

Comparing Brief and Extended Wait-Time During Small Group Instruction for Children with Challenging Behavior

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Abstract This preliminary study compared brief (1 s) and extended (4 s) wait-time on response opportunities, academic responses, accuracy, and disruptive behavior of two children with challenging behavior during small group instruction. Brief wait-time increased children's response opportunities, academic responses, and accuracy in comparison to extended wait-time. Though variable, brief wait-time also decreased children's disruptive behavior. Findings differ from previous research, which found performance improvements with extended wait-time for children with moderate to profound cognitive disabilities. Limitations of the study and future research suggestions are discussed.

Keywords Wait-time · Teacher pacing · Challenging behavior · Effective instruction · Behavioral disorders

Students who engage in high rates of challenging behavior experience difficulties in reading, math, and language (Nelson et al. 2004) and are more likely to encounter school failure (Kauffman 2004). While a variety of classroom interventions have proven successful in reducing challenging behavior and improving school success (Dunlap et al. 1995; Falk and Wehby 2001; Gresham et al. 2004; Rosenberg et al. 2004), comparatively little attention has focused on teacher pacing, the speed at which the teacher delivers repeatable elements of the learning trial (see Heward 1994). Wait-time, the duration between the teacher's instruction and student's response, is a critical element of teacher pacing. Popular wisdom and some research suggest that extending wait-time improves academic performance (e.g., Kauchak et al. 2002; Rowe 1987; Towbin 1987). Rowe (1974), for example, reported that increasing the duration of

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wait-time from 1 s to 3–5 s increased the length, spontaneity, and quality of student responses in general education science classrooms.

Several studies compared brief and extended wait-time on performance of children with moderate to profound cognitive disabilities (Duker et al. 1993; Dyer et al. 1982; Lee et al. 1987; Lowry and Ross 1975; Valcante et al. 1989). Students with significant cognitive impairments also demonstrated more accurate responding with longer wait-time. For example, Dyer et al. taught three children with autism simple discrimination and language tasks with (a) response delay, in which the therapist blocked a response or waited to ask a question for 3–5 s after presenting the instructional stimulus and (b) no response delay, in which the child was permitted to respond immediately after presenting the instructional stimulus. Participants, who were described as impulsive responders, demonstrated higher percentages of unprompted correct responding in the response delay condition, which increased their attention to instructional stimuli.

Research finds positive effects for extended wait-time; however, none of the aforementioned studies explicitly assessed effects of wait-time on students' challenging behavior. Moreover, to date no research has systematically examined brief and extended wait-time for students who engage in high rates of challenging behavior, including students with behavioral disorders. Four studies assessed effects of brief and extended inter-trial interval (ITI) on instructional responding and problem behavior of students who displayed high rates of challenging behavior during instruction (Carnine 1976; Dunlap et al. 1983; Koegel et al. 1980; Tincani et al. 2005). Contrary to positive reported effects of extended wait-time, these studies found higher levels of participation and correct responding, and lower levels of off-task, self-stimulatory, and disruptive behavior when the duration of inter-trial interval was reduced from approximately 5–2 s or less. Contradictory findings and lack of relevant studies suggest that additional research is needed to confirm benefits of brief or extended wait-time with students who display problem behavior. The purpose of this study was to systematically replicate previous research by examining the effects of brief and extended wait-time on (a) response opportunities per minute, (b) academic responses per minute, (c) percentage of correct responses, and (d) disruptive behavior of two boys with challenging behavior during small group instruction.

Method

Participants and Setting

Participants in the study were two Caucasian boys with challenging behavior, Michael and Nathan, attending a full-day, year round private clinic for children with behavior problems and learning difficulties. The clinic enrolled approximately 25 students, many of whom had Individualized Educational Programs (IEPs), and provided instruction in academic, pre-academic, social, and functional skills in one-to-one and group formats. The clinic functioned as students' primary educational placement in lieu of their local public school and was attended by students 5 days per week. Michael and Nathan were nominated for the study by the program director because they met the

researcher's criterion of engaging in challenging behavior in the clinic setting. They were also reported to have mild to moderate language delays. As part of the screening procedures for the study, participant's teachers were administered the *Behavior Rating Profile-Second Edition (BRP-2) Teacher Rating Scale* (Brown and Hammill 1990). Michael was 6 years old and Nathan was 7 years old. Michael had no formal diagnosis, but was reported to engage in frequent problem behaviors such as tantrums, aggression, and non-compliance. On the *BRP-2*, he received a standard score of 3 and a percentile rank of 1 (very poor). Nathan was diagnosed with autism and engaged in milder intensity problem behaviors, including non-compliance and excessive questioning. On the *BRP-2*, he received a slightly higher standard score of 4 and percentile rank of 2 (poor).

Experimental sessions were conducted during two daily 5 min sessions of Lessons 31–41 of *Language for Learning Presentation Book A. Language for Learning* is a Direct Instruction (DI) program for children who need instruction in oral language (Engelmann and Osborn 1999; Waldron-Soler and Osborn 2004). The program progresses from simple to complex language skills across six areas: (a) actions, (b) description of objects, (c) information and background knowledge, (d) instructional words and problem-solving concepts, (e) classification, and (f) problem-solving strategies and applications.

To affirm participants' reported language delays and to determine the *Language for Learning* lesson in which instruction would begin, Michael and Nathan were administered the placement test for *Presentation Book A*, which consisted of Parts I, II, and III (Engelmann and Osborn 1999). Michael and Nathan answered all 15 questions correctly in Part I, which included receptive body part identification questions (e.g., "Show me your shoulder.") and questions accompanying pictures of people or animals performing actions (e.g., "What is the cat doing?"). Part II was comprised of more complex questions with and without pictures, including preposition questions (e.g., "Tell me what is in front of the car.") and questions involving participants performing and then labeling their actions (e.g., "Hold your hand under your leg. Tell me where you are holding your hand."). On Part II, Michael answered 10 questions correctly and 5 incorrectly, while Nathan answered 12 questions correctly and 3 incorrectly. Placement testing ended at Part II because both participants gave more than two incorrect responses. Participants' scores on Part II determined that both Michael and Nathan would start at Lesson 31 of *Language for Learning*. Placement testing also indicated that while participants possessed certain necessary prerequisite skills, including imitation, object identification, and basic vocabulary, Michael and Nathan's language was less than adequate for their ages, 6 and 7 years respectively, thus supporting their reported mild to moderate language delays (see Waldron-Soler and Osborn 2004, pp. 71–72).

Participants had no history of exposure to any Direct Instruction program, including *Language for Learning*. The relatively brief duration of sessions, 5 min, was selected on the basis of participants' reported high rates of challenging behavior and naiveté with respect to highly structured, scripted Direct Instruction programs. Specifically, it was thought that 5 min was an optimal duration to maintain participants' attention to Lessons.

Sessions took place in an empty classroom with desks and chairs. The teacher (Tincani) sat in a chair approximately 0.5 m in front of participants, who sat in chairs next to each other. The teacher held a Ph.D. in special education and had previously taught *Language for Learning* to pre-kindergarten students with challenging behavior.

Materials

Language for Learning was implemented in the study because participants demonstrated language delays and the scripted presentation of *Language for Learning* allowed for precise delivery of learning trials and manipulation of wait-time intervals. Materials for the study were the *Language for Learning Presentation Book A*, items required for specific exercises (e.g., pencil, toothbrush, paper), data sheets, pencils and clipboards for data collection, and chairs for children and the teacher to sit. A JVC Digital Video Camera, positioned behind the teacher, was used to videotape sessions to collect procedural fidelity and disruptive behavior data. Crozier operated the video camera during each session.

Dependent Variables

Four dependent variables were selected to assess the differential effects of brief and extended wait-time: (a) response opportunities per minute, (b) academic responses per minute, (c) percentage of correct responses, and (d) disruptive behavior. Response opportunities per minute were measured to evaluate the effect of wait-time on teacher-presented response opportunities. A response opportunity occurred when the teacher asked a scripted question of participants. Teacher questions posed during error correction sequences (described below) were not counted as response opportunities. Response opportunities per minute were determined by dividing the number of teacher-posed questions by the number of minutes per session. Data on academic responses per minute were collected to evaluate the effect of wait-time on participation. Academic responses per minute were calculated by dividing the number of participant responses to teacher-posed questions by the number of minutes per session. Student responses during error correction sequences were not counted as academic responses. Percentage of correct responses were measured to determine the effect of brief and extended wait-time on student accuracy. Percentage of correct responses was calculated by dividing the number of correct responses (excluding error correction sequences) by the total number of responses per session. Finally, disruptive behavior was measured to assess the effect of wait-time on challenging behavior. Disruptive behavior was defined as non-lesson related responses including chair-tipping, out-of-seat, yelling, non-lesson related talk, touching another student, and aggression. It was calculated as the percentage of partial intervals of occurrence.

Observation and Recording Procedures

Dependent variables were measured by an observer (Crozier) who was a graduate student in special education. Prior to the first session, the teacher and

observer reviewed response definitions and practiced recording from videotapes of teaching sessions until achieving at least 90% interobserver agreement. During each session, the observer sat behind the teacher, in view of the participants, timing the sessions. Data for correct, incorrect, non-responses were recorded from the videotapes of experimental sessions using event recording. Disruptive behavior data were also recorded from the videotapes using a partial interval recording system. Each 5 min session was divided into 5 s intervals. An interval was scored ‘Yes’ if the participant engaged in a disruptive response during any portion of the interval, ‘No’ if the participant emitted no disruptive responses during the interval.

Interobserver Agreement

Interobserver agreement (IOA) data for response opportunities, correct responses, and disruptive behavior were collected by Tincani during 28.6% of sessions, selected at random. IOA for response opportunities was calculated by dividing the number of interval agreements by agreements plus disagreements and multiplying by 100. Response opportunity IOA was 97.8% (range 97.5–100%). IOA for correct responses, which was 94.7% (range 85–100%), was calculated by dividing the number of agreements for correct responses by the number of agreements plus disagreements and multiplying by 100. IOA for disruptive behavior was determined by dividing agreements by agreements plus disagreements for each interval and multiplying by 100. IOA for disruptive behavior was 96.9% (range 71.4–100%).

Experimental Design

The effects of brief and extended wait-time were evaluated using a single-subject multi-element design (Cooper et al. 1987; Kennedy 2005). In this design, two or more experimental conditions are alternated for each participant. Experimental control is demonstrated when data paths show stable or opposing levels and no overlap. When some overlap is evident, “a degree of experimental control over the target behavior can still be demonstrated if the majority of data points for a given treatment fall outside the range of values of the majority of data points for the contrasting treatment” (Cooper et al. 1987, p. 182). Brief and extended wait-time sessions were alternated at random to reduce the likelihood of sequence effects, with no more than two of each session occurring consecutively. Random alternation resulted in 13 brief wait-time sessions and 15 extended wait-time sessions by the end of the study. Two sessions were conducted each day for 5 days per week; on some days, random alternation resulted in two of the same condition occurring in back-to-back sessions. The second session was conducted immediately (i.e., less than 1 min) after the end of the first. The seating positions of participants and the teacher, instructional materials, error correction procedures, praise statements, and post-session rewards were held constant across both conditions to decrease the likelihood of confounding variables influencing the data.

Procedures

Prior to session 1, the teacher explained general expectations for the study to Michael and Nathan. The teacher stated that he would be asking a series of questions from the presentation book (*Language for Learning Presentation Book A*) and, when he gave the hand signal, they should answer his question at the same time (i.e., chorally). Next, the teacher conducted a warm-up activity in which he asked several practice questions from the book followed by a brief delay (approximately 1 s) and delivery of the hand signal. Praise statements (e.g., “That’s good following my signal.”) were delivered to Michael and Nathan when they responded immediately after signal. The teacher progressively increased the delay between the question and the signal by up to 5 s until both participants were consistently responding on cue. When one or both participants made a response before the signal, the teacher said, “Wait for my signal,” and praised Michael and Nathan for following the signal.

At the beginning of each session, the teacher set a timer for 5 min, which signaled the end of the session. Delivery of *Language for Learning* involved the teacher reading a series of scripted questions to students, many of which require the student to respond to both visual (i.e., pictures, objects, or teacher models) and auditory stimuli. Lesson 31, in which Michael and Nathan began, was comprised of questions about body parts, school related information, missing objects, opposites, and part/whole concepts. The teacher read questions from *Language for Learning Presentation Book A*; when appropriate, Michael and Nathan were shown objects or pictures in the book about which they were asked questions (e.g., “We’re going to talk about a picture. What is this?”). When both participants made a correct response, the teacher gave a brief praise statement and moved immediately to the next question. Inter-trial intervals were kept as brief as possible (i.e., less than 1 s). When one or more participants made an incorrect response or did not respond, the teacher (a) modeled the correct response; (b) repeated the question, allowing participants to say the correct response along with him; and (c) repeated the question, allowing participants to perform a correct, unprompted response. When participants made two consecutive errors, the teacher repeated the procedure and then moved immediately to the next question. Responses during error sequences were not counted as academic response data; only participant responses to the initial teacher question (correct, incorrect, or non-response) were counted as academic response data.

The teacher ignored disruptive responses during sessions unless a participant posed harm to himself or the other participant, attempted to leave the instructional area, created a distraction for the other participant, or interfered with the delivery of the lesson. For example, on several occasions Michael leaned back on his chair, placed his feet on the teacher, or pinched Nathan. The teacher used a system of least-to-most prompts to redirect the participant on-task when such behaviors occurred. No formal system of reinforcement was used during sessions to prevent overshadowing effects on academic performance and disruptive behavior (cf. Skinner et al. 1994). Following the two daily sessions, the teacher allowed Michael and Nathan 5 min of non-contingent access to a preferred item of their choosing to reinforce participation in the sessions.

In the brief wait-time condition, the teacher paused 1 s after asking a question to present the response signal. In the extended wait-time condition, the teacher paused 4 s after asking a question to present the response signal. Brief and extended wait-time durations were selected on the basis of similarity to those reported in previous studies, in which brief wait-time durations were approximately 1 s or less and extended wait-time durations were closer to 5 s (e.g., Carnine 1976). The teacher used a self-cueing system to control the wait-time interval by counting silently (i.e., “one-one-thousand...”) to maintain the appropriate interval. In the first several sessions, if either participant responded before the signal, the teacher said, “Wait for my signal,” and presented the signal after the prescribed interval. Subsequently, responses before the signal were ignored.

Procedural Fidelity

Data on the average duration of wait-time were collected to ensure the teacher was adhering to the described wait-time durations. The Tincani and Crozier observed 28.6% of videotaped sessions, selected at random. Using a stopwatch, both observers recorded the cumulative duration of wait-time pauses during the session. To assess interobserver agreement, the smaller duration was divided by the larger duration and multiplied by 100. Interobserver agreement averaged 91.7% (range 84.9–98.7%). Average duration of wait-time was calculated by dividing the total duration of wait-time pauses by the number of response opportunities per session. For the brief wait-time condition, mean wait-time was 1.0 s (range 0.6–1.6). For the extended wait-time condition, mean wait-time was 4.1 s (range 3.4–4.6).

Results

Results for academic responses per minute, percentage of correct responses, and percentage of intervals engaged in disruptive behavior are depicted in Figs. 1–3, respectively. Figures 1 and 2 demonstrate stable levels of responding and little overlap in data paths between brief and extended wait-time conditions after Session 6, indicating experimental control. One purpose of the study was to evaluate differential effects of brief and extended wait-time on teacher presented response opportunities. Not shown in Figs. 1, 2, or 3, on average, the teacher presented 6.4 opportunities per minute with brief wait-time (range 2.6–8.0) and 3.7 opportunities per minute with extended wait-time (range 2.0–4.6), suggesting that brief wait-time significantly increased the rate at which the teacher presented response opportunities to students.

Figure 1 depicts Michael’s and Nathan’s academic responses per minute with brief and extended wait-time. Nathan was absent for Sessions 9, 10, 19, and 20; therefore, data are displayed only for Michael for these sessions. On average, Michael demonstrated 5.9 responses per minute with brief wait-time (range 2.4–8.0), but only 3.2 responses per minute with extended wait-time (range 1.8–4.4). Nathan also demonstrated 5.9 responses per minute with brief-wait time (range 2.0–7.8), whereas he demonstrated only 3.3 responses per minute with

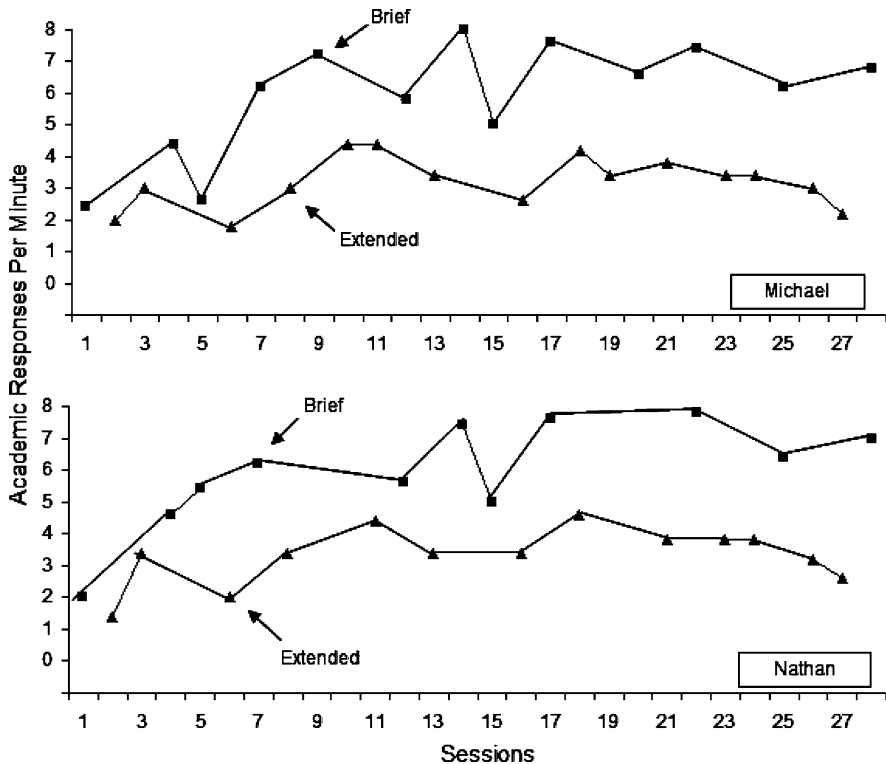


Fig. 1 Academic responses per minute for Michael and Nathan

extended wait-time (range 1.4–4.6). Visual analysis of the data shows similar levels of academic responding in Sessions 1–6 for Michael and 1–3 for Nathan; however, thereafter differences in academic responding between conditions emerged.

Figure 2 shows the percentage of correct responses with brief and extended wait-time. Michael demonstrated an average of 87.8% correct responses with brief wait-time (range 67–97%), but only 72.9% correct responses with extended wait-time (range 44–93%). Nathan demonstrated an average of 83.5% correct responses with brief wait-time (range 63–95%), but only 75.5% correct responses with extended wait-time (range 53–100%). Figure 2 indicates that extended wait-time initially yielded more accurate responding for both participants; however, after Session 5 for Michael and Session 3 for Nathan, brief wait-time produced relatively small, but consistent increases in accuracy compared to extended wait-time.

Not displayed in Fig. 2, Michael demonstrated an average of 5.6% non-responses with brief wait-time (range 0–51.8%) and 14.6% non-responses with extended wait-time (range 0–50%). Nathan demonstrated an average of 1.7% non-responses with brief wait-time (range 0–16.2%) and 6.2% non-responses with extended wait-time (range 0–20%). While Michael and Nathan demonstrated relatively high levels of participation relative to response opportunities in both conditions, brief wait-time resulted in slightly fewer non-responses and thus greater participation than extended wait-time.

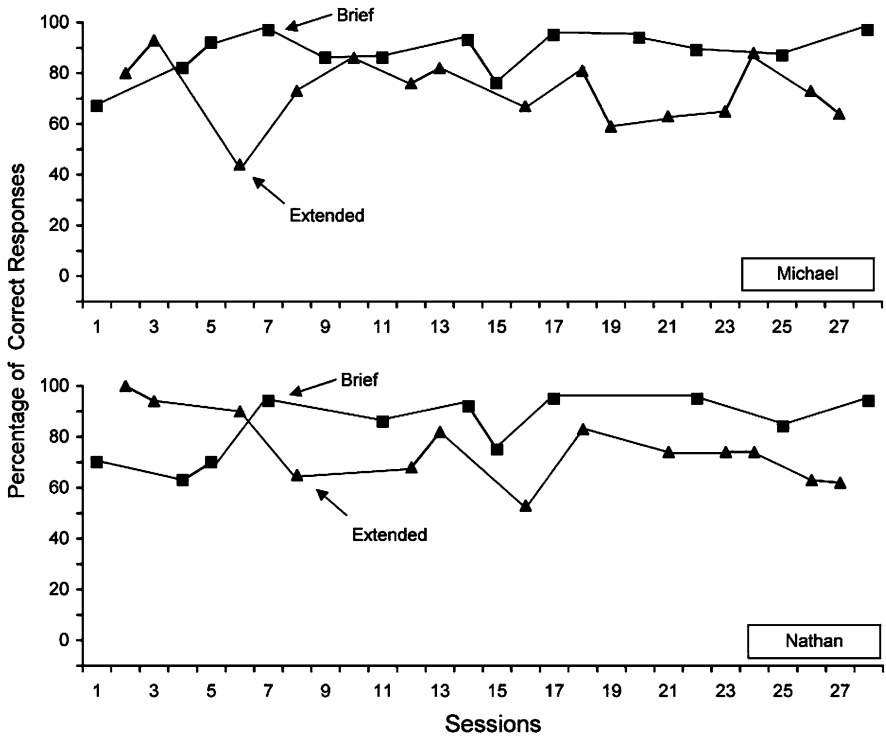


Fig. 2 Percentage of correct responses for Michael and Nathan

Results for disruptive behavior are shown in Fig. 3. A higher degree of variability is evident and there is considerable overlap between data paths, suggesting less robust effects on disruptive behavior. Nonetheless, visual inspection reveals that brief wait-time produced a lower range of disruptive responses than extended wait-time. Michael demonstrated an average of 34.8% intervals of disruptive behavior with brief wait-time (range 12.5–64.7%) and 54.3% intervals of disruptive behavior with extended wait-time (range 12.5–87.5%). Nathan displayed 11.1% intervals of disruptive behavior with brief wait-time (range 0–29.4%), compared to 31.7% of intervals of disruptive behavior with extended wait-time (range 0–62.5%).

Discussion

Brief wait-time produced more response opportunities, academic responses, and correct responses than extended wait-time. Though variable, brief wait-time also yielded lower levels of disruptive behavior. Results do not replicate previous research, which reported more accurate responding with extended wait-time for students with moderate to profound mental retardation (Duker et al. 1993; Dyer et al. 1982; Lee et al. 1987; Lowry and Ross 1975; Valcante et al. 1989). Perceptual difficulties reported for persons with mental retardation (e.g., Carlin et al. 1995) may contribute

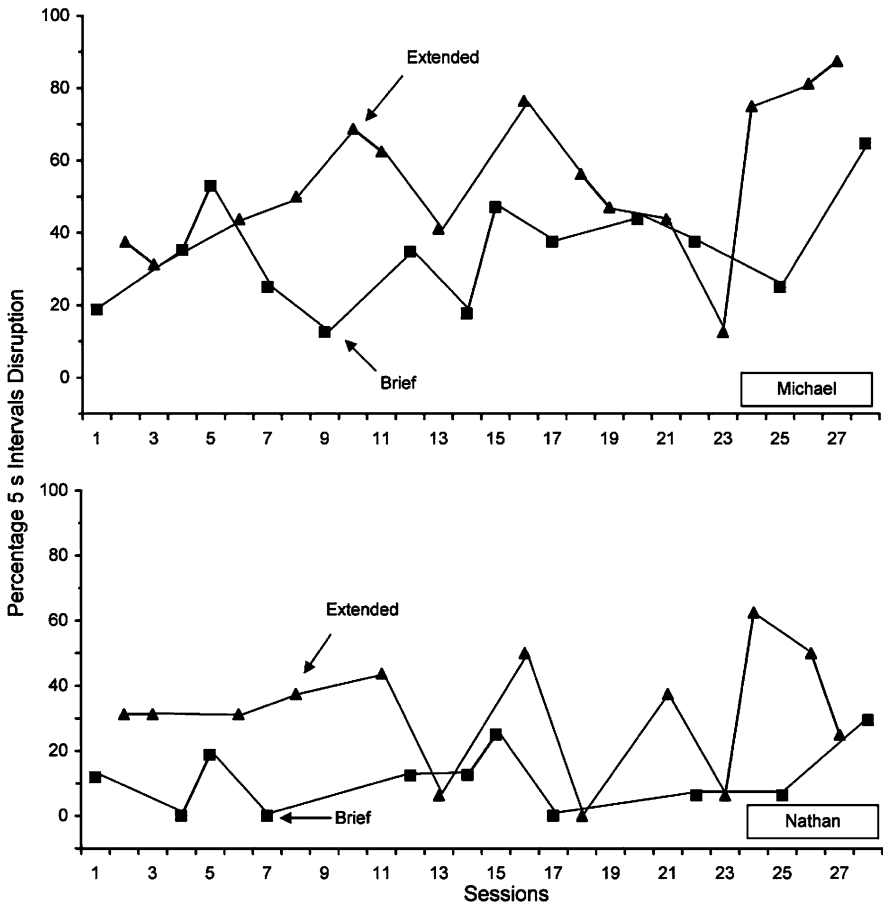


Fig. 3 Percentage of 5 s intervals engaged in disruptive behavior for Michael and Nathan

to the positive effects of extended stimulus presentations and longer wait-times in previous studies. In the current study, extended presentations were not necessary to produce attention and correct responding for students. In fact, anecdotal observation of videotaped sessions revealed that participants' visual attention frequently waned during extended wait-time pauses. Results were more consistent with studies of ITI (Carnine 1976; Darch and Gersten 1985; Dunlap et al. 1983; Tincani et al. 2005), which showed increased accuracy with brief inter-trial intervals.

Although reductions in disruptive behavior were observed during the brief wait-time condition, levels were variable and remained relatively high. This finding suggests that brief wait-time alone may not be sufficient to control the disruption of children who display high rates of challenging behavior. The addition of supplementary behavior management procedures may be indicated in most situations for students who display high rates of challenging behavior. Further, no procedures were implemented to determine the function of participant's challenging behavior prior to intervention. Students' disruptive behavior with brief or extended

wait-time may vary depending upon whether responses are maintained by positive reinforcement, negative reinforcement, or both, thus highlighting the need for function-based intervention procedures in addition to pacing modifications.

It could be argued that brief wait-time pauses would necessarily produce higher rates of response opportunities and academic responses. However, if brief wait-time produced higher rates of error, consistent with previous studies, the teacher would have administered more error correction sequences. The resulting error corrections would have lowered the rate of response opportunities and academic responses. In contrast, students' high percentage of accuracy with brief wait-time enabled higher rates of response opportunities and correct responses, as reflected in the data.

Results suggest that Michael and Nathan required two to three sessions to adjust to the brief wait-time interval (see Fig. 2). Initially, both participants performed more accurately with extended wait-time. Subsequently, extended wait-time produced lower levels of accuracy and brief wait-time produced higher levels of accuracy. Reasons for the crossover are unclear, but are possibly related to students' unfamiliarity with the curricular content, the instructional format, and the use of a response signal. One implication is that the duration of wait-time should be longer when new introducing new material or instructional procedures to students with problem behavior and then should be decreased as students acquire practice.

The effects of wait-time on opportunity to respond should also be considered. On average, there were 2.7 more opportunities to respond per minute with brief wait-time than extended wait-time. Although this might not seem to be a significant difference, if multiplied by, for example, a 20 min instructional period, this would result in an additional 54 response opportunities with brief wait-time. Given the positive reported effects of increasing response opportunities for students with challenging behavior (Sutherland and Wehby 2001), this would seem to be a substantial benefit of brief wait-time.

The benefits of brief versus extended wait-time may differ according to other variables, as well. Good and Brophy (2003) suggest that fast teacher pacing is appropriate for drill or review activities, such as those found in *Language for Learning*, whereas slower teacher pacing is required for activities that require students to "think" about material or to formulate original responses. The optimal duration of wait-time may also vary according to students' cognitive abilities and levels of disruptive behavior; novelty and complexity of instructional material; signaling, prompting, and error correction procedures; reinforcement contingencies; and opportunities for active responding. Nonetheless, practitioners may consider strategies for decreasing the duration of wait-time during small group instruction for appropriate instructional activities.

The study, which should be viewed as a preliminary investigation, has a number of limitations that affect the generality of results. First, only two children participated. Additional replications will be necessary to confirm benefits of brief wait-time for students with behavior problems. Moreover, future replication studies should examine effects of brief and extended wait-time in larger group contexts. Second, the study occurred in a non-public school setting and the teacher held a Ph.D. in special education. The atypical circumstances of the study further limit the generality of results to settings in which most students with behavior problems are

educated. Third, the brief duration of sessions, 5 min, is considerably less than typical teaching periods. Future studies should address effects of wait-time during periods that more closely approximate real lessons. Fourth, no measures of generalization or maintenance were taken in either condition. Evidence of generalization and maintenance would further support the use of brief wait-time. Fifth, the teacher deviated from the error correction and firming procedures described in *Language for Learning Presentation Book A*, perhaps resulting in a higher rate of incorrect response in both conditions. However, deviations were necessary to maintain consistency in the presentation of learning trials between brief and extended wait-time conditions. Finally, Tincani served as the teacher and both authors served as data collectors, thus neither was blind to the purpose of study.

The alternating treatments design used in the current study was selected because it permits quick comparison of the effects of two or more interventions on target responses, allows for experimental evaluation of unstable performances (as was the case with disruptive behavior), and minimizes sequence effects (Cooper et al. 1987, pp. 189–192). However, this design may be less internally valid than some single subject designs, such as the reversal, since it does not include baseline or withdrawal of treatment phases. Future studies comparing effects of wait-time or other pacing variables could include an initial baseline phase, followed by alternating treatments, and then a final “best treatment” phase in which the most effective pacing condition is implemented alone (pp. 187–190).

Results suggest several areas for future research (see also Tincani et al. 2005). The effects of wait-time may vary based upon instructional stimuli. Subsequent research might examine the effects of simple (e.g., “Where is this bird?”) versus complex (e.g., “Say the whole thing about where this bird is.”) stimulus presentations in relation to brief and extended wait-time. The latter stimulus presentation would require the student to generate a whole sentence response (e.g., “The bird is in the tree.”), thus potentially affecting the optimal wait-time duration. The current study combined vocal and visual instructional stimuli. Future studies could examine the effects of vocal or visual stimuli separately in relation to brief and extended wait-time. Additionally, future studies may investigate the mode of student response (e.g., oral, written, both) and the length or complexity of response (e.g., “Bird” or “That animal is a bird.”). The relationship between the form of the feedback (e.g., affirmation or reinforcement, error correction, instructive feedback) and the immediacy of feedback (i.e., the latency between student response[s] and feedback) could also be examined. Finally, the effects of brief and extended wait-time could be studied in combination with brief and extended durations of inter-trial intervals to discover the optimal parameters of instructional pacing.

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