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Effects of increased exposure to training trials with children with autism

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Effects of Increased Exposure to Training Trials with Children with Autism

A Thesis Presented

by

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Effects of Increased Exposure to Training Trials with Children with Autism

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Abstract

We examined effects of increasing rate of exposure to training trials on response acquisition. Academic objectives for 2 participants at a residential school for children with autism were selected for inclusion in the study due to a lack of progress. During baseline, teaching sessions were conducted once or twice a day, five days a week until response acquisition was not improving. Using a multiple baseline design, the participants encountered each objective in the treatment condition in a staggered design. During the treatment condition teaching sessions occurred multiple times in one hour during the day, five days a week. Results indicate increasing exposure to training trials increased the rate of response acquisition.

Effects of Increased Exposure to Training Trials with Children with Autism

Children with developmental disabilities may need relatively intensive teaching strategies to promote learning. Previous research has examined response acquisition as a function of two strategies to increase the number of teaching trials; manipulating the time between teaching trials and manipulating the amount of time allocated to teaching trials.

A teaching trial is comprised minimally of a discriminative stimulus or instruction, a student response, differential reinforcement, and an intertrial interval. Intertrial interval (ITI) is the length of time between the delivery of the reinforcer and the onset of the instruction for the next trial. The number of teaching trials that can be delivered in a set period of time is directly related to the amount of time spent in each of these trial components. The effect of ITI durations on acquisition has been studied empirically. Carnine (1976) manipulated the length of time between the delivery of the reinforcer and the onset of the instruction of the next trial in teaching sessions with typically-developing students. Measuring off-task behavior, participation, and correct responding, Carnine evaluated fast-rate trial presentations and slow-rate trial presentations in a reversal design. Carnine reported a delay between the student's response and the presentation of the next trial was considered a slow presentation rate. No delay between the student's response and the presentation of the next trial was considered fast presentation rate. Carnine reported that off-task behavior decreased, and participation and correct responding increased when the rate of presentation was 1 s or less. With increased time between the student response and the next task at a slower rate, off-task behavior increased, and participation and correct responding decreased. During a slow rate presentation, the time between the student response and the next task was 5 s or more.

Koegel, Dunlap, and Dyer (1980) also assessed the effects of ITIs on skill acquisition. Koegel et al. examined correct responding for children with autism when intertrial intervals were manipulated in skill acquisition programming. In a multiple-baseline design, the effect of two ITI durations on correct responding was assessed. The long intertrial interval consisted of a 4 to 26-s break between the end of the consequence and the presentation of the next instruction. The short intertrial interval consisted of a 1 to 4-s break between the end of the consequence for the previous response and the presentation of the next instruction. Results showed that across participants long intertrial interval performance was unpredictable. None of the three participants' performances reached acquisition criterion in the long intertrial interval conditions. Once the short intertrial interval was implemented for each participant, there was an immediate increase in correct responding, and criterion performances were observed for all participants in this condition.

Koegel et al. (1980) conducted a reversal design for some tasks. The percentage of unprompted correct responses was measured in the reversal design. For all tasks and all participants, the reversal design showed an increased percentage of unprompted correct responses in the short intertrial interval condition. In both designs, the results showed increases in correct unprompted responses and rapid acquisition of the tasks assessed in the short intertrial interval. In the long intertrial intervals there was little to no improvement in unprompted correct responding and mastery criterion for acquisition was never met. Carnine (1976) and Koegel et al. showed that manipulation of intertrial interval durations affects the rate of correct responding by students during skill acquisition programming.

A second strategy to increase the number of training trials, increasing instructional time, was reported by Torgesen et al. (2001). They examined the effects of intensive remedial

instruction on reading skills with children with learning disabilities. The participants in the study had received below-average standard scores on two measures of reading skills. During baseline, 100 min of instruction a day was divided among many different topics. In treatment, 100 min of instruction a day was devoted to reading instruction only. Training took between 8 and 9 weeks to complete. For training to be considered completed, each participant needed exposure to 67.5 hours of instruction in reading. Once the intensive training was completed, the student continued in generalization training for an additional 8 weeks. The total time in instruction for the study was 16 to 17 weeks.

The results showed improvements in generalized reading skills in the intensive remedial instruction condition. The effects were not only substantial, but were also stable over time. In a 2-year follow-up, the results showed similar scores from those recorded immediately after the intervention. Within 1 year of the intervention, 40% of the students in the specialized reading classroom no longer needed special educational services for reading. An important factor assessed in the study by Torgesen et al. (2001) was the long-term follow-up. The intervention was proven to be effective in the short term as well as the long term. By simply providing more reading instruction per day, the students were able to improve reading scores on standardized tests that allowed them to leave special reading instruction classes.

Wanzek and Vaughn (2008) implemented similar methods to those reported by Torgesen et al. (2001). They assessed increasing the amount of time spent in individual sessions with students in a high-poverty school system. A high percentage of participants were minority students who were not achieving grade-level reading scores on standardized tests. In the first comparison, the effects on skill acquisition were measured in a group that received no extra intervention in reading and a group that received 30 extra minutes in reading intervention daily.

The results showed no significant difference in skill acquisition between the two groups. Students in both groups received similar scores on reading tests once intervention was completed.

In the second comparison, the effects on skill acquisition were measured in a group that received no reading intervention and a group that received 60 min of reading intervention daily. Results on reading tests showed significant differences between the intervention and comparison groups on one test. There were more students in the treatment groups that showed progress in reading than the comparison groups, but the differences were not significant.

Wanzek and Vaughn (2008) did not report significant results across all measurable aspects of the dependent variables with students with reading disabilities. They did, however, show an increase in reading scores when the time in intervention was doubled from the first to the second comparison study, but the gains were minimal. Wanzek and Vaughn suggest that in future research time in intervention should be increased by more than 60 min. The purpose of the current study is to evaluate effects of increased exposure to training trials on response acquisition with children with autism.

Method

Participants

Two male students diagnosed with autism spectrum disorders participated in the study. The participants resided at a residential school for children with autism. The students attended school between 10 am and 3 pm 6 days a week. Academic objectives were run between the hours of 8 am and 8 pm 7 days a week. Both participants were referred by supervisors and teachers that worked with the students on a daily basis due to a lack of progress on objectives in their Individualized Educational Programs (IEP).

AJ was a 19-year-old male diagnosed with an autism spectrum disorder. AJ communicated vocally with four-to five-word sentences. He exhibited severe self-injury and aggression to others. Bret was a 15-year-old male diagnosed with an autism spectrum disorder, who communicated vocally with three-to four-word sentences. Bret exhibited severe environmental destruction, self-injury, and aggression to others.

Settings and Materials

All sessions were conducted in the students' classrooms at the main facility or in the bedroom or community room at their residential home. The classrooms contained two to three desks and four to six chairs. Up to three other students and two other teachers were present during experimental sessions. Materials for academic sessions as well as leisure items available during trade-ins were present. The bedrooms at the residential facility contained a desk, chair, bed, dresser, and personal leisure items. The community room contained a large table, four chairs, and leisure items such as a TV, games, puzzles and books. Each session consisted of academic materials, token boards, reinforcer containers, primary and secondary data sheets, and a binder. Curriculum data sheets were altered to include procedural integrity data collection.

Response Measurement

The dependent variable, *independent correct response* was defined as the participant responding correctly to the teaching instruction without the use of a prompt. Data were also collected on correct prompted responses, independent incorrect responses, incorrect prompted responses, and no response. *Correct prompted response* was defined as the participant responding correctly to the teaching instruction after a prompt. *Independent incorrect response* was defined as the participant emitting an incorrect response to the teaching instruction without a prompt. *Incorrect prompted response* was defined as the participant emitting an incorrect

response to the teaching instruction despite the use of a prompt. *No response* was defined as the participant not emitting a response after the teaching instruction was given with or without a prompt.

The independent variable manipulated was duration of exposure to training trials. One hour was selected; training trials were run for the duration of that hour. After one hour elapsed the session ended; the criterion disregarded the number of trials conducted with the participant in a session.

Interobserver Agreement and Procedural Integrity

Interobserver agreement was calculated by dividing the number of trials with agreement by the total number of trials with agreement plus disagreement and multiplying by 100%. Agreement was scored for 50% of trials for AJ with 100% agreement. Agreement was scored for 33% of trials for Bret with 100% agreement.

Procedural integrity data were collected on the accuracy of the stimulus presentation, prompt, correction procedure, and prescription for the session. Procedural integrity data were taken on 50% of trials for AJ and 33% of trials for Bret. Procedural integrity was recorded at 100% across all observations.

Design and Procedure

A multiple-baseline design across responses was employed for each participant. During sessions all reinforcement and behavior guideline programs were followed, and no changes were made to the curriculum. According to behavior guidelines, each student was to receive a small edible for a predetermined number of correct responses. The edibles used during experimental sessions were not isolated for experimental sessions. All experimental sessions were conducted by the same therapist except for one generalization probe. The last set of trials was run by

different teaching personnel that worked with the students regularly. This set of trials was run to meet mastery criteria as written in the IEP objective.

The objectives included for AJ were Community Signs, Reading, and Manual Signs. Community Signs was a match-to-sample program with a comparison array of three community signs (stop, men, and closed) that the participant matched to a verbal sample (one of three sample names were presented in a quasi-random fashion across 9-trial sessions). There were three exemplar sets for each sign and the position of each comparison stimulus varied across trials. The prompting procedure used was a 1-s progressive delay with point cue. After two consecutive sessions with responding at 89% correct, the time between the discriminative stimulus and the prompt (point cue to correct comparison) was increased by 1 s. Mastery criteria was met when 89% or better independent correct responding across two environments and two teachers in three consecutive sessions was achieved.

Reading was a match-to-sample program with a comparison array of three written words (chips, cereal, and milk) that the participant matched to a verbal sample (one of three sample names were presented in a quasi-random fashion across 9-trial sessions). There were three exemplar sets for each word and the position of each comparison stimulus varied across trials. The prompting procedure used was a 1-s progressive delay with a point cue. After two consecutive sessions with responding at 89% correct, the time between the discriminative stimulus and the prompt (point cue to correct comparison) was increased by 1 s. Mastery criteria was met when 89% or better independent correct responding across two environments and two teachers in three consecutive sessions was achieved.

Manual Sign was a discrete trial program in which the student was required to request a desired item in his teacher's hand using manual signs. One item was used for the 5-trial sessions.

The item in the teacher's hand was a ball. A preference assessment had previously determined that the ball was preferred. The prompting procedure used was a 2-s constant delay with most-to-least fading of visual prompts. After two consecutive sessions with responding at 100% correct, the visual prompt was faded. Mastery criteria were met when 89% or better independent correct responding across two environments and two teachers in three consecutive sessions was achieved.

Bret's objectives were Sequencing Pictures and Tooth brushing. Sequencing Pictures was a discrete trial program in which the student put three pictures of a vocational task in order on a stimulus board. One vocational task was used in the 5-trial sessions. The vocational task pictured was wrapping silverware. The prompting procedure used was a 1-s progressive delay with point cue. After two consecutive sessions with responding at 100% correct, the time between the discriminative stimulus and the prompt (point cue to the correct order) was increased by 1 s. Mastery criteria were met when 89% or better independent correct responding across two environments and two teachers in three consecutive sessions was achieved.

Tooth brushing was a chain that the student brushed six regions of his teeth in three strokes. The chain was conducted in 5-trial sessions. The prompting procedure used was most to least manual guidance. The prompt hierarchy included hand over hand manual guidance, forearm, upper arm, light touch, and independent. Mastery criteria was met when 100% independent correct responding across one environment and two teachers in three consecutive sessions was achieved.

AJ was given a token for every correct prompted or independent response. His token exchange schedule was fixed ratio (FR) 5 for which he received a small edible of his choice. After completing three teaching sessions, AJ could trade-in for 10 min with a toy of his choice

and music. Bret was given a token for every correct prompted or independent response. His token exchange schedule was FR9 for which he received a small edible of his choice. Bret's 10-min trade-in was on a token exchange FR45 schedule.

Baseline. The number of baseline sessions for each program was equated to the number of teaching sessions being run prior to the beginning of the experiment. This included approximately three months of data collection for AJ and one month of data collection for Bret prior to experimental inclusion. During discrete trial and match-to-sample baselines, an incorrect response resulted in all stimuli and attention removed for 3 s, and then the trial was represented at the most restrictive prompt. If there were two consecutive or three total incorrect responses in a session, the session would end immediately. The student was then prompted at one step lower than previously prescribed in the next teaching session. Correct responses were reinforced with verbal praise and the student-specific token delivery.

During Tooth brushing instruction, an incorrect response on a previously learned step or on a training step was corrected immediately with hand-over-hand guidance. Two consecutive incorrect responses on a previously learned step resulted in retraining that step at the most restrictive prompt. Two consecutive incorrect responses on a training step resulted in a more restrictive prompt at that step. Correct responses on a training step resulted in an edible reinforcer being delivered to the student.

Community Signs was run five times per week for a maximum total of 45 trials. Reading was run five times per week for a maximum total of 45 trials. Manual Signs was run five times per week for a maximum total of 25 trials. Sequencing Pictures was run twice a week for a total of 10 sessions and a maximum total of 50 trials. Tooth brushing was run five times per week for a maximum total of 25 trials.

Treatment. In treatment, the academic objective was run for one continuous hour five days a week. Sessions were conducted sometime between the hours of 10 am and 8 pm. The time of day varied depending on student availability. The hour included any consumption time for edibles and one 10-min period in which the students had access to a preferred activity without demands. The same correction and reinforcement procedures were used in baseline and treatment. Table 1 shows the maximum number of trials during baseline per week and the average number of trials during treatment per week.

Maintenance. After mastery criteria were met on an objective with one therapist and one generalization teacher, the teaching programs were implemented by all 20 teachers on the student's team at the same frequency as in baseline. One and three months after mastery criteria were obtained on AJ's and Bret's last objective, respectively, maintenance probes were run for all objectives. Except for Brett's tooth brushing program, maintenance probes were run without a correction procedure for incorrect responses. If an incorrect response was emitted, the stimuli were removed and the next trial was presented. Correct responses were verbally praised and a token was delivered. In the maintenance probe for tooth brushing, an incorrect response was interrupted and hand-over-hand manual guidance was provided for that step only.

Results

Following treatment implementation, both participants met all of their targeted academic objectives. Figure 1 shows the results for AJ for all three academic objectives plotted by sessions. Community Signs showed no progress during 18 baseline sessions (162 trials). On Session 19, treatment was implemented. On Session 61, after 345 trials in 42 sessions, AJ's performance met mastery criteria for Community Signs. Reading also showed no progress during 42 baseline sessions (336 trials). On Session 43, treatment was implemented. On Session 78,

after 302 trials in 35 sessions, AJ's performance met mastery criteria for Reading. Manual Sign showed no progress during 23 baseline sessions (113 trials). On Session 24, treatment was implemented. On Session 49, after 130 trials in 25 sessions, AJ's performance met mastery criteria for Manual Signs.

Figure 2 shows the data plotted across days. These graphs show the data in real time. Each data point represents the average responding for that day. During treatment, multiple sessions were run each day. Baseline sessions were run for 18, 42, and 23 days for Community Signs, Reading, and Manual Signs, respectively. Once treatment was implemented Community Signs was mastered in 11 days, Reading was mastered in 12 days, and Manual Signs was mastered in 11 days.

Figure 3 shows the results for Bret for both academic objectives plotted by sessions. Sequencing Pictures showed no progress during 36 baseline sessions (180 trials). On Session 37, treatment was implemented. On session 97, after 588 trials in 60 sessions, Bret's performance met mastery criteria for Sequencing Pictures. Bret obtained a maximum of 60% independent correct responses throughout baseline. Once treatment was implemented, the percent of independent correct responses was variable until it reached 100% for seven consecutive sessions. Tooth brushing showed no progress during 11 baseline sessions (50 trials). On Session 12, treatment was implemented. On Session 47, after 185 trials in 35 sessions, Bret's performance met mastery criteria for Tooth brushing.

Figure 4 represents the data plotted across days in real time. Each data point represents the average responding for that day. Baseline sessions were run for 16 days for Sequencing Pictures, and 10 days for Tooth brushing. Once treatment was implemented Sequencing Pictures was mastered in 6 days, and Tooth brushing was mastered in 9 days.

Discussion

The results suggest that an increase in the rate of training trials is effective in increasing response acquisition. Prior to inclusion in the study, the students had made little or no progress in these teaching programs over months of instruction. These results continued in baseline when the programs were implemented at the same rate as prior to the study. When the number of teaching trials per day was increased a different trajectory of correct independent responding was observed for all objectives across both participants. During treatment, all five objectives met mastery criteria in days compared to the months with no progress prior to the study. In the follow-up maintenance probe, AJ and Bret continued to demonstrate mastery criterion performance in all their targeted objectives.

The current research findings have applied implications. Supervisors could implement this procedure for the objectives that students are not progressing on in their IEP, as well as all objectives listed on a student's IEP. The benefit of using this procedure for all objectives could be faster acquisition on all objectives and could allow the student to access other areas of instruction that would help improve their independence. With faster response acquisition target goals could be attained and allow new, more complex skills to be trained.

The treatment design is a relatively simple procedure for teachers to implement. The teaching procedure required no additional training for the teachers involved in the study. Unlike intertrial interval procedures, this procedure required no timing of trials or intertrial intervals. The teaching sessions were conducted as previously prescribed and implemented. There was no manipulation of task materials or the environment during the treatment sessions. All sessions were run in the regular classroom and academic work areas with other students present. The

teaching personnel were merely required to present more consecutive trials than previously prescribed on the curriculum sheets.

Many special education programs may have minimal resources and space in which to provide academic instruction to their students. The current procedure requires no additional materials or environments to implement the treatment. The current procedure does not require additional time in an academic setting, but uses time already required to teach the student. The time is condensed into blocks rather than spread out over multiple days and months.

One possible process responsible for the behavior change is the increase in rate of reinforcement. While all reinforcement guidelines were held constant prior to inclusion in the study, during baseline sessions, and treatment sessions, all the participants could access reinforcement more with the increase in trial presentations. It is unclear if this process had an effect on the behavior change seen in the current study. Future research should look to control this potential factor to ensure that the behavior change is due to increased exposure to training trials and not due to an increased rate of reinforcement.

One limitation of the current research is that the actual rate of exposure to training trials varied across participants and objectives. The actual rate that is needed to increase response acquisition is unclear both in the research literature and in the current study. Future research should look to systematically alter the rate of exposure to training trials to determine the optimal rate for response acquisition.

Another limitation in the current study was that data for Bret's Sequencing Pictures objective was on a variable increasing trend when treatment was implemented. It is difficult to attribute the treatment to the behavior change given that the data show an increase prior to treatment implementation.

During the study, only one teacher ran sessions with the participants except for the generalization probe. It is difficult to assess whether or not the results will generalize to the remainder of the teaching personnel. Future research should look at expanding the number of teachers that run experimental sessions to ensure that the students will be able to generalize the skills to other teachers.

Procedural integrity for experimental sessions for both participants was assessed at 100%. The therapist running sessions had been employed by the school for over 3 years and had experience teaching IEP objectives. Other teaching personnel may have less experience teaching IEP objectives and procedural integrity might be less than 100%. This factor may have also contributed to the increase in response acquisition. Results may not be replicated with lower procedural integrity levels in conducting experimental sessions. A further suggestion for future research is to evaluate response acquisition with systematic changes to procedural integrity levels during conditions of increased exposure to training trials.

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Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K. K. S., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities; Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities*, *34(1),* 33-58.

Wanzek, J., & Vaughn, S. (2008). Response to varying amounts of time in reading intervention for students with low response to intervention. *Journal of Learning Disabilities*, *41(2),* 126-142.

Figure Captions

Figure 1. This figure depicts the percent of independent correct responses for Community Signs, Reading, and Manual Signs in the top, middle, and bottom panels, respectively.

Figure 2. The figure depicts the percent of independent correct responses per day for Community Signs. Reading, and Manual Signs in the top, middle, and bottom panels, respectively. Each data point represents the average responding for that day. There were multiple sessions run per day.

Figure 3. This figure depicts the percent of independent correct responses for Sequencing Pictures and Tooth Brushing in the top and bottom panels, respectively.

Figure 4. This figure depicts the percent of independent correct responses per day for Sequencing Pictures and Tooth Brushing in the top and bottom panels, respectively. Each data point represents the average responding for that day. There were multiple sessions run per day.

Table 1.

Average Number of Trials Run Per Week in Baseline and Treatment

Participant	Objective	Baseline	Treatment
AJ	Community Signs	45	255
	Sight Words	45	255
	Manual Signs	25	100
Bret	Sequencing Picture	50	285
	Tooth Brushing	25	150

Table 1. The table depicts the maximum number of trials run per week during baseline and the average number of trials run per week during treatment for each participant and objective.

Figure 1.

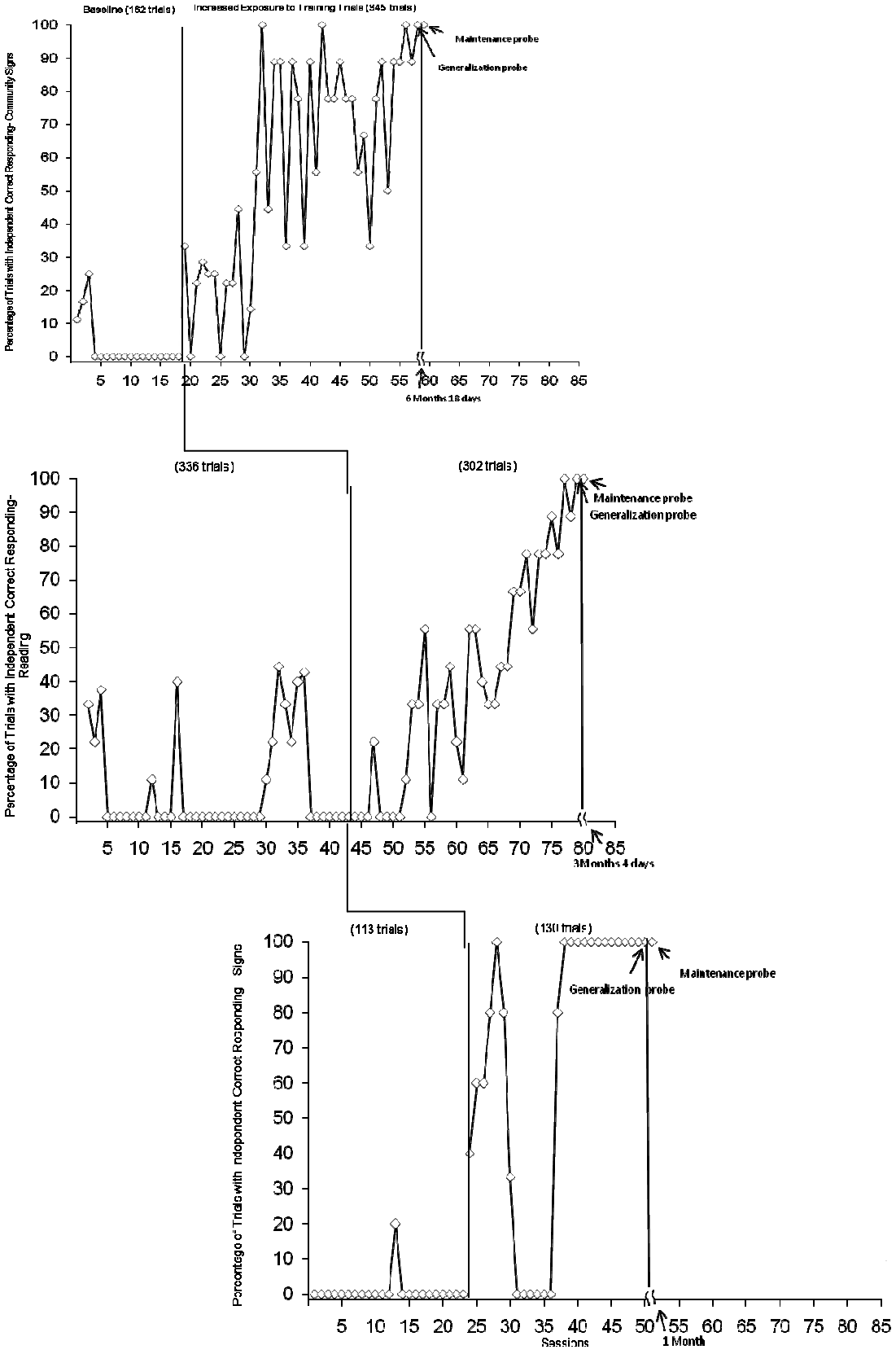

Baseline (152 trials)
Increased Exposure to Training Trials (545 trials)
Percentage of Trials with Independent Correct Responding- Community Signs
Maintenance probe
Generalization probe
6 Months 18 days
(336 trials)
(302 trials)
Percentage of Trials with Independent Correct Responding- Reading
Maintenance probe
Generalization probe
3Months 4 days
(113 trials)
(130 trials)
Percentage of Trials with Independent Correct Responding Signs
Maintenance probe
Generalization probe
Sessions
1 Month

Figure 2.

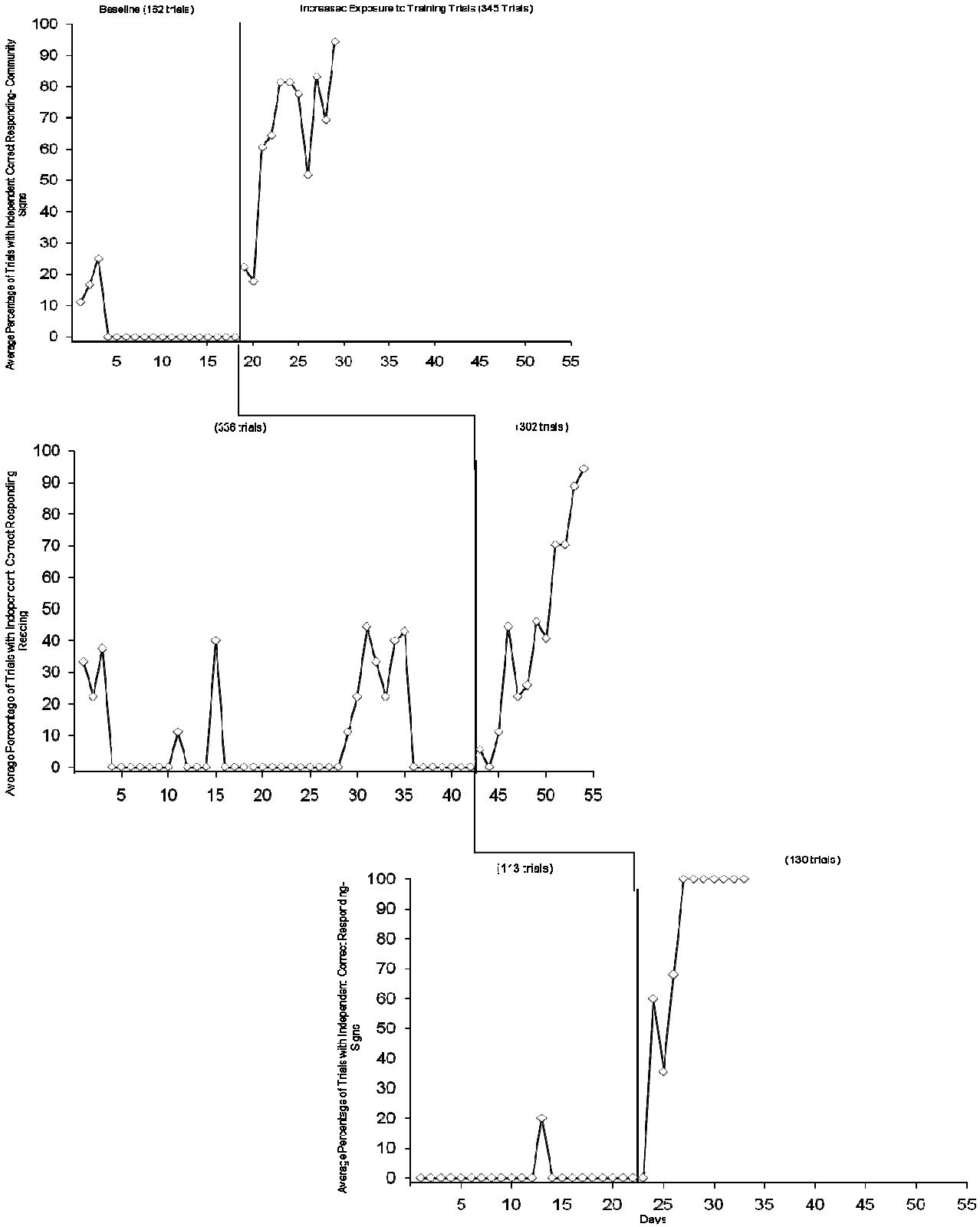

Baseline (152 trials)
Increased Exposure to Training Trials (345 Trials)
Average Percentage of Trials with Independent Correct Responding- Community Signs
(336 trials)
(302 trials)
(113 trials)
(130 trials)
Days

Figure 3.

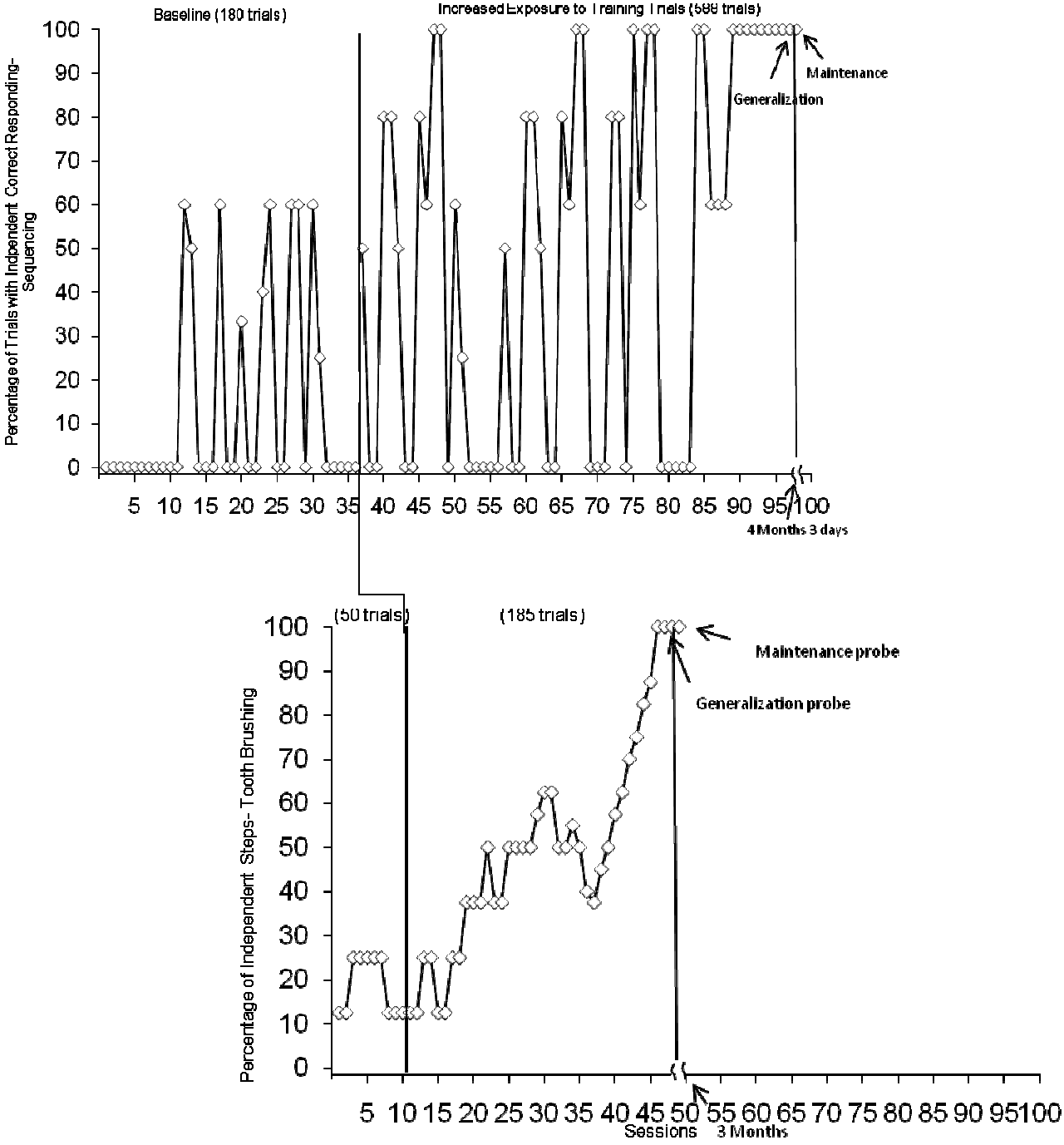
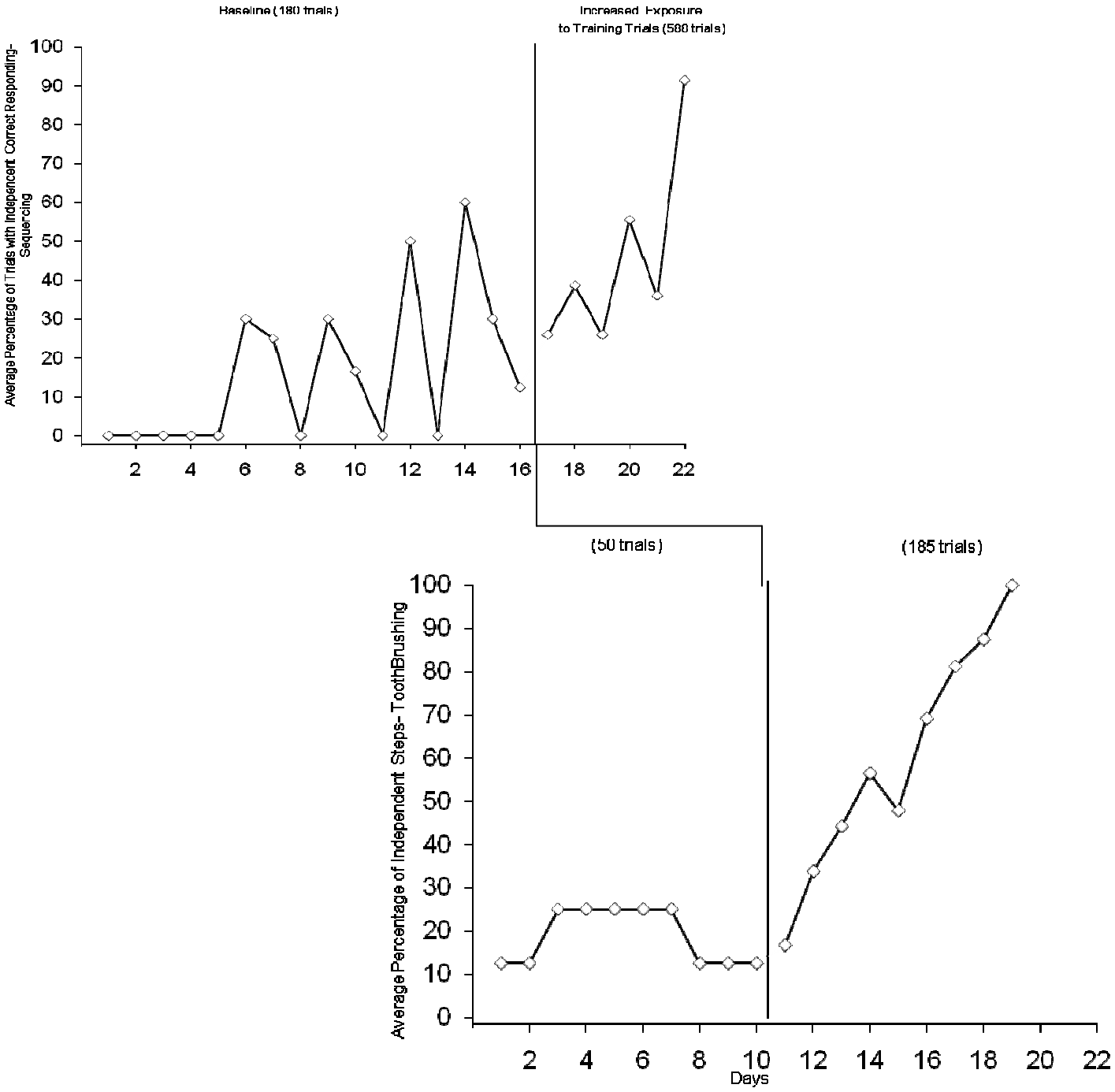

Baseline (180 trials)
Increased Exposure to Training Trials (588 trials)
Maintenance
Generalization
Percentage of Trials with Independent Correct Responding- Sequencing
4 Months 3 days
(50 trials)
(185 trials)
Maintenance probe
Generalization probe
Percentage of Independent Steps- Tooth Brushing
Sessions
3 Months

Figure 4.


Baseline (180 trials)
Increased Exposure to Training Trials (560 trials)
Average Percentage of Trials with Independent Correct Responding-Sequencing
100
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
22
(50 trials)
(185 trials)
Average Percentage of Independent Steps- ToothBrushing
Days