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Effects of Visual Activity Schedules on Independent Classroom Transitions for Students with Autism

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The purpose of this study was to evaluate the effectiveness of visual activity schedules on the behaviour of four students with moderate autism during transitions within a self-contained classroom. Generalisation measures included pre-tests and post-tests with novel stimuli and novel visual activity schedule pictures. This A-B-A-B withdrawal design study replicated and expanded parts of a study by MacDuff, Krantz, and McClannahan and another by Bryan and Gast. Students were trained to use visual activity schedules using the system of least prompts. Results indicated that, in the presence of visual activity schedules, all participants increased independence during transitions. Pre-test/post-test data revealed generalisation of visual activity schedules with novel stimuli and novel visual activity schedule pictures across participants. Implications for practitioners and for future research are discussed.

Keywords: autism; centre activities; on-task; on-schedule; picture schedules; primary grades; transitions; visual schedules

Introduction

Visual activity schedules (VAS) are sets of pictures used to depict a sequence of events. Their use in classrooms for children with disabilities is fast becoming best practice as increased independence is observed (Bennett, Reichow, & Wolery, 2011; Bryan & Gast, 2000; Carson, Gast, & Ayres, 2008; Spriggs, Gast, & Ayres, 2007). Research has supported the use of VAS for supporting individuals with disabilities to perform single steps of complex routines (Blum-Diamaya, Reeve, & Reeve, 2010; Copeland & Hughes, 2000; Morse & Schuster, 2000; Pierce & Schreibman, 1994), to plan and engage in activities (Anderson, Sherman, Sheldon, & McAdam, 1997; Bevill, Gast, Maguire, & Vail, 2001; Morrison, Sainato, Benchaaban, & Endo, 2002), and to complete a series of activities (Bennett et al., 2011; Bryan & Gast, 2000; Carson et al., 2008; Dettmer, Simpson, Myles, & Ganz, 2000; Krantz, MacDuff, & McClanahan, 1993; MacDuff et al., 1993; Massey & Wheeler, 2000; Schmit, Alper, Raschke, & Ryndak, 2000; Sowers, Verdi, Bourbeau, & Sheehan, 1985; Spriggs et al., 2007; Whatley, Gast, & Hammond, 2009). Although research supports VAS use with students with intellectual disabilities (Anderson et al., 1997; Bevill et al., 2001; Carson et al., 2008; Copeland & Hughes, 2000; Morse & Schuster, 2000; Sowers et al., 1985; Spriggs et al., 2007; Whatley et al., 2009) and with students with learning disabilities

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(Rivera, Koorland, & Fueyo, 2002), their visual nature makes them ideal to use for children with autism disorder (AD).

Visual supports are often used for children with AD to aid communication (Quill, 1995). Individuals with AD "tend to create meaning thru visual images rather than sound" (Rosenkrantz, 2009, p. 328), relying on visual imagery as their primary learning modality:

> Visual communication tools such as objects, photographs, picture symbols, daily schedules, and choice boards can provide the support necessary to greatly improve a child's understanding and ability to communicate, helping children be more active, independent and successful participants in their lives. (Center for Autism and Related Disabilities, 2009)

In a primary classroom, transitions are often preceded by a teacher's verbal task direction. Students with AD typically have difficulty following verbal directions alone due to their communicative deficits. Visual cues offer non-intrusive prompts for smooth transitions, often increasing activity engagement (Bryan & Gast, 2000; MacDuff et al., 1993; Massey & Wheeler, 2000; Morrison et al., 2002), decreasing aberrant behaviours (Dettmer et al., 2000; Schmit et al., 2000), or both (Krantz et al., 1993; Pierce & Schreibman, 1994). Since transition behaviours between and within activities can be difficult for individuals with AD, VAS can serve as an antecedent strategy to increase independence, alleviating the need for intense staff support.

Specifically looking at increasing on-task and on-schedule behaviours via VAS, MacDuff et al. (1993) taught four middle school boys with autism to complete leisure activities independently in a group home using photographs of each activity. Using a graduated guidance procedure to teach appropriate VAS use, all four boys demonstrated an increase in both on-task and on-schedule behaviours. Bryan and Gast (2000) extended these findings by replicating the study with four primary students with high-functioning autism in a public school. Using line drawings to depict academic centre areas within the classroom, findings were similar; all four students increased time on-task and time on-schedule after learning how to use VAS via graduated guidance.

In an attempt to expand findings of MacDuff et al. (1993) and Bryan and Gast (2000), the current study offers an expansion of literature for using VAS for children with AD. Differences between the studies include: student demographics (e.g., age, level of AD); investigator; setting of the study; form of the picture; methods used to teach the use of visual schedules; activities completed during the centres; and dependent measures. These differences can expand the literature in several ways. Including primary students with moderate AD in self-contained settings can: aid practitioners in planning; illustrate differences and/or similarities in learning styles across the spectrum; and provide alternative strategies to implement VAS in a variety of settings. The form of the picture used to represent each centre area may also aid in future planning. To date, research has centred on photographs or line drawings representing actual centre areas or specific activities (Banda & Grimmett, 2008). Using an abstract figure (shape) can help determine specific characteristics needed within VAS to promote independent transitions. Increasing dependent measures to include transition behaviours both between and within centre activities can aid practitioners in maximising independence when creating VAS in their classrooms. Using various systematic instructional procedures (e.g., system of least prompts) to teach schedule use can provide alternatives when looking at specific student characteristics (Taber-Doughty, 2005). The studies were similar in that each used VAS to promote independent transitions during various

activities. The purpose of the current study was to answer the following research questions: will the percentage of independent transitions increase between and within centre activities for students with moderate AD when using VAS? and will independent transitions generalise to novel pictures and materials?

Method

Participants

Four students who were served in a self-contained class for students with moderate AD participated in the study. All students had Childhood Autism Rating Scale (CARS) scores above 30, indicating AD diagnoses. They each also had Psychoeducational Profile Revised (PEP-R) scores falling five to eight developmental years below their current chronological ages. Table 1 includes specific developmental scores (i.e., CARS, PEP-R) for each student to supplement the behavioural descriptions below. All students were familiar with tasks chosen for centre activities; none were familiar with centre-time routines or pictures representing centre activities.

Jack was 11 years, 1 month old. He was able to match pictures to objects and had experience using VAS for whole day schedules. He required verbal and physical prompts to walk to the schedule, pull a picture off, and transition to the next activity. He communicated with single words (e.g., popcorn, cookie, potty) and gestures (e.g., pointing or pulling an adult's hand to the desired object). He was learning to communicate wants and needs using a Springboard (2002) augmentative communication device with verbal and physical prompts. When given verbal directions, Jack's latency was approximately 10 seconds, often requiring multiple repetitions of directions prior to response initiation; he demonstrated shorter response latencies when directions were paired with manual signs or pictures.

Dan was 9 years, 10 months old. He was able to follow two-step directions, but required verbal prompting for transitions between tasks. He was familiar with whole day VAS, but required verbal prompting to perform steps in the picture schedule sequence. Dan was verbal and was able to match pictures. Transitions were difficult for Dan (e.g., refusing to participate in activities following transitions). Stereotypic behaviours included repetition of sounds and flicking objects in front of his eyes.

Collin was 10 years, 5 months old. He was able to match pictures and follow daily picture schedules with verbal prompts, often requiring redirection to locate each activity after checking his schedule (e.g., he often became distracted at the computer or window). He communicated using simple phrases and gestures and followed one-step to two-step verbal directions. Collin displayed difficulty during transitional periods within the classroom (e.g., yelling or refusing to participate when transitioning between activities).

Table 1. Participants' ages and test scores.

Student	Age (years, months)	CARS[a] scores	PEP-R[b] scores (years, months)
Jack	11, 1	42.5	3, 10
Dan	9, 10	40.0	4, 4
Collin	10, 5	33.0	3, 10
Mike	10, 3	33.5	4, 2

Notes: [a]The Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1986). [b]The Psychoeducational Profile Revised (PEP-R; Schopler, Reichler, Bashford, Lansing, & Marcus, 1990).

Mike was 10 years, 3 months old. He was able to match pictures and follow picture activity schedules with verbal prompting. He was easily distracted by auditory and visual stimuli within the classroom, often looking around the room or talking to other students during task completion. Mike communicated using phrases and short sentences and followed one-step and two-step verbal directions.

Setting

Intervention took place in the students' self-contained classroom. Participants spent most of the school day in their classroom, leaving for non-academic classes (e.g., art, music, physical education), lunch, and recess. The classroom, approximately 9 m × 7 m, contained a semi-circular instructional kidney table, a round table, six study carrels, and a small literacy room. The intervention focused on increasing independent transition behaviours during centre-time activities within the self-contained classroom.

Four areas were designated as "centres" during centre time. Centres were located at the kidney table, circle table, individual study carrels, and literacy room. Centres included mathematics, fine motor, literacy, and reading. The kidney table and circle table were approximately 2 m × 1 m each. Individual study carrels were located in the same general area within the classroom and consisted of a flat desk with three 0.5 m high partitions for privacy during independent work tasks. The reading room was 3 m × 2.5 m and contained a small table, tent, bookshelves, and three chairs.

Materials

Centre Activities

All activities were within the students' repertoire but included tasks that needed maintenance. Each centre was labelled with a 15.24 cm × 15.24 cm coloured shape identical to coloured shapes in the VAS book. Each centre had a 30.5 cm × 15.24 cm × 12.7 cm plastic box without a lid that contained materials for students to use. Specific centre materials are listed in Table 2. A small digital timer with minute, second, and start/stop buttons was used to signal centre transitions. Centre activities occurred in the morning or afternoon depending on other classroom activities.

Table 2. Centre materials.

Centre	Centre materials
Intervention	
Mathematics	Worksheets from Harcourt Math (2005) workbooks
	Small multi-coloured plastic pieces for sorting
Fine motor	Sensible Pencil (Becht, 1985) handwriting worksheets
	Scissors
	Construction paper
Literacy	Edmark Reading Program (1992) worksheets
Reading	Short story books
	Books on tape
Generalisation	
Recreation and leisure	Various materials for cutting and gluing
	Computers
	Puzzles
	Sorting

Visual Activity Schedules Books

Each student had a VAS book (10.2 cm×15.2 cm plastic photograph holder) with Boardmaker (1990) pictures representing the four centre activities to be completed. Specific centre locations were depicted with coloured geometric shape cards (e.g., blue diamond for mathematics, green circle for fine motor, yellow triangle for literacy, red square for reading, and red oval for start and stop location). Five pages of the book included sentence strips consisting of five 2.5 cm×2.5 cm pictures, sequenced in order from left to right, representing task analytic steps to be completed: stop, clean up, stand up, specific centre location (coloured geometric shape card), and sit (an example sentence strip is illustrated in Figure 1). Each sequence strip was inserted into one page (only one sequence of pictures was visible at a time). Novel shape cards were used during generalisation conditions (green rectangle for cutting and gluing, yellow star for computer, blue cross for puzzles, red oval for sorting, and red flower for start and stop locations).

Design and Procedures

Experimental Design

Owing to the limited number of students in special education classes, single case research designs are often chosen to provide quantitative answers to research questions (Gast, 2010). Using single case research designs, participants serve as their own control, with data-based decisions to introduce and/or withdraw interventions relying solely on individual student behaviours observed. While comparisons of multiple participants are made *post hoc*, during the research itself individual performance is analysed and decisions made are applied individually. An A-B-A-B withdrawal design (Gast & Hammond, 2010) was used to evaluate the effectiveness of using visual schedules for independent transitioning within the classroom. The withdrawal design evaluates experimental control by replicating effects through the repeated introduction and withdrawal of the independent variable (VAS) with a single participant. If data trends and levels during intervention conditions (B_1 and B_2) increased and decreased under baseline conditions (A_1 and A_2), a functional relation would be demonstrated between independent variables (VAS) and dependent variables (independent transitions). Replication of effect can also be evaluated via the withdrawal design. Comparing the last two conditions (A_2 and B_2) with the first two conditions (A_1 and B_1), with the same participant and the same behaviour, evaluates direct intra-subject replication; if the comparison reveals similar data trends and levels, direct intra-subject replication would be confirmed. With each replication of effect (A to B), the internal validity of results is strengthened. The closer and more immediate the replication (comparing A_1 and A_2 and B_1 and B_2), the stronger the internal validity. Including four participants allows for

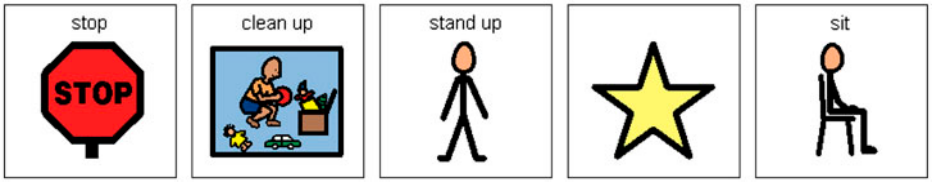

Figure 1. Example sentence strip.

direct inter-subject replication evaluation; if all four students' performances indicate a functional relation with similar data trends and levels, direct inter-subject replication would be verified. External validity is achieved when functional relations are replicated with other similar participants under the same or similar experimental conditions. Conditions in this study followed the same order as Bryan and Gast (2000): Generalisation Pre-test, No Schedule (NS), Visual Activity Schedule (VAS), NS, VAS, and Generalisation Post-test.

General Procedures

Sessions occurred once a day, five days a week, for approximately 30 minutes. Centre materials were available to participants during each condition. Centres began with a student sitting at a small table in the middle of the classroom and the teacher saying "It's centre time. What time is it?" After the student's response, "It's centre time", the teacher reviewed the order of centre activities, pointing to their respective locations within the classroom. Centre activity order changed randomly across days. The teacher also told the student he had five minutes at each centre and to stop working when the timer sounded. In all conditions a cue to begin centres was delivered to the student by the teacher saying "We will begin centre time now". The student was to transition to centre activities and begin working. Once the student sat down at the centre, the timer was set for five minutes. After five minutes the timer cued the student to stop working and begin following their VAS. The student was prompted through all transitioning steps using the system of least prompts during all conditions. Descriptive verbal praise was given to students on average every one minute for appropriate behaviour (sitting at the correct centre, moving when the timer buzzed, and working quietly during centre activities) during all conditions.

Generalisation Pre-test/Post-test Condition

The purpose of Generalisation conditions was to assess participants' use of VAS with novel tasks and novel VAS pictures. A Generalisation Pre-test condition was conducted before the initial NS baseline condition and a Generalisation Post-test following the second VAS condition. Novel activities included sorting tasks, puzzles, computer games, and cutting and gluing paper, each assigned to one of the four centre locations. Students were familiar with all tasks. VAS were present, but instruction on how to use the VAS prior to the Pre-test did not occur. Data were collected on the percentage of independent transitions. VAS were available during Generalisation conditions and novel pictures were used rather than those used during VAS conditions. VAS were made available for students during Pre-test and Post-test, but use was not required or prompted (the book was laid in front of the student, and the teacher transferred the book to each centre with the student).

Generalisation condition procedures followed general procedures to begin centre activities. The student was given five seconds to stand up after the teacher prompt "We will begin centre time now". If the student initiated the first step within five seconds, he was given 10 seconds to complete the step. If the student did not initiate the step within five seconds or initiated but did not complete the step within 10 seconds, a gesture + verbal prompt was delivered. The teacher signed the word "stand" and said "Stand up". The student was given five seconds to initiate the step and 10 seconds to complete it. If the student did not initiate the step within five seconds or initiated but did not

complete the step within 10 seconds, the second prompt, physical + verbal, was delivered. The teacher said "Stand up", placed her hands under the student's arms and gently lifted up until the student was standing. All steps in the task analysis for transition behaviour followed the same prompt hierarchy (see Table 3). Upon completion of each step in the task analysis, the student sat at the appropriate centre and the teacher set the timer for five minutes. When the timer sounded, the student was expected to follow the task analysis for transition behaviour and the prompt hierarchy began again for each step. Students followed the task analysis for each of the five transitions between centres.

Descriptive verbal praise was delivered for an average of one minute for appropriate behaviours. Inappropriate behaviours (e.g., talk-outs, tantrums, self-stimulatory behaviours) were ignored. The NS baseline condition was implemented when data remained stable for independent transitions over a minimum of three consecutive sessions.

No Schedule Baseline Condition

The purpose of the NS condition was to measure independent transitions between and within centre activities without VAS. During transitions, procedures were identical to those in Generalisation Pre-test condition, except VAS were not present. The NS condition continued until data were stable for a minimum of three consecutive sessions.

Visual Activity Schedule Intervention Condition

The purpose of the VAS condition was to teach children how to use VAS and to evaluate the effectiveness of VAS on students' independent transitions between and within centres. Each session followed procedures outlined in General Procedures; VAS were present during this condition. Students were prompted to use VAS using a system of least prompts. After the teacher presented a verbal direction to begin centre activities, students followed procedures described in the Generalisation Procedure section, paired with a picture prompt delivered to the student (i.e., teacher pointed to the picture and gave verbal directions) instead of a gestural prompt in the task analysis of transition behaviour. VAS conditions were continued until students consistently transitioned independently for at least three sessions at 90% or above.

Response Definitions and Data Collection

Response Definitions

The dependent variables, independent transitions between and within centre activities, were similar to those used by Bryan and Gast (2000, p. 556); adaptations were made based on student needs and classroom arrangement:

Independent transitions within and between centres were scored for each task analytic skill completed independently: stop working on task within five seconds of the timer going off; clean up by placing materials in the box; standing up within five seconds of cleaning up; walking to correct centre; and sitting down at the correct centre.

Data Collection

Students' transitioning behaviours were recorded using event recording. Students were prompted using a system of least prompts for each step in the task analysis during all

Table 3. Task analysis of students' transition behaviour and teacher prompt levels.

	Independent	Gesture + verbal	Picture + verbal	Physical + verbal
1. Stop working on task	Student stopped task within five seconds of timer going off	Teacher signed the word "stop" and said "stop working"	Teacher pointed to picture of stop and said "stop working"	Teacher placed hand on top of task student was working on and said "stop working"
2. Clean up	Student placed materials in box	Teacher pointed to materials and said "put in box"	Teacher pointed to picture of clean up and said "put in box"	Teacher guided child's hand to pick up materials and place in box and said "put in box"
3. Stand up	Student stood up within five seconds of completion of Step 2	Teacher signed the word stand and said "stand"	Teacher pointed to picture of stand and said "stand"	Teacher placed both hands under student's arms, lifted up and said "stand"
4. Walk to correct centre	Student walked to correct centre location	Teacher pointed to centre location and said "go to [centre name]"	Teacher pointed to picture of centre and said "go to [centre name]"	Teacher held student's hand and guided him to centre location, saying "go to [centre location]"
5. Sit down	Student sat at correct centre location	Teacher signed "sit down" and said "sit down"	Teacher pointed to picture of sit and said "sit down"	Teacher physically guided student to sit and said "sit down"

Notes: Behavioural definitions were adapted from Bryan and Gast (2000, p. 556) and MacDuff et al. (1993, p. 91); adaptations were made based on student needs and classroom arrangements. Independent prompt level descriptions serve as behavioural definitions for each transition behaviour.

conditions. An independent response was recorded for each step initiated within five seconds of the discriminative stimulus (teacher stating "We will begin centre time now", timer going off, or completion of previous step) and completed within 10 seconds of response initiation. For steps not completed independently, three prompt levels were recorded: gesture + verbal, picture + verbal, and physical + verbal. Table 3 outlines parameters of each prompt level for the five steps in following the VAS. Percentage of total steps (within and between centre activities) completed in the task analysis independently as well as percentage of between-centre transitions ("walk to centre" steps only) completed independently were calculated and graphed for each child during each observational period.

Reliability

A variety of professionals, previously trained in data collection procedures, collected inter-observer reliability data on dependent measures and procedural reliability data on teacher behaviours at least once per condition across participants. Inter-observer reliability estimates were calculated using the point-by-point method in which the number of agreements were divided by the number of agreements plus disagreements and multiplied by 100. A minimum of 90% mean inter-observer agreement was required to continue the study. The formula used for calculating procedural reliability was the number of appropriate teacher behaviours divided by the total number of proposed teacher behaviours, multiplied by 100. Teacher behaviours that were monitored included: delivery of attentional cue for students to begin centres; verbally telling the sequence that centres were to be completed in; delivering verbal direction to begin; delivering prompts following a system of least prompts guidelines; waiting five seconds between delivering prompts; and delivering verbal praise on average every one minute. A minimum of 90% mean procedural reliability was required to continue the study.

Social Validity

Social validity data were collected on study objectives and outcomes of VAS to assess the perceptions of persons who knew and worked with the students. Data were collected upon study completion using a five-point Likert scale (5 indicating a rating of "strongly agree" to 1 indicating a rating of "strongly disagree"). Mean and range per question were analysed and are reported in Table 4.

Table 4. Social validity questionnaire: Mean score and range per question.

Question	Mean	Range
1. Visual activity schedules are a useful tool for teaching independence to students with AD in the classroom	5	5
2. Increased independent behaviour in the presence of visual activity schedules	4.75	4–5
3. Participants were able to generalise visual activity schedules with novel tasks within the classroom	4.75	4–5
4. Participants were able to generalise visual activity schedules with novel pictures (shapes)	4.75	4–5
5. Visual schedules are a socially acceptable method for teaching independence, not only within the classroom, but outside the classroom, as well	5	5

Results

Reliability

Inter-observer agreement data on student performance and procedural reliability data on teacher behaviour were simultaneously collected for 21.6% of all sessions, with at least one occurring in each condition, across participants. Mean inter-observer agreement for independent transitions across all participants was 99% (range = 98–100%) during Generalisation and NS conditions. Mean agreement during VAS conditions was 100%. Mean procedural reliability was 99% across all students and conditions indicating procedures for all conditions were implemented as planned.

Effectiveness of Procedure

Total Steps Completed Independently

Graphic displays of total task analytic steps completed independently for each participant appear in Figures 2–5 (closed circles). Direct intra-subject and inter-subject replications were obtained. The withdrawal design allowed a demonstration of experimental control by the replication of effects via repeated introduction and withdrawal of VAS during centres with a concomitant change in the dependent variables. That is, student independent transition behaviours increased during VAS conditions (B_1 and B_2) and were low or decreased during NS conditions (A_1 and A_2). There was little or no overlap in data from the first NS condition (A_1) to the initial implementation of the VAS condition (B_1) for all participants. There was 0% overlapping data for each of the four participants when comparing the second NS condition (A_2) with reintroduction of the VAS condition (B_2).

Collin's percentage of independent transitions within and between activities is depicted in Figure 2. Mean performance during initial NS (A_1) was 33% (range = 30–35%). Upon introduction of VAS (B_1), Collin's data for total steps in the task analysis showed an immediate change in level with an accelerating trend that maintained at or above 90% for three consecutive sessions. Return to NS (A_2) yielded a mean of 71%

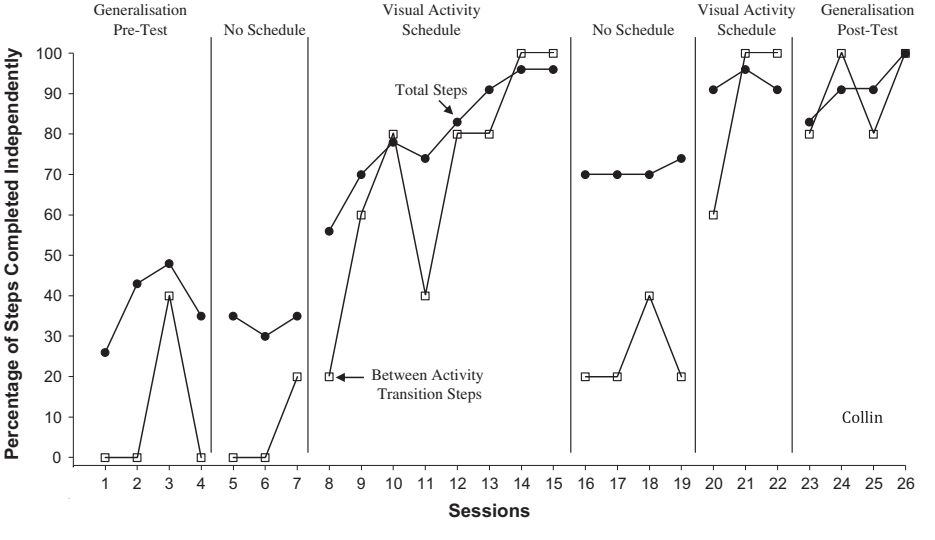

Figure 2. Percentage of independent transitions for Collin.

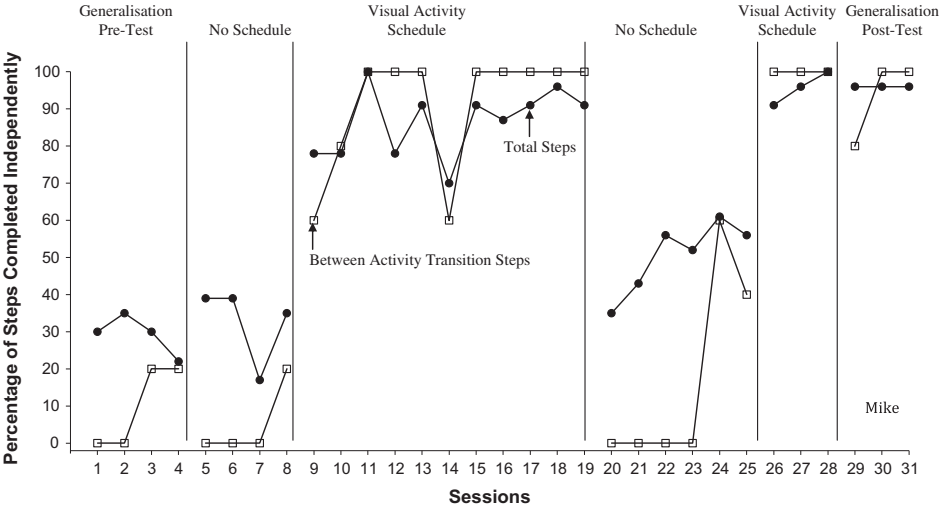

Figure 3. Percentage of independent transitions for Mike.

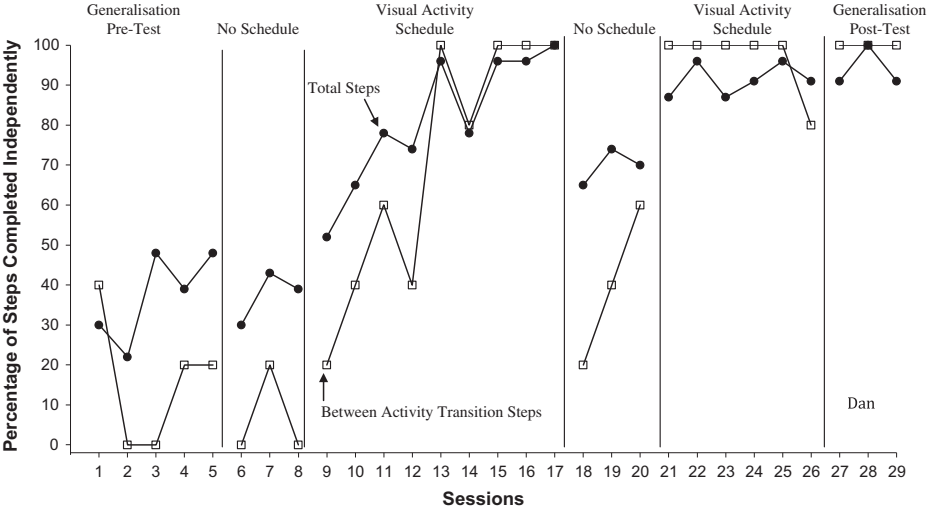

Figure 4. Percentage of independent transitions for Dan.

(range = 70–74%) for independent transitions between and within activities. Upon reintroduction of VAS (B_2), mean levels immediately rose to 93% (range = 91–96%).

Figure 3 shows Mike's percentage of within-activity and between-activity transitions data. The initial NS (A_1) mean percentage of independent transitions was 32%, ranging from 17% to 39%. VAS introduction (B_1) resulted in an immediate and abrupt change in level with a mean of 86%, ranging from 70% to 96%, maintained above 90% for three consecutive sessions. Return to NS (A_2) resulted in an immediate change in level with a mean percentage of independent transitions of 51% (range = 35–61%). Upon reintroduction of VAS, Mike's percentage of independent transitions rose to a mean of 96% (range = 91–100%).

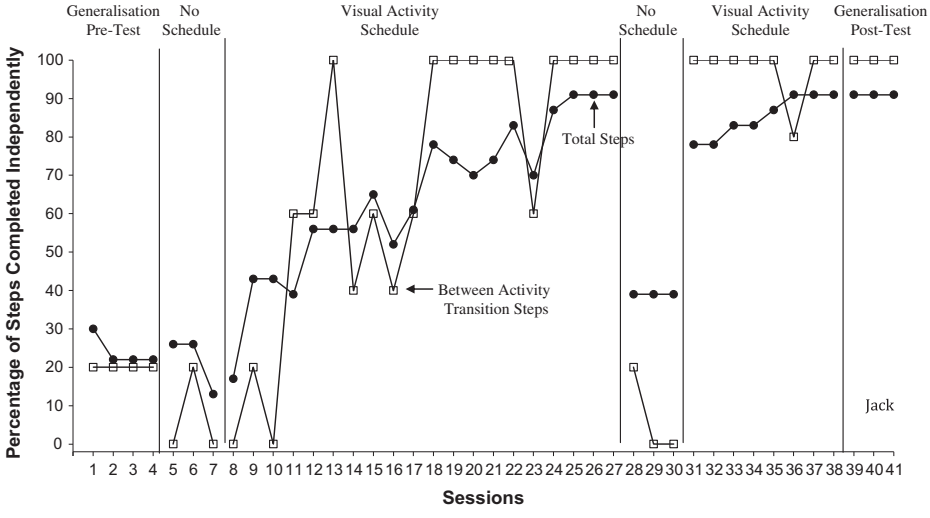

Figure 5. Percentage of independent transitions for Jack.

Dan's percentage of independent transitions within and between centre activities is shown in Figure 4. During initial NS (A_1) conditions, Dan's mean percentage of independent transitions was 37%, ranging from 30% to 43%. VAS introduction (B_1) resulted in an accelerating trend that stabilised at over 90% for three consecutive sessions. Dan's mean performance for the nine sessions during initial VAS condition was 82% (range = 52–100%). Return to NS (A_2) yielded a mean percentage of independent transitions at 70% (range = 65–74%). Reintroduction of VAS condition (B_2) resulted in an immediate change in level with a mean of 91% (range = 87–96%).

Figure 5 illustrates Jack's percentage of independent transitions. Initial NS (A_1) conditions resulted in a low percentage of transitions completed independently, with a mean of 22% (range = 13–26%). Introduction of VAS conditions resulted in an accelerating trend stabilising at 91% for three consecutive sessions. The mean percentage of independent transitions was 65%, ranging from 17% to 91% over the 20 sessions. Return to NS (A_2) yielded a mean percentage of independent transitions of 39%. Reintroducing VAS conditions resulted in an immediate and abrupt level change with a mean of 85% (range = 78–91%), stabilising at 91% for three consecutive sessions.

Between-activity Transition Steps Completed Independently

Graphic displays of between-centre transitions ("walk to centre" steps) completed independently are also shown in Figures 2–5 (open squares). Replication of effect is evidenced through the A-B-A-B design. Data trends during VAS conditions (B_1 and B_2) rose and then decreased under NS conditions (A_1 and A_2) for all students, with little to no overlap in data points from either NS condition (A_1 or A_2) to VAS conditions (B_1 or B_2). Collin (Figure 2) performed at low levels during both NS conditions with means of 7% and 25% independent between-centre transitions, respectively. Introduction of VAS resulted in an accelerating trend in data stabilising at 100%. Mean independent between-centre transitions during the initial VAS condition were 70%, ranging from 20% to 100%. The second VAS condition resulted in a mean of 87% over three sessions, ranging from 60% to 100%.

Mike (Figure 3) also exhibited low levels of independent between-centre transitions during NS conditions with means of 5% (range = 0–20%) during the first NS condition and 20% (range = 0–60%) during the second NS condition. Upon introduction of both VAS conditions, abrupt changes in level were observed. During the initial VAS condition (B_1), Mike's mean independent between-centre transitions increased to 90% (range = 60–100%), stabilising at 100% independent for five consecutive sessions. During the second VAS condition, Mike's independent between-centre transitions returned to 100% and were maintained for three consecutive sessions.

Dan's (Figure 4) mean percentages of independent between-centre transitions were 7% (range = 0–20%) during the initial NS (A_1) and 40% (range = 20–60%) during return to NS (A_2). Upon introduction of the VAS condition (B_1), the trend of independent between-centre transitions accelerated, stabilising at 100% for three consecutive sessions. The mean percentage of independent between-centre transitions during the initial VAS condition was 71% (range = 20–100%). Reintroduction of VAS conditions (B_2) resulted in mean independent between-centre transitions of 97% (range = 80–100%).

Jack's (Figure 5) independent between-centre transitions replicate the other participants' performance with low levels during NS conditions and higher levels, stabilising at 100% during VAS conditions. Jack's mean independent between-centre transitions were 7% (range = 0–20%) for both NS conditions (A_1 and A_2). Introduction of the VAS condition (B_1) resulted in an increased mean of 73% (range = 0–100%), stabilising at 100% for four consecutive sessions. Return to VAS generated an immediate and abrupt change in level to 100% (mean = 97%; range = 80–100%).

Generalisation Data

During the Generalisation Pre-test condition, the mean of total task analytic steps completed independently was 32% for all participants with a range of 22% to 48% (see Figures 2–5). During the Generalisation Post-test condition, the mean of the total task analytic steps completed independently was 93%, ranging from 83% to 100%. The independent between-centre transitions yielded similar results with a Generalisation Pre-test condition mean of 14% (range = 0–40%) and a Generalisation Post-test condition mean of 95% (range = 80–100%) for all participants.

Social Validity

Table 4 presents the mean score for each question for all participants. Five questions were scored using a Likert scale format ranging from one (strongly disagree) to five (strongly agree). All three raters strongly agreed that VAS were useful tools for teaching classroom independence to students with autism (mean = 5). Raters agreed that participants increased independent behaviour in the presence of VAS (mean = 4.7). Raters also agreed that VAS use generalised to novel tasks (mean = 4.7) and novel pictures (mean = 4.7). All raters strongly agreed that VAS were a socially acceptable method for teaching independence within various settings (mean = 5).

Discussion

The purpose of this study was to examine effects of VAS on independent transition behaviours within the classroom for students with moderate autism. The results extend

findings of previous studies (Bryan & Gast, 2000; Carson et al., 2008; MacDuff et al., 1993; Spriggs et al., 2007) and expand the literature to include primary students with moderate AD. This study also expands the literature to include using the system of least prompts to teach VAS use as well as looking at task analytic transition behaviours between and within centre activities. Results of the study indicate increased independent transition behaviours while using VAS and generalisation across activities and pictures.

Increases in independent transition behaviours both within and between centre activities were demonstrated via the A-B-A-B withdrawal design and were replicated across four students, providing both intra-subject and inter-subject replications of effect. A-B-A-B withdrawal designs are used when target behaviours are not learned or can be reversed. All four students demonstrated failure to completely return to baseline levels when VAS were removed in the second baseline condition. This could be attributed to acquisition of skills needed to independently transition within and between classroom activities. In the task analysis used, acquisition of within-activity transitioning steps could have been acquired due to those steps being routine transition behaviours (e.g., stop, clean up); the between-activity transition step ("walk to centre") could not have been learned due to teacher-chosen centre order. Taking this into consideration, "walk to centre" steps were isolated and reported separately.

Using an alternative single-case research design may have negated the need for a return to baseline, thus negating the need to separate the between-centre transition steps from the collective between-centre and within-centre transition steps in the task analysis. Using an alternative single-case research design also may have counterbalanced the "recovery" from the second NS (A_2) to the second VAS condition (B_2); it took two students six to eight sessions to return to criterion upon VAS reintroduction. Using a multiple probe or multiple baseline design across participants (Gast & Ledford, 2010), for example, would have alleviated the need for VAS withdrawal and reintroduction. Although withdrawing intervention may not always be favourable, using another single-case design could have masked students acquiring routine transition skills within but not between centre-type activities. Using a multiple probe or multiple baseline design across participants would not have permitted a demonstration of intra-subject replication. Future research could investigate teaching these skills within the context of portable VAS, as demonstrated in this study, and then transitioning between-centre steps (e.g., "walk to centre") back into the student's overall daily visual schedules.

Although multiple demonstrations of effect were replicated across participants, limitations in the current study exist. For the purpose of future replications with similar participants, standardised test scores, such as the Autism Diagnostic Observation Schedule, establishing participants' language levels would have been beneficial. Although behavioural descriptions are included, lack of standardised scores is a limitation. Re-evaluating reinforcers could also prove beneficial. Verbal praise for correct behaviour was provided on average every one minute. More preferred reinforcers may have yielded fewer sessions to criterion. Conducting a stimulus preference test prior to study implementation might be effective in future research efforts. Generalisation measures show generalisation of VAS use to novel materials and centre pictures. Varying the locations to include more inclusive settings could strengthen support for future use outside the self-contained classroom. Probing for generalisation throughout the study, as opposed to before and after, could also have yielded stronger generalisation data. The current study also could have been strengthened via pre-test and post-test measures of daily visual schedules already in place for each participant.

In spite of limitations, prior to VAS instruction, students were unable to independently transition between centres, often requiring verbal and physical prompts. Independent transition behaviours increased for all students once they knew how to use VAS. At least two students enjoyed using them (asking for them during return to NS) and social validity answers by various stakeholders indicated a high level of value and success in independent functioning for these students.

The use of visuals has been successful for children with AD to increase independence at school (Bennett et al., 2011; Bryan & Gast, 2000; Dettmer et al., 2000; Massey & Wheeler, 2000; Morrison et al., 2002; Schmit et al., 2000) and home (MacDuff et al., 1993; Pierce & Schreibman, 1994). Future research should focus on increasing independence into a variety of school settings (e.g., lunchroom, other classrooms, etc.) and different community locations. Most research to date evaluates visual schedules to complete single chained tasks (Blum-Diamaya et al., 2010; Copeland & Hughes, 2000; Krantz et al., 1993; Morse & Schuster, 2000; Pierce & Schreibman, 1994) or a series of tasks within a short amount of time (e.g., centre-based activities) (Bennett et al., 2011; Bryan & Gast, 2000; Carson et al., 2008; Dettmer et al., 2000; MacDuff et al., 1993; Massey & Wheeler, 2000; Sowers et al., 1985; Spriggs et al., 2007; Whatley et al., 2009). Future research should evaluate the use of VAS to not only complete these smaller tasks, but to embed these smaller tasks within a larger daily schedule where all transitions are captured in the daily VAS. Researchers should also consider using VAS for transitions between home, school, and community. Expanding research to capture older participants should also be a focus for future research. While research with young adults exists (Anderson et al., 1997; Carson et al., 2008; Sowers et al., 1985) it is almost non-existent for adults with AD. Research at this age could include teaching them how to make their own daily VAS and then how to use them independently.

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References

Anderson, M., Sherman, J., Sheldon, J., & McAdam, D. (1997). Picture activity schedules and engagement of adults with mental retardation in a group home. *Research in Developmental Disabilities, 18*, 231–250. doi:10.10169/S0891-4222(97)00006-1

Banda, D. R., & Grimmett, E. (2008). Enhancing social and transition behaviors of persons with autism through activity schedules: A review. *Education and Training in Developmental Disabilities, 43*, 324–333.

Becht, L. C. (1985). *The sensible pencil*. EBSCO Curriculum Materials. Birmingham, AL: ACT Learning, LLC.

Bennett, K., Reichow, B., & Wolery, M. (2011). Effects of structured teaching on the behavior of young children with disabilities. *Focus on Autism and Other Developmental Disabilities, 26*, 143–152. doi:10.1177/1088357611405040

Bevill, A. R., Gast, D. L., Maguire, A. M., & Vail, C. O. (2001). Increasing engagement of preschoolers with disabilities through correspondence training and picture cues. *Journal of Early Intervention, 24*, 129–145. doi:10.1177/105381510102400207

Blum-Diamaya, A., Reeve, S. A., & Reeve, K. A. (2010). Teaching children with autism to play a video game using activity schedules and game-embedded video modeling. *Education and Treatment of Children, 33*, 351–370. doi:10.1353/etc.0.0103

Boardmaker. (1990). *Boardmaker application software: Version 5.1.3*. Solana Beach, CA: Mayer Johnson.

Bryan, L., & Gast, D. (2000). Teaching on-task and on-schedule behaviors to high-functioning children with autism via picture activity schedules. *Journal of Autism and Developmental Disorders, 30*, 553–567. doi:10.1023/A:1005687310346

Carson, K. D., Gast, D. L., & Ayres, K. M. (2008). Effects of a photo activity schedule book on independent task changes by students with intellectual disabilities in community and job sites. *European Journal of Special Needs Education, 23*, 269–279. doi:10.1080/08856250802130475

Center for Autism and Related Disabilities. (2009). *Visual supports*. Retrieved from http://card.ufl.edu/visual.htm

Copeland, S., & Hughes, C. (2000). Acquisition of a picture prompt strategy to increase independent performance. *Education and Training in Mental Retardation and Developmental Disabilities, 35*, 294–305.

Dettmer, S., Simpson, R., Myles, B., & Ganz, J. (2000). The use of visual supports to facilitate transitions of students with autism. *Focus on Autism and Other Developmental Disabilities, 15*, 163–170. doi:10.1177/108835760001500307

Edmark Reading Program. (1992). *Edmark practice workbook, level 1* (2nd ed.). Washington, DC: Edmark Corporation.

Gast, D. L. (2010). *Single subject research methodology in behavioral sciences*. New York, NY: Routledge.

Gast, D. L., & Hammond, D. (2010). Withdrawal and reversal designs. In D. L. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 234–275). New York, NY: Routledge.

Gast, D. L., & Ledford, J. (2010). Multiple baseline and multiple probe designs. In D. L. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 276–328). New York, NY: Routledge.

Harcourt Math. (2005). *Harcourt math practice workbook, pupil edition, Grade 2*. Orlando, FL: Harcourt.

Krantz, P. J., MacDuff, M. T., & McClanahan, L. E. (1993). Programming participation in family activities for children with autism: Parents' use of photographic activity schedules. *Journal of Applied Behavior Analysis, 26*, 137–138. doi:10.1901/jaba.1993.26-137

MacDuff, G., Krantz, P., & McClannahan, L. (1993). Teaching children with autism to use photographic activity schedules: Maintenance and generalization of complex response chains. *Journal of Applied Behavior Analysis, 26*, 89–97. doi:10.1901/jaba.1993.26-89

Massey, N., & Wheeler, J. (2000). Acquisition and generalization of activity schedules and their effects on task engagement in a young child with autism in an inclusive pre-school classroom. *Education and Training in Mental Retardation and Developmental Disabilities, 35*, 326–335.

Morrison, R., Sainato, D., Benchaaban, D., & Endo, S. (2002). Increasing play skills of children with autism using activity schedules and correspondence training. *Journal of Early Intervention, 25*, 58–72. doi:10.1177/105381510202500106

Morse, T. E., & Schuster, J. W. (2000). Teaching elementary students with moderate intellectual disabilities how to shop for groceries. *Exceptional Children, 66*, 273–289.

Pierce, L., & Schreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *Journal of Applied Behavior Analysis, 27*, 471–481. doi:10.1901/jaba.1994.27-471

Quill, K. A. (1995). Visually cued instruction for children with autism and pervasive developmental disorder. *Focus on Autism and Other Developmental Disabilities, 10*, 10–20.

Rivera, M. O., Koorland, M. A., & Fueyo, V. (2002). Pupil-made pictorial prompts and fading for teaching sight words to a student with learning disabilities. *Education and Treatment of Children, 25*, 197–207.

Rosenkrantz, M. L. (2009). Review of the book *Learning with a visual brain in an auditory world: Visual language strategies for individuals with autism spectrum disorder*, by E. L. Arwood & C. Kaulitz. *Childhood Education*, *85*, 328–329.

Schmit, J., Alper, S., Raschke, D., & Ryndak, D. (2000). Effects of using a photographic cueing package during routine school transitions with a child who has autism. *Mental Retardation, 38*, 131–137. doi:10.1352/0047-6765(2000) 038<0131:EOUAPC>2.0.CO;2

Schopler, E., Reichler, R. J., Bashford, A., Lansing, M. D., & Marcus, L. M. (1990). *The Psychoeducational Profile Revised (PEP-R)*. Austin, TX: Pro-Ed.

Schopler, E., Reichler, R. J., & Renner, B. R. (1986). *The Childhood Autism Rating Scale (CARS)*. Los Angeles, CA: Western Psychological Services.

Sowers, J. A., Verdi, M., Bourbeau, P., & Sheehan, M. (1985). Teaching job independence and flexibility to mentally retarded students through use of a self-control package. *Journal of Applied Behavior Analysis, 18*, 81–85. doi:10.1901/jaba.1985.18-81

Spriggs, A. D., Gast, D. L., & Ayres, K. M. (2007). Using picture activity schedule books to increase on-schedule and on-task behaviors. *Education and Training in Developmental Disabilities, 42*, 209–223.

Springboard. (2002). *Assistive technology device*. Wooster, OH: Prentke Romich Company.

Taber-Doughty, T. (2005). Considering student choice when selecting instructional strategies: A comparison of three prompting strategies. *Research in Developmental Disabilities, 26*, 411–432.

Whatley, A. D., Gast, D. L., & Hammond, D. L. (2009). Visual activity schedules: Teaching independent transitioning during recreation and leisure. *Therapeutic Recreation Journal, 43*, 27–42.