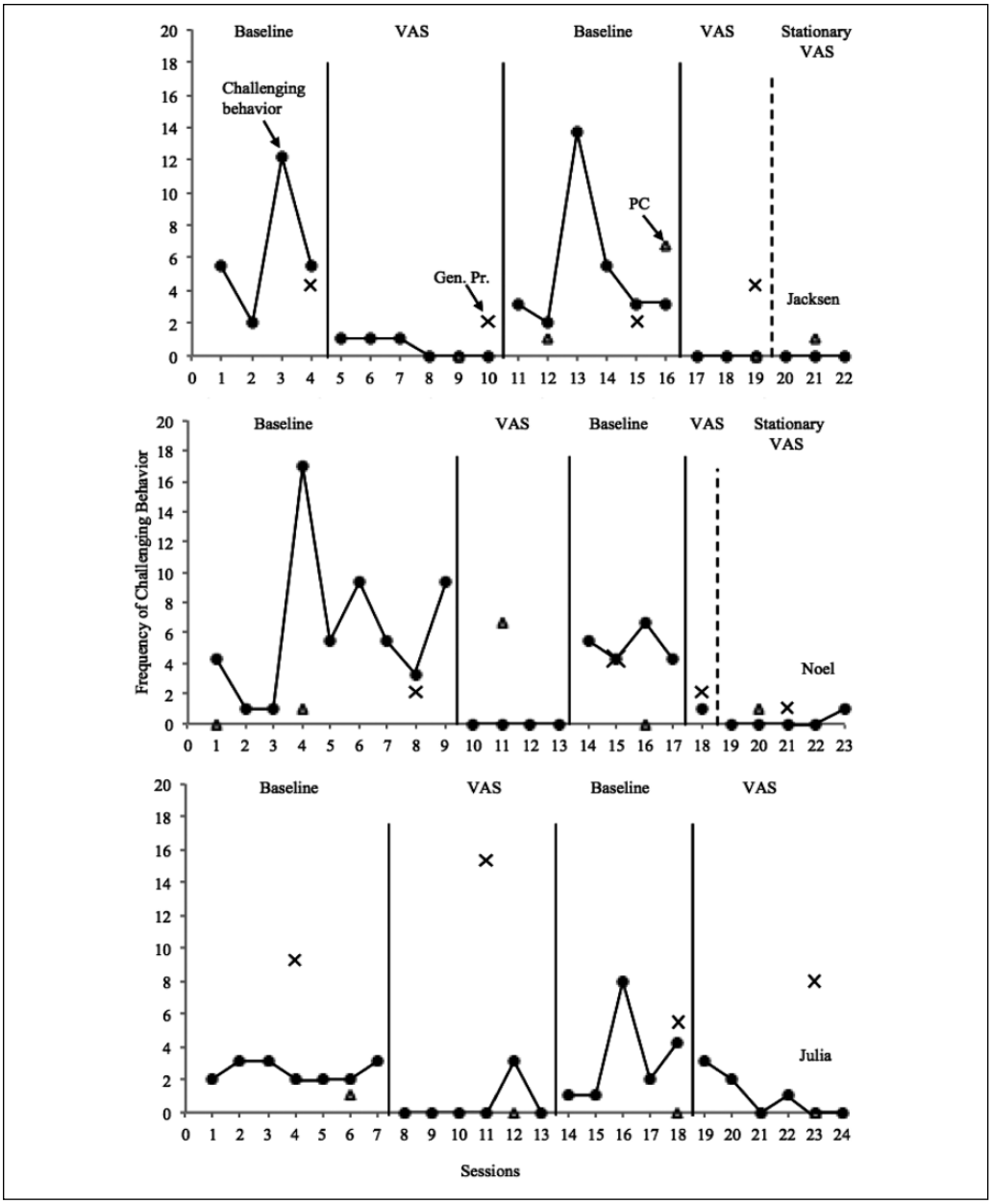

Figure 2. Challenging behaviors and peer comparisons across participants.
Note. VAS = visual activity schedules; PC = peer comparison; Gen Pr. = generalization probe.

Correct Completion

Unprompted correct completion of steps increased across intervention conditions when CTD was implemented, consistent with data patterns generally observed when CTD is used (Wolery, Ault, & Doyle, 1992; Wolery, Holcombe, et al., 1992; Figure 3). Data are reported only during intervention conditions as no VAS were present during either baseline condition. At intervention onset, Jacksen and Julia's levels of independent correct completion (UPC) increased as CTD

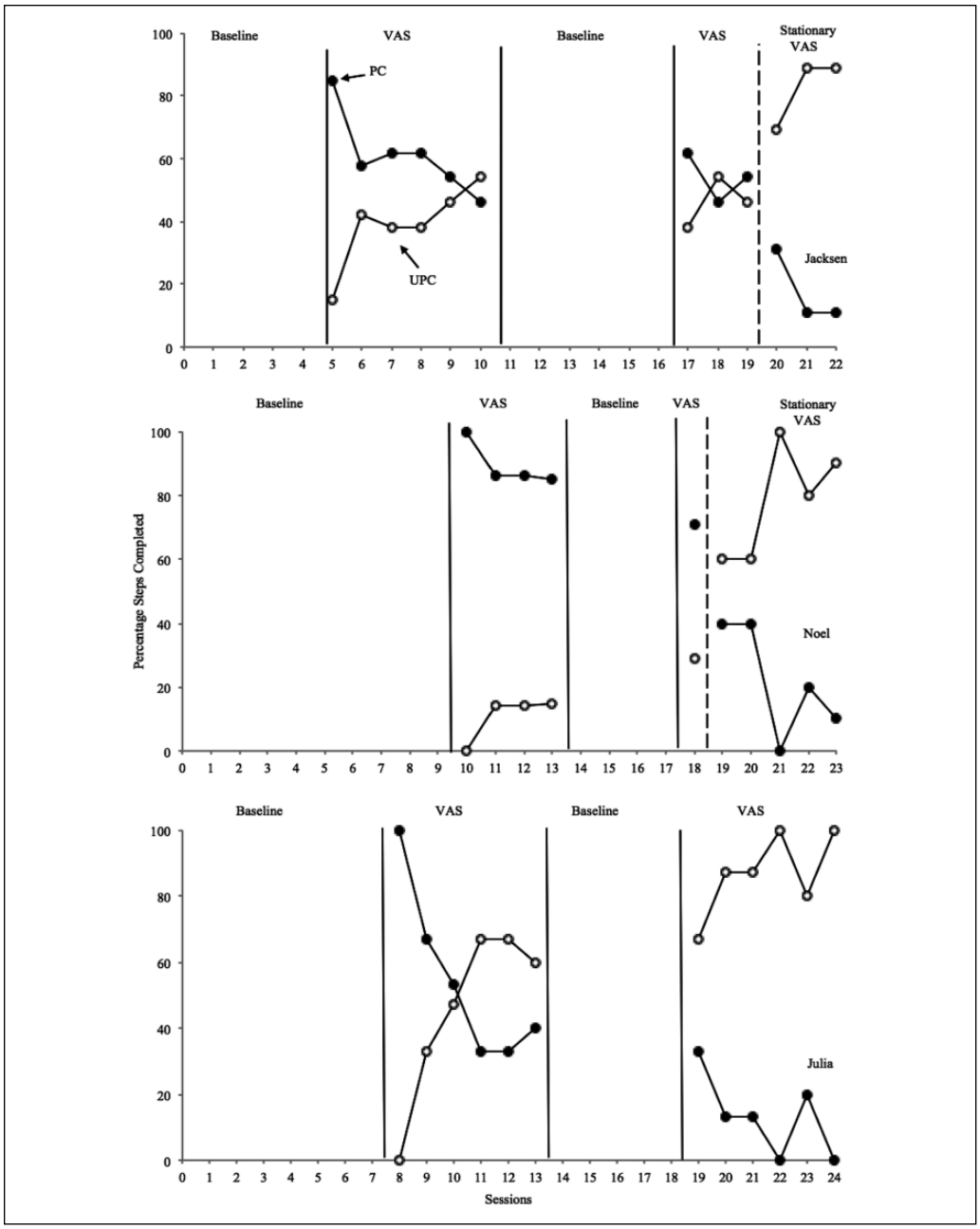

Figure 3. VAS task analysis completion using CTD across participants.
Note. VAS = visual activity schedules; CTD = constant time delay; UPC = unprompted correct; PC = prompted correct.

procedures were implemented and displayed an increasing trend for correct independent completion (UPC) throughout the first intervention condition. Independent correct completion (UPC) of VAS task analysis steps increased in level after two intervention sessions for Noel and remained stable at approximately 20% of steps. Participants most commonly required prompting to take an icon off the schedule and place completed icons in an "all done" bucket. When intervention was

reintroduced with the VAS, participant independent responding immediately increased in level and returned to initial intervention levels for Jacksen and Julia; Noel increased independent schedule use from approximately 20% in the first intervention condition to around 60% when intervention was reintroduced. VAS independent completion (UPC) data displayed an increasing trend in the final intervention condition across all participants.

During the second intervention condition, researchers implemented a planned procedural modification to the VAS task analysis after noting Jacksen and Noel did not independently complete the steps to remove the icons and place the completed icons in the "all done" bucket. Researchers determined neither of these steps significantly contributed to Jacksen or Noel's abilities to successfully complete their target activities, so their VAS were modified to include stationary icons rather than removable icons for the last three and five intervention sessions, respectively. The steps of the activity on the schedule remained the same, but the icons were laminated onto the Velcro strip to keep them stationary rather than attached via Velcro (which allowed removal of the icons). As a result, Step 2 of the VAS task analysis was modified to require each child only to attend to the appropriate icon (visual gaze or pointing) and Step 5 (return completed task icon to the "all done" bucket) was removed, reducing the number of steps in the task analysis to four instead of five for each step (icon) of the targeted activity. Modifications were not made to Julia's VAS task analysis procedures.

Generalization and Social Validity

Participants did not generalize the use of VAS to novel contexts. The percentage of intervals in which participants were engaged was zero (equal to baseline levels) and the percentage of intervals in which participants engaged in CB was higher in generalization sessions when compared with intervention sessions for all participants. During baseline conditions, target participants had lower engagement and more CB than peers (normative comparisons). During intervention conditions, target participants' levels of engagement met or exceeded those of peers (normative comparisons) and CBs were approximately equal to peer levels.

Discussion

The current study provided the first demonstration of the effectiveness of (a) CTD to teach visual schedule use and (b) VAS intervention to increase engagement and decrease CB in young children at-risk for social problems who do not have ASD, ID, or cognitive disabilities. Results indicated all participants learned to use VAS when CTD was used. Julia continued to display some appropriate engagement when the VAS intervention was removed, but engagement decreased as baseline sessions continued. The presence of the VAS may have served as a reminder or discriminative stimulus for how to successfully complete sign-in procedures (Gauvreau & Schwartz, 2013). However, the VAS may not have prompted initiation of the routine because Julia identified the correct location and materials to use for sign-in procedures when the VAS was not present. As the time since last exposure to the visual support increased, Julia's ability to successfully complete the routine decreased. One participant demonstrated 100% independent use of the VAS during intervention sessions and all participants completed 89% to 100% of steps independently by the end of the second intervention condition, indicating that 0 to 2 prompts were required per session; this may be a reasonable expectation for preschool children (i.e., 3- to 4-year-olds may require at least 1 prompt during a 10-min sustained activity).

Continued prompts in this study were required specifically to assist the children in removing icons and placing them in the "all done" bin (Jacksen and Noel). Independent schedule use occurred when the VAS were modified to be stationary (icons laminated directly on the schedule strip) rather than mobile (i.e., the icons remained stationary and were not removable from the schedule). Although none of the participants had delays in cognitive development, it may be noteworthy to

investigate why two of three participants did not need to manipulate the icons. This suggested children without ASD or ID may not need to manipulate the VAS to successfully use it to navigate multistep tasks and that the presence of the visuals alone may provide the necessary cues to complete each required step (Watson & DiCarlo, 2015). The required stationary icon modification may also be an artifact of child preference or children's desire to exert the least effort required to manipulate the VAS (stationary icons decrease a step required to manipulate the VAS). Future research is needed to investigate whether schedule manipulation (mobile or stationary icons) should be different for children with ASD and ID versus children without developmental disabilities. It is unclear whether the mobility of the schedule icons or the CTD prompting procedure may have contributed to two participants' inability to independently complete the original task analysis.

Although limited prompting to complete tasks may be developmentally appropriate for young preschool children and although CTD procedures did result in immediate increases in engagement and decreases in CB, it is unclear whether CTD procedures should be used to teach young children to use VAS rather than the commonly used graduated guidance procedure (Lequia et al., 2012). Participants in the current study did not acquire independent use of the VAS in one to three sessions using CTD procedures, consistent with previous research (Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007; Watson & DiCarlo, 2015). CTD may be a more feasible VAS intervention procedure for use in inclusive classrooms due to predictable and designated times for prompting (Wolery et al., 2002), but graduated guidance may be more efficient. Procedures were not compared in this study, so the relative efficiency cannot be determined. Future research is needed to investigate (a) whether graduated guidance or CTD procedures are more efficient for teaching young children to use VAS and (b) whether indigenous implementers prefer one of the procedures.

Engagement consistently exceeded 90% during intervention conditions; there was a concurrent decrease in variability, adding to the current research suggesting VAS interventions may increase consistency of classroom performance (Lequia et al., 2012; Wong et al., 2014). Moreover, every child met or exceeded peer engagement comparisons. This suggested VAS intervention resulted in socially valid changes. Participant engagement may have increased due to the presence of a prompting procedure used to teach visual schedule use, but engagement remained high even as prompting decreased over time.

Although various types of schedules are commonly used, the current results provided initial experimental evidence of the effectiveness of individual VAS to increase student engagement in children at-risk for social problems exhibiting CB. This information is critically important to building the evidence base for the effectiveness of VAS interventions for children in inclusive preschool classrooms with and without special education services. Additional research is needed, but results add to the current literature (Watson & DiCarlo, 2015) that suggests VAS may be effective for children without ASD or ID to increase the consistency of engagement in classroom activities. This may be true for children with non-ASD or ID disabilities (e.g., social behavioral delays) and those who are not eligible to receive special education services.

The promising results of VAS intervention indicated levels of CB can be reliably decreased using a low-cost, antecedent-based intervention for children considered at-risk for social delays due to CB. VAS intervention simultaneously resulted in increased student engagement and decreased CB without the addition of specialized assessments or individualized behavior plans. Teacher selection of nonpreferred activities as intervention targets in the current study also suggested teaching children to use a VAS may increase the likelihood of children engaging with nonpreferred materials. However, the failure of children to generalize schedule use to novel contexts suggested children may be unlikely to use VAS without explicit systematic instruction for each activity. Thus, adding a schedule to an activity or routine may not result in increases in student engagement. However, current results suggest teaching children to use VAS results in considerable changes in independent schedule use in only a few sessions.

Additional Limitations and Future Research

Although results in the current study indicate the VAS intervention was effective for increasing engagement and decreasing CB, results should be considered in light of several limitations. First, the study was conducted in a university-affiliated inclusive childcare center with no more than two students engaging in high rates of CB in each classroom. The feasibility of implementing VAS intervention in a classroom with more students who engage in CB is unclear, although previous research showed VAS interventions may be feasible in general education kindergarten classrooms (Watson & DiCarlo, 2015). In addition, the current study investigated the effectiveness of VAS intervention on increasing engagement behaviors for only three children. Although the participants were somewhat dissimilar (race, gender, and disability status), the population of children at-risk for social delays exhibiting CB is heterogeneous. More research is needed to investigate the types of children that may benefit from VAS intervention as well as the potential topographies of CB that may decrease as a result of this intervention.

The current study also provided evidence that session length may need to vary not only based on participant age, but also the type of activity. Activities targeted for VAS intervention in previous literature lasted between 5 and 60 min (mean 30 min; Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007; Watson & DiCarlo, 2015) across early childhood, elementary, and secondary contexts. Session lengths were selected to be 10 min in duration per the existing literature guidelines, but participants required a variable amount of time to complete VAS intervention activities (approximately 2 min to over 10 min). Variations in the amount of time required to complete a task were expected since classroom teachers selected the target activities, but researchers felt a standard session length was necessary to compare data across conditions. Previous research focused on engagement as a result of task completion (Bryan & Gast, 2000; Krantz et al., 1993; MacDuff et al., 1993; Spriggs et al., 2007; Watson & DiCarlo, 2015), but tasks in early childhood contexts rarely have a readily distinguishable conclusion (i.e., art activities or block play). We chose to create a context that closely resembled typical early childhood classroom settings by failing to require young children to sit at an activity for a designated period of time (10 min), if the child was able to appropriately engage with materials and complete the activity in less time. Although access to other activities after completion of targeted activities mirrored typical classroom contexts, it is unclear whether access to other activities may have served as a reinforcer for some participants. Future research investigating the length of typical EC activities using VAS may assist in providing the field a metric by which to plan activity duration. Future research also is needed to investigate whether access to other (potentially more preferred) activities after completion of nonpreferred tasks may function as a naturally occurring reinforcer for some children when VAS are used.

Although teachers assisted in selecting participants and planning target activities, feasibility of use for typical implementers was not assessed. Changes in engagement and CB could be related to the presence of a novel adult implementer. However, noncontingent social attention and responses to participant bids for attention were consistent across conditions and mirrored typical interactions in early childhood settings, indicating that presence and responsiveness alone was not sufficient for behavior change. Furthermore, participant engagement and CB changed only when the VAS intervention was implemented or withdrawn, suggesting participant behavior varied as a function of the presence or absence of the VAS intervention. Previous research related to VAS has suggested high-fidelity implementation by teachers is possible (Bryan & Gast, 2000; Watson & DiCarlo, 2015), but additional research is needed to determine the practicality of implementation by indigenous adults in inclusive early childhood settings.

Results of this study suggest the use of CTD to teach use of VAS is effective, leading to increased engagement and decreased CB for young children without ASD or ID. Children's engagement met or exceeded that of their peers in an inclusive setting and CB occurred at near

zero levels during intervention conditions only. Additional studies are needed to continue to investigate the value of using VAS as a low-cost, individualized intervention to improve the classroom performance of young children at-risk for social delays.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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