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# A COMPARISON STUDY OF CONSTANT TIME DELAY AND PROGRESSIVE TIME DELAY IN THE ACQUISITION OF ACADEMIC CONTENT FOR STUDENTS WITH INTELLECTUAL DISABILITIES

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A COMPARISON STUDY OF CONSTANT TIME DELAY AND PROGRESSIVE  
TIME DELAY IN THE ACQUISITION OF ACADEMIC CONTENT FOR  
STUDENTS WITH INTELLECTUAL DISABILITIES

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THESIS

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A thesis submitted in partial fulfillment of the requirements  
for the degree of Master of Science in Education in the  
College of Education  
at the University of Kentucky

By

Melissa M. Zinck

Lexington, Kentucky

Director: Dr. Melinda Ault, Professor of Special Education

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2018

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## ABSTRACT OF THESIS

### A COMPARISON STUDY OF CONSTANT TIME DELAY AND PROGRESSIVE TIME DELAY IN THE ACQUISITION OF ACADEMIC CONTENT FOR STUDENTS WITH INTELLECTUAL DISABILITIES

Constant time delay (CTD) and progressive time delay (PTD) are both evidence-based practices used to teach students with intellectual disability (ID). The prompt delay strategies have been used for instruction with academics, social, vocational, and communication skills. There is limited research regarding the differential effectiveness of the time delay variations for teaching academic content to students with ID. The present study compares the effects of CTD and PTD in the acquisition of academic content with four students with ID. An adapted alternating treatments design was used to compare the effectiveness and efficiency of the two procedures. Generalization was assessed across settings, participants, and materials. Results indicated that both strategies were effective but PTD was more efficient in regards to number of errors and average time to criterion.

**KEYWORDS:** Elementary school, constant time delay, progressive time delay, intellectual disability, academic content

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Melissa M. Zinck

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April 13, 2018

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## Section 1: Introduction

Federal law mandates that teachers use effective interventions to maximize learning opportunities for students with intellectual disability. Systematic response prompting strategies have a long-standing history in the literature as effective strategies for teaching new behaviors to all student, including those with ID. Response prompting strategies consist of an instructor inserting a response prompt into an instructional trial after presenting a stimulus, thus increasing the likelihood the student will make a correct response (Collins, 2012, p. 210). Two response prompting strategies that have been heavily researched in the special education literature are constant (CTD) and progressive (PTD) time delay.

In time delay strategies, both PTD and CTD, an initial prompt is provided and then faded by inserting an amount of time between a task direction and a controlling prompt (i.e., a prompt that ensures the learner performs the correct response; Collins, 2012). In CTD instruction, the instructor begins with 0-s delay interval in which the instructor gains student attention, delivers the discriminative stimulus, immediately delivers the correct response (i.e., controlling prompt), and the student imitates the response. Following 0-s prompt delay trials, it's antecedent immediately followed by the response prompt antecedent – (response prompting) – behavior - consequence. CTD uses a constant amount of time in all subsequent training sessions. For example, one scenario may include a 0 s session, then use a 5-s delay for all subsequent sessions. PTD is a comparable response prompting procedure, however, it incorporates a progressively increasing time inserted between the stimuli and delivering of the controlling prompt. PTD, like CTD, begins with 0-s delay trials and as training progresses, the prompt is

faded by gradually delaying the prompt in time. For example, one scenario might include the teacher using 0 s delay trials for the first sessions then increasing 1 s for each delay trial until a set delay interval is reached. The instructor sets a maximum delay interval prior to instruction.

There are multiple studies that have demonstrated the effectiveness of CTD for teaching a variety of behaviors in students with disabilities. It has been used to teach vocabulary words in embedded text to young adults with intellectual disabilities (Hau, Woods-Groves, Kaldenburg, & Synder, 2013), food preparation skills, purchasing skills, and leisure skills to individuals with developmental disabilities (Dogue & Banda, 2009), and academics to preschool aged children with developmental disabilities (Aldemir & Gursel, 2014). In each of these examples, CTD was effective in teaching new skills to criterion levels.

PTD has been used to teach letter discrimination to students with reading deficits (Hook, Hixon, Decker, & Rhymer, 2014), social behaviors during instructional sessions to students with autism spectrum disorder (ASD; Ledford & Wehby, 2015), sight words to student with cognitive delays (Casey, 2008), and food and drink preparation skills to students with ASD (Tekin-Iftar & Birkan, 2010). In each of these examples, PTD was effective in teaching new skills to criterion levels.

Wolery, Ault, and Doyle (1992) define teaching as a process of causing students to perform target behaviors under new stimulus conditions. For this to happen there must be a transfer of stimulus control (i.e. predictable responding in the presences of a particular stimuli and the absence of responding when the stimuli is not present).

Although CTD and PTD have both been proven effective for teaching through numerous demonstrations and replications, Swain, Lane, and Gast (2014) discussed the importance of researchers focusing on the efficiency of response prompting procedures to benefit and maximize instruction for students and improve instructional procedures.

Wolery and Gast (1990) discussed the importance of identifying efficient procedures. The benefits for identifying efficient procedures being (a) the ability to learn more information in the same amount of time, (b) acquiring equal amounts of information in less time, and (c) increasing student independence. Response prompting procedures, like CTD and PTD, have proven effectiveness, although there is no clear indication in current research to indicate which is more efficient for individual learners.

Walker (2008) published a literature review on 22 studies examining the use of CTD and PTD in teaching children with ASD, moderate to severe disabilities, Down syndrome, cerebral palsy, and developmental delay. Parameters analyzed included task directions, number of sessions at 0-s delay, frequency of instruction, attending cues, duration of delay intervals, response intervals, controlling prompt presentation, consequences, and procedural modifications. Both response prompting procedures were shown to be effective with persons with ASD, in various settings, and with different instructional arrangements. The results showed that CTD resulted in more errors to criterion, transfer of stimulus control occurred later in CTD studies than PTD, and more modifications were required for CTD instruction. Literature noted that more accurate comparison of variables between the two prompting procedure could provide a more direct evaluation of efficiency.

There have been several studies in which researchers have examined the differential effectiveness of the CTD and PTD strategies. Ault, Gast, and Wolery (1988) compared the CTD and PTD strategy to teach community- sign words to three students with moderate and severe disabilities. The investigator taught 12 words that were common in the community environment. The 12 words were divided into two sets, six words taught using CTD procedures and six words taught using PTD procedures. A parallel treatments design was used to compare the two conditions. Both time delay procedures were effective in teaching the acquisition of community-sign words to criterion levels that were maintained across over time. The efficiency results of the study demonstrated for all students the minutes of direct instructional time and sessions to criterion was greater in the PTD procedures but findings were mixed when discussing number of errors and percentage of errors to criterion.

Due to inconclusive results in the literature regarding comparisons of efficiency for PTD and CTD, the present study was conducted to extend the research on the efficiency of PTD and CTD for students with intellectual disability.

## **Section 2: Research Question**

- (1) What are the differential effects of a CTD and a PTD condition on the acquisition of academic content for elementary students with ID?
- (2) Is there a difference in maintenance between content learned with CTD or PTD?

### Section 3: Methods

#### Participants

**Inclusion criteria for students.** Participants were included in the study if they (a) had a current individualized education program, (b) were between the ages of 5 and 21 years old, (c) had a label of ID, and (d) qualified for alternate assessment testing. Additional participant demographic information is shown in Table 1. The investigator conducted screening trials to determine that the participants had the prerequisite skills of (a) imitating a verbal model, (b) sitting and attending to stimuli for at least 5 min, (c) waiting at least 3 s for a verbal prompt, and (d) having a mode of verbal communication. All of the participants had learning histories with both PTD and CTD.

Table 1: *Student Criterion*

Student	IEP	Alternate Testing	Cognitive (IQ) <sub>1</sub>	Adapted Behavior Skills <sub>2</sub>	Vision / Hearing in normal limits
Nate	Yes	Yes	51	49	Yes
Tiffany	Yes	Yes	47	61	Yes

\*1 Kaufman Assessment Battery for Children-2nd Edition

\*2 Vineland Adaptive Behavior Scales-2nd Edition Teacher Rating Form

**Students.** Nate was 11 years old Caucasian male and was identified with ID. He received speech and occupational therapy supports. Nate used oral language to communicate; he used 1-2 word phrases. He spent a portion of his school day in the resource setting but was included in general education for specials (e.g. gym, music, art, science), lunch, recess, and 1 hour daily of social skills. He had instruction on academic, communication, and behavioral skills including telling time, counting money, identifying

next dollar strategy, skip counting, reading comprehension, sight word identification, typing from a model, writing a paragraph, stating his personal identification, transitioning between preferred and non-preferred task, and decreasing attention seeking behaviors during work time.

Tiffany was 10 years old and identified with Other Health Impairments (OHI) and Functional Mental Disability (FMD; Kentucky's classification for students with moderate and severe ID). She received speech and occupational therapy weekly. Tiffany was a verbal communicator and spoke in complete sentences. She received a portion of her instruction in the resource setting but was included in general education for specials, lunch, recess, and an hour of modified reading academics in the general education classroom. She had instruction academic and communication skills including reading comprehension, sight word identification, consonant-vowel-consonant word identification, writing from a model, writing her first and last name in correct sequence, typing her name, number identification, 1:1 correspondence on a number line, counting money, telling time on a digital clock.

**Investigator.** The investigator, who was also the special education teacher, had 6 years of experience teaching in the resource classroom. She had previous experience using both response prompting procedures. She was currently working toward earning a master's degree in special education.

**Others.** The paraeducator was a retired special education teacher. She served as the reliability observer. She also had previous experience with CTD and PTD and was proficient in data collection. The instructor and observer have worked with the students prior to the present study for at least 2 years and have worked together in the resource

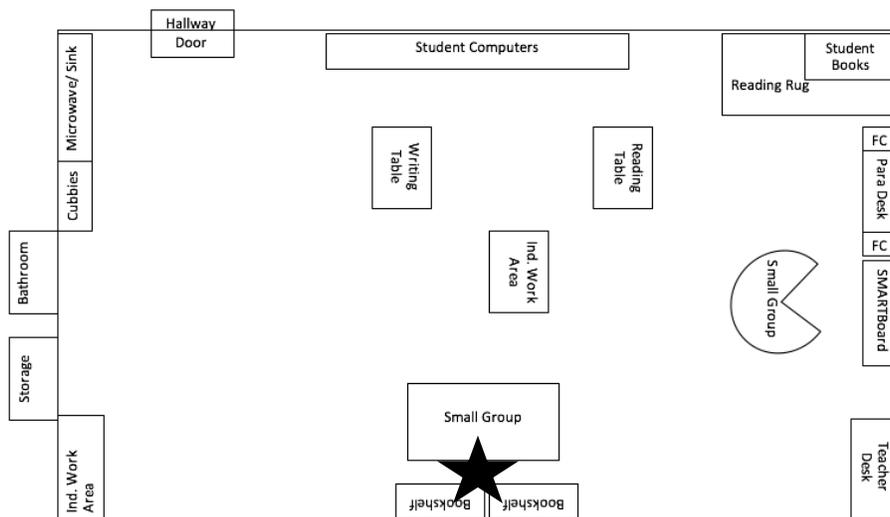
setting together for 3 years. The staff was familiar with the student’s instructional needs and reinforcement schedule.

### **Instructional Setting and Arrangement**

The investigator conducted the study in an elementary special education resource classroom in a public school setting located in the Southeastern sregion of the United State. The school was located in an urban area and had a population of 734 students with a racial composition of 76% white, 6% African-American, 6% Asian, and 6% other. In addition, 27% of the students qualified for free and reduced lunch.

All sessions were conducted in a 1:1 format in the back of the classroom. The investigator sat across from the participants at a small table, where the participant was turned away from visual distractions in the rest of the classroom. See Figure 1 for classroom layout. Note the star on the figure that shows where the instructional sessions took place. A room divider was used to visually close off the work area while conducting the session.

Figure 1: Classroom Layout



## Materials/Equipment

The investigator identified 12 terms and definitions from grade level content to teach to the students. CTD=4 stimuli; PTD=4 stimuli; control condition=4. No materials were used during baseline or intervention sessions, sessions consisted of a verbal SD only (e.g. What word means (adapted definition?)). Definitions were adapted from the Merriam-Webster dictionary ("Dictionary by Merriam-Webster: America's most-trusted online dictionary", 2018). See Table 2 for terms, definitions, and adapted definitions.

Table 2: *Terms and Definitions*

Term	Definition	Adapted Definition
Need	to be in a condition or situation in which you must have (something) : to require (something)	Something you must have to live
Research	careful study that is done to find and report new knowledge about something	Studying a problem to find new answers
Prediction	a statement about what will happen or might happen in the future	A guess of what will happen
Evaluate	to judge the value or condition of (someone or something) in a careful and thoughtful way	Judge something in a careful way
Want	to desire or wish for (something)	To wish for something you do not really need
Experiment	a scientific test in which you perform a series of actions and carefully observe their effects in order to learn about something	A science test that helps you learn something

Table 2 (continued)

Analyze	to study (something) closely and carefully : to learn the nature and relationship of the parts of (something) by a close and careful examination	To study the parts of something closely
Data	facts or information used usually to calculate, analyze, or plan something	Facts used to plan something
Hypothesis	an idea or theory that is not proven but that leads to further study or discussion	An idea that starts an experiment
Materials	a substance from which something is made or can be made	Things used to make something
Solve	to find a way to deal with and end (a problem)	To find an answer
Results	something that is caused by something else that happened or was done before	The answer to a science experiment

Materials used by the investigator included: a stop watch; to record duration of sessions, data sheets, a writing utensil, and three different colored (24" x 12") pieces of construction paper. The colored paper was used to denote when different strategies were being used. The investigator placed the colored paper on the table during each conditional session (Slocum & Tiger, 2011). Byiers, Reichle, and Symons, (2012) noted, "Many researchers pair an independent but salient stimulus with each treatment (i.e., room, color of clothing, etc.) to ensure that the participants are able to discriminate which intervention is in effect during each session (McGonigle, Rojahn, Dixon, & Strain, 1987)."

To ensure that the words and definitions taught in each condition were of equal difficulty the investigator spoke with how many grade level general education teachers on the vocabulary set list and adapted definitions and asked the following questions: (1) Are the terms from grade level standards?, (2) Are the adapted definitions clear?, (3) Do the definitions accurately describe the term?, (4) Are the terms in each set equally difficult?, (5) Are the definitions of similar in length and meaning? Grade level teachers gave written responses to the content questions. The stimuli sets were analyzed for the words to be of similar length with definitions of similar length and word complexity.

Discrete trial data sheets were the same across all sessions: if in baseline sessions, the investigator will circle baseline at the top of the paper and similarly for instructional conditions (see Appendix A for data sheet examples).

### **General Procedures**

The investigator presented a set of adapted definitions in three different sessions per instructional day. There were a total of four stimuli presented twice for a total of eight trials per session for each condition (CTD, PTD, Control). Discrete trial data collection sheets was used for baseline, intervention, and maintenance sessions. Data also were collected on efficiency criterion including, time, number of sessions, and percent of errors to criterion. (see example of data sheet in Appendix A). Conditions were counterbalanced for time of day using a (1) for morning, (2) for mid-morning, and (3) for early afternoon. The condition numbers were placed in a randomizing tool found online (Haahr, 2018). If two conditions were presented at the same time of day for more than 2 instructional days in a row, the investigator would cross out that randomized session and move to the next session.

Intervention procedures were conducted in a 1:1 instructional arrangement. Stimuli sets were counterbalanced between Nate and Tiffany (see Table 3) so that words assigned to Nate to be taught using CTD were taught using PTD to Tiffany. Data were collected in the intervention phase until the student reached 100% criterion for three consecutive instructional days. If one condition reached mastery before the other, the investigator continued to collect intervention data on the mastered set, each instructional day, until both conditions met criterion.

Table 3: *Vocabulary Sets for Nate*

Set 1 (CTD) – Blue	Set 2 (PTD) - Pink	Set 3 (Control) – Green
Need	Want	Hypothesis
Research	Experiment	Materials
Evaluate	Analyze	Solve
Prediction	Data	Results

*Vocabulary Sets for Tiffany*

Set 1 (CTD) – Blue	Set 2 (PTD) - Pink	Set 3 (Control) – Green
Want	Need	Hypothesis
Experiment	Research	Materials
Analyze	Evaluate	Solve
Data	Prediction	Results

### **Data Collection**

A discrete trial data collection sheet was used for baseline, intervention, maintenance, and generalization sessions. Baseline data were collected for a minimum of three sessions or until data were stable. During baseline, the following responses were possible: unprompted correct (B+), unprompted

incorrect (B-), and no response (0). Definitions of participant responses and teacher consequences can be seen in Table 3.

During intervention sessions, the investigator recorded five possible responses and gave five possible consequences. Each participants' response was recorded on the student data collection sheet after each response was given.

Participant responses will be recorded as unprompted correct (B+), unprompted incorrect (B-), prompted correct (A+), prompted incorrect (A-), and no response after the prompt (0). Definitions of participant responses and teacher consequences can be seen in Table 3.

Table 4: *Examples of Participant Response & Investigator Consequence*

Response	Definition of Response	Investigator Consequence	Occurs in
Unprompted correct (B+)	Verbalizes correct word within 5 s of task direction, "Which word means _____"	Verbal praise, "Great job, that is right!" waits for the intertrial interval to present next stimuli	Baseline Intervention
Unprompted incorrect (B-)	Verbalizes another word other than correct word within 5 s of task direction, "Which word	Verbal reprimand, "If you do not know the answer wait, and I will help you." waits for the intertrial interval to present next stimuli	Baseline Intervention

Table 4 (continued)

	means _____?"		
Prompted correct (A+)	Verbalizes correct word within 5 s of prompt	Gives verbal prompt then verbal praise for imitation. waits for the intertrial interval to present next stimuli	Intervention
Prompted incorrect (A-)	Verbalizes another word other than correct word within 5 s of prompt	Ignores and waits for the intertrial interval to present next stimuli	Intervention
No response after prompt (0)	Does not respond with any word within 5 s of prompt	Ignores and waits for the intertrial interval to present next stimuli	Intervention Baseline

### Screening

Screening was conducted in a 1:1 setting with each participant prior to implementing the study. The purpose of these sessions were to measure the participant's familiarity with the terms. The investigator checked for exposure to the terms using the screening session. The investigator conducted one screening session presenting all words printed on 8'x11' printer paper using text only with a size 50 font, Times New Roman. The participants were told they would be shown a word and ask to say the word. During the screening the investigator gave an attentional cue, "Are you ready to work?" ensured

the attentional response, showed the stimulus, and gave the task direction, “What word?” The students were given 5 s to respond. Responses were recorded as (+) for correct, (-) for incorrect, and (0) for no response. Reinforcement in the form of descriptive verbal praise was given for attention to the task at the end of the screening session.

Nate read the words: data, need, and want. Tiffany did not read or recognize any of the 24 words presented.

## **Procedures**

**Baseline procedures.** Baseline procedures were conducted in a 1:1 instructional arrangement. For baseline sessions, the investigator called the participant to the table and provide a general attentional cue, “Are you ready to work?” After gaining the attentional response, the investigator said, “Which word means (adapted definition),” and waited 5 s for a response. The investigator recorded the response as an unprompted correct (B+), unprompted incorrect (B-), or no response (0). The investigator did not provide praise for unprompted correct responses and ignored unprompted incorrect or no responses. After the participant response, the investigator waited for 3 s for the intertrial interval then presented next stimuli in the condition set. Data were collected by the instructor for three consecutive instructional days at a stable zero-celerating trend. Baseline sessions consisted of each set of condition words twice, 24 trials total. Descriptive verbal praise was given for attending to the task at the end of each session. All words were tested in baseline session.

### **Intervention procedures.**

**CTD procedures.** One session of 0-s delay interval was conducted with each student or until the students had 100% correct prompted responding. The investigator

gained the students attention using a cue, “Are you ready to work?” the investigator said, “Which word means (adapted definition),” and immediately verbalized the correct response. The participant was given 5 s to imitate the instructor’s response. See Table 3 for participant response and investigator consequence.

The investigator implemented 5-s delay sessions. The 5-s delay interval were chosen as the participants were familiar with this delay procedure. The investigator explained to the students that they were to wait for the prompt if unsure of the correct response. The investigator gained the students attention using a cue, “Are you ready to work?” After ensuring the attentional response, the investigator said, “Which word means (adapted definition),” and waited 5 s for the student to respond. Possible student responses, as shown in Table 3, were recorded and the appropriate consequence provided.

**PTD procedures.** PTD sessions were conducted exactly the same as CTD sessions with the exception that the investigator used a predetermined interval increasing 1 s after a participant reaches 100% correct responding with unprompted correct or prompted correct responses. The intervals range from 0 s to a maximum of 5 s and will increase systematically as criterion is met. If the participant did not receive 100% correct responding with unprompted or prompted responses then the investigator would move back to the previous interval delay.

**Control procedures.** Control stimuli data were collected using the same procedures as baseline. The control data was used to increase opportunities to detect maturation or history effects. The control session alternated throughout the day (morning, mid-morning, and afternoon) based on the randomized schedule. For control sessions, the investigator called the participant to the table and provide a general attentional cue,

“Are you ready to work?” After gaining the attentional response, the investigator said, “Which word means (adapted definition),” and waited 5 s for a response. The investigator recorded the response as an unprompted correct (B+), unprompted incorrect (B-), or no response (0). The investigator did not provide praise for unprompted correct responses and ignored unprompted incorrect or no responses. After the participant response, the investigator waited for 3 s for the intertrial interval then presented next stimuli in the control set.

**Maintenance.** Maintenance data were measured by using baseline procedures 1 and 2 weeks after criterion was met. Maintenance data will continue to be collected after this study resolves through 4 and 8 weeks.

### **Experimental Design**

An adapted alternating treatments design (AATD) across participants was used to assess the effectiveness and efficiency of the CTD and PTD procedures in the acquisition of academic content (Gast & Ledford, 2014). An AATD design is a relatively fast comparison of two treatments designs for non-reversible behaviors. One purpose of this design was comparing interventions teaching academic behaviors that facilitate the acquisition of new behavior. A requirement for an AATD is the use of equally difficult stimuli. Stimuli must be equally different because the instructional strategies are being applied to separate behavior sets. If one behavior set is easier than the other behavior set, the test of the two interventions would be imbalanced (Wolery, Gast, & Ledford, 2014). The conditions were randomly alternated across morning, mid-morning, and early afternoon sessions and across stimuli sets, daily. Collecting intermittent data on the control set during intervention of the comparison phase increases the opportunities to detect maturation or history effects (Wolery, Gast, & Ledford, 2014). Experimental

control is demonstrated with the comparison of the effectiveness and the efficiency of one condition over the other.

### **Social Validity**

Social validity data were collected at the completion of the study through informal survey with general education teachers. A survey was given to determine the social validity of the study. The survey was measured using a five-point Likert scale shown in Appendix C. Survey questions were (a) Is this an appropriate way to teach the definitions? (b) Is this an appropriate goal for these students? General education teachers were given the survey in person after the investigator explained how the skill was taught.

### **Reliability**

The paraeducator collected the reliability data. She simultaneously collected both interobserver agreement (IOA) and procedural reliability data during at least 20% of all sessions across all instructional conditions (Gast & Ledford, 2014). See Appendix C for reliability collection sheets. The instructor calculated the IOA by using the point-by-point method: the number of agreements divided by the total number of agreements plus the number of disagreements multiplied by 100% (Ledford & Gast, 2014). The procedural fidelity data was calculated by figuring the number of teacher behaviors observed divided by the number of teacher behaviors planned and multiplying by 100%.

Teacher behaviors measured in baseline/control set investigator behaviors included: (a) gaining student attention, (b) saying “which word means \_\_\_\_\_,” (c) waiting correct delay interval, (d) record student response, (e) provide consequence, (f) wait intertrial interval, until eight trials are completed for each condition set.

Teacher behaviors measured in PTD and CTD sessions include: (a) gaining student attention, (b) saying “which word means \_\_\_\_\_,” (c) waiting correct delay interval, (d) record student response, (e) provide consequence, (f) wait intertrial interval, until eight trials are completed for each condition set. PTD intervention (a) gaining student attention, (b) “which word means \_\_\_\_\_,” (c) wait predetermined number of seconds per corresponding session, (d) record student response, (e) provide consequence, (f) wait intertrial interval, until eight trials are completed for each condition set. Acceptable levels of reliability data were 80% or higher for this study.

## Section 4: Results

### Effectiveness Results

Figures 2 and 3 show student responding data for all participants in the CTD, PTD, and control condition. Percent correct response for baseline and intervention sessions for all participants with maintenance data for all participants.

During the three baseline sessions, both participants had 0% accurate responses. Three sessions were conducted based on a time limitation with the approach of the end of the school year and the start of the study.

After intervention was initiated, visual analysis revealed that both participants had a gradual accelerating trend in percentage of accurate responses in both conditions: PTD and CTD. Tiffany reached criteria in PTD in 16 days and in 15 days in CTD condition. Nate reached criteria in 15 days in both sets. Maintenance sessions were conducted similar to baseline sessions once participants reached criteria. Tiffany and Nate both maintained 100% accuracy.

Figure 2

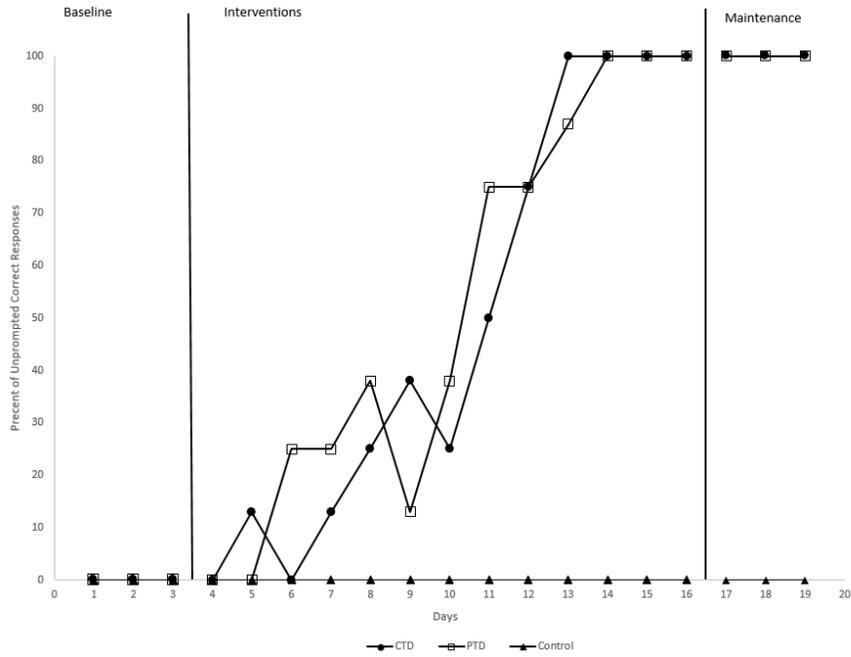


Figure 2: graph of results for Tiffany: comparison of the percent of correct responses in acquisition of academic content with PTD and CTD conditions

Figure 3

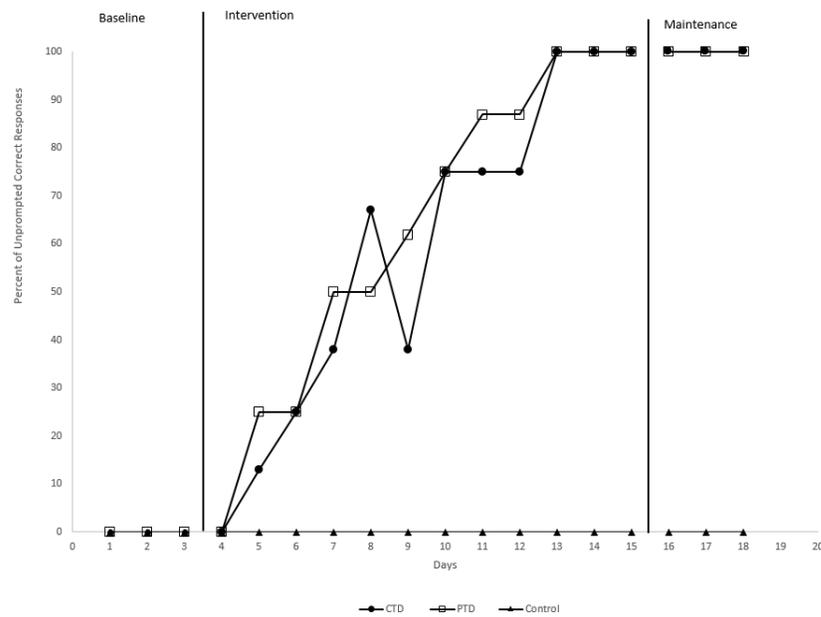


Figure 3: graph of results for Nate: comparison of the percent of correct responses in acquisition of academic content with PTD and CTD conditions

## Efficiency Results

Table 5 presents the efficiency data which shows the number of sessions required for each participant to reach criteria, average duration to criteria, total duration to criteria, number of errors, and percentage of errors that occurred in each condition. Both participants had fewer errors in the PTD condition. Comparison of percentages show Nate at 38% and Tiffany at 52% error. Tiffany had one more session in the PTD condition than Nate but both participants had 12 sessions to criteria in the CTD condition. Comparison of average duration to criteria and total duration to criteria show the PTD condition for both participants was lower than the CTD condition with Nate at 76 s average and 937 s total and Tiffany at 77 s average and 1001 s total time to criteria.

Table 5: *Student Efficiency Results*

Student and Condition	Sessions to Criteria	Average Duration to Criteria	Duration to Criteria	Number of Errors	Percent of Errors
Nate					
CTD	12	80 s	937 s	40	42%
PTD	12	76 s	907 s	36	38%
Tiffany					
CTD	12	94 s	1125 s	52	54%
PTD	13	77 s	1001 s	50	52%

## Reliability

**Baseline reliability.** Results from reliability data collected showed mean procedural reliability was 100%. Teacher behaviors measured in baseline investigator behaviors include: (a) gain student attention, (b) “which word means \_\_\_\_\_,” (c) wait 5 s, (d) record student response, (e) provide consequence, (f) wait intertrial interval.

**Intervention reliability.** Results from reliability data collected showed mean procedural reliability was 100% for all conditions. Teacher behaviors for CTD intervention (a) gaining student attention, (b) “which word means \_\_\_\_\_,” (c) wait 5 s, (d) record student response, (e) provide consequence, and (f) wait intertrial interval. PTD intervention (a) gaining student attention, (b) “which word means \_\_\_\_\_,” (c) wait predetermined number of seconds per corresponding session, (d) record student response, (e) provide consequence, and (f) wait intertrial interval. Control conditions include: (a) gain student attention, (b) “which word means \_\_\_\_\_,” 100%, (c) wait 5 s, (d) record student response, (e) provide consequence, (f) wait intertrial interval.

Maintenance reliability data collected showed mean procedural reliability was 100%. Teacher behaviors measured in baseline investigator behaviors include: (a) gain student attention, (b) “which word means \_\_\_\_\_,” (c) wait 5 s, (d) record student response, (e) provide consequence, (f) wait intertrial interval.

IOA collected was collected with a mean of 100% across all participants.

### **Social Validity**

Social Validity was measured using a five-point Likert scale shown in Appendix C. The results of the survey indicated that all five general education teachers polled agreed that this an appropriate way to teach the definitions and this an appropriate goal for these students. Likert scale survey results showed strong agreement on both survey questions.

## **Section 5: Discussion**

The purpose of this study was to determine whether CTD or PTD was more efficient in teaching academic content to students with ID. A comparison of number of sessions required for each participant to reach criteria, average duration per day, number of errors, and percentage of errors that occurred in each condition, and maintenance of acquired content in PTD and CTD conditions.

In the comparison, data indicated both PTD and CTD conditions were effective in the acquisition of the academic content. Both participants met criterion within 13 days of the start of the interventions. In terms of efficiency, the data showed minimal differences between the two instructional approaches. The average duration to criterion and number of errors to criteria were slightly lower in the PTD condition. Both participants had fewer errors in the PTD condition. Comparison of percentages show Nate at 38% and Tiffany at 52% error. Tiffany had one more session in the PTD condition than Nate but both participants had 12 sessions to criteria in the CTD condition. Comparison of average duration to criteria show the PTD condition average for both participants was lower than the CTD condition with Nate at 76 s and Tiffany 77 s to criteria.

The second research question asked whether there was a difference in maintenance between the two conditions. Results indicated participants were able to maintain the acquisition of the words in both conditions: both Nate and Tiffany at 100%, up to 2 weeks after criterion was met.

In summary, results of this study demonstrate there were subtle differences in the acquisition of academic content for students with ID when taught using PTD and CTD instructional conditions. PTD conditions had fewer errors to criteria and less time to

criteria. Tiffany required one more session in CTD to meet criteria. Nate and Tiffany had more errors to criteria and averaged more time in the CTD condition than PTD. Overall data indicated that both instructional approaches (CTD and PTD) were effective and efficient in the acquisition of academic content for students with ID.

### **Limitations and Conclusions**

Limitations in this study included the definitions used as the controlling prompt. The definitions were interpretations of dictionary definitions based on teacher input. Secondly, the study did not provide generalization of information, which may have increased the participants' ability to learn the definitions and terms in other settings. Finally, including pictures or comprehension might have made this skill more meaningful to the participants.

Interpretation of results could be used to imply that the use of PTD is more efficient than the use of CTD procedures. This study showed both instructional conditions were effective strategies to teach the acquisition of academic content to students with ID. The small differences between CTD and PTD conditions in errors to criteria, average duration to criteria, and number of sessions to criteria are not substantial enough to demonstrate if PTD is more efficient than CTD, with additional replications needed across participants to make additional claims about the differences in the two procedures.

Maintenance data were collected for 2 weeks after criteria was met. The investigator did not continue maintenance collection after 2 weeks due to the approach of the end of the school year.

### Appendix A: Event Recording Data Sheet

Name: \_\_\_\_\_

Instructor: \_\_\_\_\_

Objective: \_\_\_\_\_

**Circle the condition:**

**Baseline**

**CTD**

**PTD**

**Control**

Date:		
Session #		
Start Time:		
End Time:		
Stimulus	Student Response	
Interval: ____s	B	A
1		
2		
3		
4		
5		
6		
7		
8		
<b>%/# NR</b>		
<b>%/# Errors</b>		
<b>%/# Correct</b>		

## Appendix B: Reliability/IOA Data Sheet

### Procedural and Interobserver Reliability Data Collection Sheet

Name of Observer: \_\_\_\_\_ Date: \_\_\_\_\_

Gain attention? Yes No

Circle: Baseline CTD PTD Control

Waits \_\_\_\_\_ s

“Which card means \_\_\_\_\_?”

Student response

Provides correct consequences

Waits 3s inter-trial interval

IOA percentage

Observed/Planned

Percent Accuracy

Trial	Waits _____ s	Student response		Provides correct consequences	Waits 3s inter-trial interval
		Before	After		
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
IOA percentage					
Observed/Planned	/8			/8	/8
Percent Accuracy					

### Appendix C: Likert Scale Survey

(mark in the appropriate box)	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1.This skill was an appropriate way to teach definitions.					
2. This skill was an appropriate goal for the students.					

## References

- Aldemir, O., & Gursel, O. (2014). The effectiveness of the constant time delay procedure in teaching pre-school academic skills to children with developmental disabilities in a small group teaching arrangement. *Educational Sciences: Theory & Practice*, 14(2), 733-740.
- Ault, M. J., Gast, D. L., & Wolery, M. (1988). Comparison of progressive and constant time-delay procedures in teaching community-sign word reading. *American Journal of Mental Retardation*, 93, 44-56.
- Byiers, B. J., Reichle, J., & Symons, F. J. (2012). Single-subject experimental design for evidence-based practice. *American Journal of Speech-Language Pathology / American Speech-Language-Hearing Association*, 21(4), 397-414.
- Collins, B. (2012). Systematic instruction for students with moderate and severe disabilities. Baltimore, MD: Paul H. Brookes.
- Dogoe, M., & Banda, D. (2009). Review of recent research using constant time delay to teach chained tasks to persons with developmental disabilities. *Education and Training in Developmental Disabilities*, 44(2), 177-186.
- Gast, D. L., & Ledford, J. R. (2014). *Single subject research methodology: Application in special education and behavioral sciences* (2nd ed.). New York: Routledge.
- Haahr, M. (2018). *RANDOM.ORG - True Random Number Service*. *Random.org*. Retrieved 19 January 2018, from <https://www.random.org>
- Hook, J. M., Hixson, M. D., Decker, D., & Rhymer, K. N. (2014). Progressive time delay to remediate letter discrimination difficulty. *Behavioral Development Bulletin*, 19(1), 1-6.
- Hua, Y., Woods-Groves, S., Kaldenberg, E. R., & Scheidecker, B. J. (2013). Effects of vocabulary instruction using constant time delay on expository reading of young adults with intellectual disability. *Focus on Autism and Other Developmental Disabilities*, 28(2), 89-100.
- Ledford, J. R., & Wehby, J. H. (2015). Teaching children with autism in small group with students who are at-risk for academic problems: Effects on academic and social behaviors. *Journal of Autism & Developmental Disorders*, 45, 1624-1635.
- McGonigle J. J., Rojahn J., Dixon J., Strain P. S. (1987). Multiple treatment interference in the alternating treatments design as a function of the intercomponent interval length. *Journal of Applied Behavior Analysis* 20, 171-178.
- Slocum, S. K., & Tiger, J. H. (2011). An assessment of the efficiency of and child preference for forward and backward chaining. *Journal of Applied Behavior Analysis* 44, 793-805.
- Swain, R., Lane, J., & Gast, D. (2015). Comparison of constant time delay and simultaneous prompting procedures: Teaching functional sight words to students with intellectual disabilities and autism spectrum disorder. *Journal of Behavioral Education*, 24(2), 210-229.
- Tekin-Iftar, E., & Birkan, B. (2010). Small group instruction for students with autism. *The Journal of Special Education* 44, (1) (05): 50-63.
- Walker, G. (2008). Constant and progressive time delay procedures for teaching children with autism: a literature review. *Journal of Autism & Developmental Disorders*, 38(2), 261-275.

- Dictionary by Merriam-Webster: America's most-trusted online dictionary.* (2018).  
*Merriam-webster.com*. Retrieved 13 January 2018, from <https://www.merriam-webster.com>
- Wolery, M., Ault, M. J., & Doyle, P. M. (1992). *Teaching students with moderate to severe disabilities: Use of response prompting strategies*. White Plains, NY: Longman.
- Wolery, M. & Gast, D. L. (1990) *Efficiency of instruction: Conceptual framework and research directions*. University of Kentucky and University of Georgia (unpublished manuscript).
- Wolery, M., Gast, D. L., & Ledford, J. (2014). Comparison Designs. In D. Gast, & J. Ledford (Eds.), *Single case research methodology: Application in special education and behavior science* (pp. 297-345). New York: Routledge.

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