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Progressive Time Delay to Teach High School Students with Intellectual Disability to Initiate Manding Siri® for Unknown Information

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PROGRESSIVE TIME DELAY TO TEACH HIGH SCHOOL STUDENTS WITH INTELLECTUAL DISABILITY TO INITIATE MANDING SIRI® FOR UNKNOWN INFORMATION

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in Education in
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By

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ABSTRACT OF THESIS

PROGRESSIVE TIME DELAY TO TEACH HIGH SCHOOL STUDENTS WITH INTELLECTUAL DISABILITY TO INITIATE MANDING SIRI® FOR UNKNOWN INFORMATION

A multiple probe design across participants with intermittent generalization probes was used to evaluate (a) the effectiveness of progressive time delay to teach four high school students with intellectual disability to initiate using Siri® when asked an unknown question and (b) the generalized use of Siri® when asked questions from untrained communicative partners. Technology training occurred prior to baseline to teach all participants to use Siri®. Secondary data were collected on Siri's® response and student engagement with the answer. Due to the 2020 Covid-19 pandemic and school closures, only one participant entered intervention and the study was unable to be completed. Implications for this study based on tier one data are discussed below.

KEYWORDS: progressive time delay, Siri®, mobile devices, manding for information, intellectual disability

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Section 1: Introduction

Individuals use a variety of ways to access needed information including asking others, searching a book or other written source, and more recently, relying on technology. The use of mobile devices allows immediate access to copious amounts of information in a matter of seconds through using the internet. Artificial intelligence (AI) systems such as Siri®, Alexa®, and Google Home® provide alternative means to access the information. Across the world, it is estimated that over 5 billion people own a mobile device and over half of those mobile devices are smartphones (Pew Research Center, 2019). In the United States, on average, adults spent at least 2 hours 55 minutes on their smartphones daily in 2019 (Wurmser, 2019). Mobile technology can provide continuous access to information in a wide range of environments exactly when it is needed without requiring another individual (e.g., peer, parent, adult, family member) to be present (Ayres, Shepley, Douglas, Lane, & Shepley, 2015).

Mobile technology can be used to aid and support individuals with intellectual disability (ID) as assistive technology to increase independence and enable better access to various environments. Educators and caregivers should teach the use of mobile technology for a wide range of skills (e.g., self-instruction on life skills, independent navigation of mobile device). This could allow individuals with ID to support themselves, thus increasing independence in their lives they may not have had without the use of technology (Ayres et al., 2015). Devices with built-in accessibility features (e.g., Siri®, dictation, predictive text) that are universally used by same aged peers, such as a smart phones, could be a socially acceptable tool for individuals with ID. Teaching individuals with ID to access unknown information independently by using assistive technology

could allow greater independence; leading to less dependence on peers or adults. As individuals begin to transition from secondary education to post-school settings (e.g., college, jobs), it is important they know how to access unknown information. Based on the portability, usability, cost efficiency, and amount of time people typically spend on their mobile devices, using them for individuals with ID would be a socially acceptable and valid tool. It is logical to use these devices due to the present and growing accessibility features built into Apple® devices that are intended to make products accessibility for all individuals and can particularly be beneficial for individuals with disabilities (Apple, 2019). While Apple® offers a wide range of accessibility features within their products, the Siri® function could increase individuals with disabilities independence on initiating access to unknown information.

Researchers have taught individuals with ID to access information (without the use of technology) in a number of studies. Taylor and Harris (1995), examined the effectiveness of progressive time delay (PTD) to teach three young children with autism spectrum disorder (ASD) to ask a wh- question (i.e., "What's that?") when shown an unknown stimulus (i.e., picture cards) by a teaching assistant during an instructional task in the classroom setting. They also examined if the participants learned the novel information (e.g., functional objects) and if participants generalized to new settings (e.g., school hallway) or new communication partners. All of the participants learned to ask questions in the classroom setting and generalized the skill to novel settings and objects. Ingvarsson and Hollobaugh (2010) conducted a study with four boys with ASD in which the authors examined the effects of constant time delay as a means to teach independent mands for answers to unknown questions by saying, "I don't know please tell me". All

participants learned to mand for answers to questions using the "I don't know please tell me" statement. Two participants learned the correct answers to the previously unknown questions and some generalization occurred for all participants. Another study examined teaching three boys with ASD in the school setting to mand for information (i.e., "Who has the ____?", "Where is the __?") across different known chained tasks (i.e., making a volcano, setting a table, making strawberry milk) when items were missing (Lechago, Carr, Grow, Love, & Almason, 2010). Using echoic prompts, the participants learned to mand for information across tasks. The above studies all required a communication partner to provide answers to the unknown information and were limited to the range of questions being asked. Rather than focusing on teaching individuals to ask communicative partners (e.g., teachers, peers, parents) in their environments for help, teaching students how to initiate gaining access to information independent of another person could lead to greater independence and improved learning outcomes (Smith, Ayres, Alexander, Ledford, Shepley, & Shepley, 2015) by using mobile technology.

Mobile technology has successfully been used in many ways to teach individuals with ID skills that allow them greater independence and access to their environments. Mobile technology has been used to aid individuals with ID in communication (e.g., alternative and augmentative devices; Nepo, Tincani, Axelrod, & Meszaros, 2017), self-management (e.g., video activity schedules; Johnson, Spriggs, Shepley, Allday, & Samudre, 2019), and self-instruction (e.g., daily living skills, vocational skills, workouts, and cooking skills; Hong et al., 2017; Smith et al., 2015). Smith et al. (2015) specifically evaluated the effects of PTD on initiation of self-instruction by individuals with ASD when presented with an unknown daily living task. They measured participants' initiation

of self-instruction as taking their mobile device out of their pockets when they were asked to complete a novel task. In this study, the implementer ensured the participant had a mobile device in their pocket 3-10 min before the start of a session. This was done to resemble real-life scenarios where most individuals have their mobile device on their person (e.g., in their pocket, in a purse, on a surface in front of them) when having to problem solve (Smith et al., 2015). The participants were asked to complete a novel task (e.g., making coffee) and instructed to take their phone out of their pocket to watch a video with instructions for completing the task. Generalization was programmed throughout the study across settings, instructors, and tasks. The results indicated that all participants learned to initiate self-instruction (i.e., removing iPhone® from pocket) and three of the four participants mastered self-instruction (i.e., initiation, viewing correct video, progress on daily living skill). All participants showed some generalization to other settings and instructors. While using PTD to teach individuals with ID to initiate the use of a mobile device has been shown to be effective, more research is needed in this area. While there is research using mobile devices to increase independence, there is a gap in the literature on studies that use embedded accessibility features (e.g., Siri®) available across mobile devices (e.g., iPhone®, iPod touch®, iPad®) as AT to independently initiate gaining access to unknown information. Based on the increase in readily available technology across society, as well as the increasing presence of mobile technology in classroom settings, there is a need for more research.

With technology being an integral part of society's everyday life, it is logical to teach individuals with ID to access it to increase independence. This includes specifically teaching individuals with ID to rely on technology as a necessary support when presented

with situations in which more information is needed. The purpose of this study was to evaluate the use of PTD to teach young adults with ID how to initiate finding the answer to an unknown question using mobile devices with built in accessibility features (i.e., Siri®). High school aged students in the classroom setting were chosen due to the importance of targeting these skills as they begin to transition into post-secondary settings.

Section 2: Research Question

The research questions for this study were: (a) When asked an unknown question, will PTD be effective in teaching high school students with an ID to initiate use of Siri® on a mobile device to find the answer? (b) Will participants generalize initiation of Siri® to novel communication partners when asked unknown questions?

Section 3: Method

Participants

Students. The following criteria were required for inclusion in the study: (a) attend to a task for 5 min, (b) follow simple commands, (c) wait for a prompt, (d) navigate an iPod Touch®, (e) vocalize, and (f) imitate verbal speech. Other prerequisites included at least an 80% attendance rate during the last 9 weeks, consent from a parent or guardian to participate in the study, as well as participant assent to participate in the study. This information was collected through teacher interview, direct observation, and file review.

Four high school students who received special education services in a self-contained classroom for individuals with moderate to severe disabilities participated in this study. All participants had their own iPod Touch® in the classroom and used it throughout the school day for different tasks (e.g., checking daily schedule, calculator, weather, Next Dollar). The iPod Touches® were located in a charging station attached to the classroom whiteboard. The participants accessed their devices at the start of the school day and the devices remained on their desks or in their pockets throughout the school day.

Ashley was a 19-year-old African American female in the 12th grade with an ID and attention deficit hyperactivity disorder. Based on her most recent school evaluation conducted in 2019, Ashley had an IQ of 42 (The Wechsler Preschool and Primary Scale of Intelligence Third Edition; Wechsler 2002) and an adaptive behavior score of 64 (Vineland Adaptive Behavior Scales - Second Edition; Sparrow et al. 2005). She communicated in full sentences with typical voice fluency and articulation across all

settings (e.g., community, home, school). She enjoyed social interactions with adults and peers. During class transitions, she would independently walk in the halls to talk with peers. Throughout the school day, she followed the classroom schedule with minimal verbal prompts. During free time, she would often use the iPod Touch® independently to search preferred topics on the internet by typing and voice dictation. Her related services included speech therapy for 30 min once a week

Jason was an 18-year-old African American male in the 10th grade with a diagnosis of ASD and ID. Based on his most recent school evaluation conducted in 2020, Jason had an IQ of 58 (Kaufman Assessment Battery for Children- Second Edition; Kaufmen and Kaufmen 2004) and an adaptive behavior score of 60 (VABS-II; Sparrow et al. 2005). He occasionally wore glasses. Jason often closed his eyes during instructional times or when spoken to, resulting in verbal prompting to open them when working. He communicated in full sentences with typical voice fluency and articulation. He would engage in conversations and answer questions asked of him but occasionally word order was disorganized and/or his responses were off topic. During free time, he independently used the iPod Touch® to listen to music on YouTube™. His related services included speech therapy for 25 min twice per month.

David was a 19-year-old African American male in the 11th grade with a diagnosis of ASD and ID. Based on his most recent school evaluation conducted in 2018, David had an IQ of 52 (KABC-II; Kaufmen and Kaufmen 2004) and an adaptive behavior score of 57 (VABS-II; Sparrow et al. 2005). He wore glasses and hearing was within normal limits. He communicated using one to three word responses typically in a rapid and low tone. He would speak slower and louder when verbally prompted to do so. When

asked to complete a task or answer a question he did not know, he would wait for an answer or direction. During free time, he independently used the iPod Touch® to listen to music on YouTube™. His related services included speech therapy for 30 min once a week.

Matthew was a 17-year-old Caucasian male in the 9th grade with a diagnosis of ASD and ID. Based on his most recent school evaluation conducted in 2020, Matthew had an adaptive behavior score of 59 (VABS-II; Sparrow et al. 2005). He had the ability to speak in full sentences but typically communicated in one to two word utterances. According to his records, Matthew had receptive and expressive language deficits. He attended school 3 days a week with shortened days as prescribed in his behavior intervention plan. When working on school tasks, Matthew followed a schedule in which he worked for 6 min with a 6 min break for reinforcement. The schedule was located on his iPod Touch®. He would transition back to his desk using a timer and minimal verbal prompts. During free time, Matthew used his personal mobile device (not an Apple™ product) to search the internet surrounding preferred topics (e.g., movies, map locations).

Others. The investigator was a graduate student with a bachelor's degree in Special Education working towards a Teacher Leader Master's degree in Special Education. She conducted all of the intervention sessions and had 5 years of experience working with individuals with ID using instructional procedures in the classroom setting as a preservice and substitute teacher. Prior to the start of the study, the investigator spent 5 hours in the classroom with the students to pair with reinforcement in the form of positive adult attention and to minimize adaptation threats to internal validity (Gast & Ledford, 2018).

Various teachers and peers in the participants' classroom implemented generalization sessions. The teachers included individuals who worked with the participants daily in the special education classroom setting (i.e., special education teacher and paraprofessionals). The peers included students working as peer tutors in the participants classroom. Secondary observers were present during at least 20% of all sessions to collect interobserver agreement (IOA) and procedural fidelity (PF) data and included the classroom teacher or a graduate student seeking a master's in special education. The investigator collected procedural fidelity data during generalization sessions.

Instructional Setting and Arrangement

All sessions occurred in a high school self-contained special education classroom. During the time of sessions, students in the classroom were engaged in different activities (e.g., 1:1 instruction, break following 1:1 instruction or group instruction, transition to other environments in school). Technology training took place in a 1:1 instructional arrangement with the investigator at a desk located next to the entrance to the classroom for Ashley, Jason, and David. Technology training took place in the same instructional arrangement for Matthew except at his desk to not alter his daily schedule. Probe and PTD sessions occurred during naturally occurring opportunities throughout participants' daily schedules (e.g., break following 1:1 instruction, transition to other environments in school). Sessions occurred so that only the participant involved in that specific intervention session could hear or see procedures (i.e., participants not in intervention were not present during the trials).

Materials and Equipment

Students used an iPod Touch® to access Siri®. The investigator ensured that the students had the iPod® in view or in possession (i.e., on their desk, in hand, purse, or pocket) at least 1 min before starting each session. Data sheets (i.e., baseline, intervention, generalization, and reliability; see Appendices A-C) and a written list of identified known/unknown questions were used.

Known and Unknown Questions

For each session, participants were asked four to six unknown questions and one to two known questions (randomized for each session). All questions had a definitive answer and were not opinion related (e.g., "Who is a judge on American Idol?"). The questions were clear and concise so that the participants could vocally imitate the question when asking Siri®. The types of unknown questions asked included topics surrounding age-appropriate current events (e.g., sports, news, entertainment). See Appendix A for sample of unknown questions. These questions were selected from searching online current news publications. A future recommendation would be for investigators to survey same-age peers to compile the list of presumed unknown questions. A list of 150 presumed unknown questions were compiled. A backup question was chosen for each session in the event a participant answered an unknown question correctly without using Siri® and would be scored on the data sheet as a known question. An unknown question was defined as: when asked a question, the student did not provide a vocalized answer or vocalized anything other than the correct answer within 5 s of the question being asked. See primary dependent variable section for description of data collection for unknown questions. The types of questions asked for known information

included any topic participants could independently answer (e.g., personal information, music, entertainment). The investigator spent time in the classroom prior to the start of the study to determine each participant's interests and to collect potential known and unknown questions through direct observation for the study (e.g., during classroom activities, free time, transitions). Questions were also selected through teacher interview. A list of 30 known questions were identified for each student. A known question was defined as: when asked a question, the student provided a correct vocalized answer within 5 s of question being asked. Data for known questions were recorded if the participant (a) provided a vocal answer, (b) initiated Siri®, or (c) did not respond or provided an incorrect answer. If the participant provided the correct answer, the implementer delivered specific verbal praise (e.g., "That's right!"). If the participant did not provide the correct answer or initiated using Siri®, error correction was used by the implementer, (e.g., "You know this answer, you don't have to use Siri®", "You know the answer! It's _____"). See Appendix B for sample data sheets.

Technology Screening and Training

The purpose of this screening was to determine if participants knew how to access Siri® on an iPod® prior to the study. The investigator provided the iPod® and provided the task direction "Open Siri®". The participants had 5 s to initiate accessing Siri® independently. After 5 s the investigator ended the session and provided general praise (e.g. "Good working"). Participants who did not initiate and access Siri® within 5 s would participate in technology training prior to intervention. The purpose of technology training was to ensure that participants had the necessary skills to access Siri®. The investigator used PTD to teach accessing Siri® by using the task analysis

provided in Table 1. The delay interval was gradually increased by 1 s, starting at 0 s and ending at 5 s. Refer to 0 s and delay trial sections below for more detail. During the 0 s delay sessions, the investigator gave the participant the iPod®, ensured attention, and delivered the task direction (e.g., "Ask Siri® to open the camera") immediately providing the controlling prompt (i.e., verbal prompts for Ashley and Matthew, verbal prompts with partial physical prompts for Jason and David) and waited 5 s for participant to complete the first step and repeated for each step of the task analysis. If the participant responded 100% correct before or after the prompt, the investigator increased the delay interval by 1 s. If the participant responded below 100% correct before or after the prompt, the investigator remained at the same delay interval for next session. If a participant began to initiate an incorrect response before the delay interval, the investigator immediately delivered the controlling prompt and would be recorded as unprompted incorrect. Behavior specific praise (e.g., "Excellent job picking up your iPod®") was provided for each independent response and once at the end of the session. Mastery of technology training was three consecutive sessions at 100% unprompted correct responses of the task analysis. See Appendix C for sample data sheet.

Table 1. Accessing Siri® Task Analyses

Task Analysis for Activating Siri®
1. Pick up iPod®
2. Press and hold down home button
3. Wait for line at bottom of screen and two-tone sound
4. Vocally ask question

Dependent Variables

Primary dependent variable. The primary dependent variable was the participant's independent manding for unknown information using Siri®. This was defined as, after being asked an unknown question, the individual accessed Siri® within 5 s (or the specified delay interval during PTD intervention) and vocalized the question in a semantically correct manner. For example, the meaning of the phrase is maintained even if the word order is not specifically imitated. Examples include but are not limited to: after being asked, "How do you make popcorn?" the participant picks up the iPod® and vocally asks Siri® "How do you make popcorn?" or "Popcorn how do". Nonexamples include but are not limited to: after being asked an unknown question, the participant initiates manding Siri® for the answer, after being asked, "How do you make popcorn?" the participant vocally asks Siri® "Popcorn". There were five potential responses for manding Siri® for information: (a) unprompted correct, (b) unprompted incorrect, (d) prompted correct, (e) prompted incorrect, and (f) no response. Unprompted correct responses were recorded if the participant asked Siri® the question within 5 s (or the specified delay interval) of being asked a question by the communication partner before the prompt was delivered. Unprompted incorrect responses included were recorded when the participant said anything other than the question asked by the communication partner before the prompt was delivered. Prompted correct responses were recorded if the participant asked Siri® the question within 5 s after the prompt. Prompted incorrect responses were recorded when the participant said anything other than the specified question within 5 s after the prompt. No response was recorded if the

participant said nothing within 5 s after the prompt. Only independent correct responses (i.e., unprompted correct) of the target behavior (i.e., manding Siri® for information) were graphed. See Appendix B for sample data sheets. Within each session, four to six unknown questions were asked to each participant, allowing for four to six opportunities for the participants to mand Siri® for information. A percentage of questions in which the participant correctly manded Siri® for unknown information was calculated at the end of each session with a single communicative partner. This was calculated by dividing the number of correct responses of manding Siri® for unknown information by total number of unknown questions asked multiplied by 100.

Secondary dependent variables. Secondary dependent variables were recorded contingent on the participant manding Siri® for unknown information. The secondary variables included (a) if and how Siri® responded to the question, and (b) if and how the participant engaged with Siri's® answer. This was collected to see if this was a socially valid skill to teach participants and for future research questions. Siri's® responses were either answered directly (i.e., Siri® produced a vocal answer), a link to more information was provided (e.g., a hyperlink to a Wikipedia page), an incorrect answer was given, or it was stated that she did not know or did not understand the question. Participant engagement with answers included the student scanning information provided (e.g., clicking on hyperlink, watching video, scrolling through the Siri® responses), the student echoing the vocalized answer, the student indicating that Siri® gave them a wrong answer, or no engagement following Siri® answer. The occurrence or nonoccurrence of Siri® responses and student engagement was recorded. A percentage of Siri® responding

and student engagement within correct mands for information were reported. See Appendix B for sample data sheet.

Experimental Design

A single-case multiple probe design across participants with intermittent generalization probes (Gast, Lloyd, & Ledford, 2018) was used to evaluate the effectiveness of PTD to teach participants to initiate using Siri® on a mobile device to find an answer after being asked an unknown question, as well as the generalized use of Siri® when asked questions from untrained communicative partners. Multiple probe across participants sequentially introduces an intervention to similar participants (e.g., characteristics, behaviors) who are exposed to similar environmental conditions (Gast et al., 2018). Experimental control is demonstrated in this design when the data in each tier are stable and behavior change occurs only when the intervention is introduced for at least three participants at three different points in time (Gast et al., 2018). This design was chosen over other experimental designs because the research question for this study evaluated the effects of PTD on the target behavior (i.e., manding Siri® for unknown information), which is a nonreversible behavior (i.e., likely to maintain after intervention has ended). This design also allows multiple participants to receive intervention and learn the same target behavior. This design was chosen over a multiple baseline across participants design because the baseline sessions were delivered intermittently (or predetermined) instead of continuously which helps prevent testing threats to internal validity (Gast et al., 2018). This design helped to prevent against attrition and instrumentation threats to internal validity when compared to multiple baseline design due to extended time spent in the baseline condition. Using a multiple probe design

across participants decreased the amount of probe sessions which decreased the likelihood of implementers having low fidelity on procedures (Gast et al., 2018). Baseline probe data were collected for all participants with all communicative partners (investigator, teacher, peer) and continued until all participants' data were stable (i.e., zero-celerating). There were a minimum of five baseline sessions with the investigator, two with a teacher, and two with a peer for each participant. The order in which participants received intervention was randomized prior to the start of the study. PTD sessions occurred with the investigator asking the questions only. Weekly generalization probes occurred with a teacher and peer asking the questions. PTD sessions began for the first participant with the investigator until they met mastery. Mastery criterion included the participant independently manding Siri® for information for at least 80% of trials for at least three consecutive sessions and participants having three sequential generalization sessions at or above 80%. Mastery to introduce to the next tier included a participant having a single PTD session at 80% of trials unprompted correct or greater and a single generalization session at or above 50% unprompted correct. After mastery to introduce the next tier was met with the first participant, probes were conducted with all communication partners. Three probe sessions were conducted for the next participant immediately before PTD sessions to ensure stable data (e.g., zero-celerating). Once probe sessions were conducted, PTD began with the second participant. After mastery to introduce the next tier with the second participant, probes were conducted with all communication partners to assess for maintenance of target behaviors in previous tiers, and generalization of behavior to untrained communicative partners within the mastered tier. Intermittent probing occurred at least weekly for participants who are not in

intervention yet to ensure data remained at stable levels. For the remaining participants, the same procedures were followed after mastery to introduce next tier was met and until mastery to criterion.

General Procedures

All sessions occurred during first and fourth block in the special education self-contained classroom. First and fourth block lasted for 1 hr at the beginning and end of each school day respectively. During this period, the current implementer (i.e., investigator, teacher, or peer) asked the participant four to six unknown questions and one to two known questions (randomized for each session). Within a session, there was at least 1 min between unrelated questions; but conversationally related questions could be sequentially presented within a session. The questions asked to the participants were randomly selected through an online list randomizer before each session. The questions came from the list of identified presumed unknown and known questions. Once an unknown question was asked, it was not used as an unknown question for future sessions unless the answer to the questions changed daily (e.g., "Who won the <sports team> game last night?"). In the case that the answers changed, those unknown question could be asked for future sessions. The implementer asked the participant the known/unknown question so that other participants could not hear to avoid observational learning.

Baseline probes. Baseline sessions occurred with each of the communicative partners (i.e., investigator, teacher, and peer) for each participant. The investigator ensured the participants had the iPod® in view or in possession at least 1 min before starting each session. To begin the trial, the investigator secured the participant's attention (e.g., said "Hey David" and waited for participant to respond or make eye

contact) and asked the participant the unknown question (e.g., “What was the score of the <sports team> game last night?”). Participants were given 5 s to initiate manding for unknown information by accessing Siri® and asking the question. If the student engaged in the target behavior, the trial ended and the implementer delivered specific praise (e.g., “Good job asking Siri® for the answer!”). Data were collected on Siri’s® response and if the participant engaged with the Siri® answer. If the student did not initiate manding Siri® for unknown information within 5 s of the question being asked, the trial ended and the implementer delivered an overt response (e.g., “Hmm I don’t know either”) and continued the conversation.

Progressive time delay. During instructional sessions, the investigator first ensured that the participant had an iPod® in their possession as described in the baseline sessions. PTD procedures were implemented by the investigator where the delay interval was gradually increased by 1 s, starting at 0 s and ending with a terminal 5 s delay interval. The implementer delivered a verbal prompt as the controlling prompt for all participants. However, the implementer used one of six different response variations as the controlling prompt (i.e., “Hmm let’s ask Siri®!”, “I’m not sure. Find out by asking Siri®”, “I don’t know, but I bet Siri® can help. Ask her”, “I don’t know that answer. Ask Siri®!”, “I bet Siri® knows. Ask her!”, “Hmm, when I don’t know something, I ask Siri”) to program for generalization using multiple overt responses.

0-s delay sessions. During the 0 s delay trials, the investigator ensured the participant’s attention (e.g., said, “Hey David” and waited for participant to respond or make eye contact), asked the unknown question (e.g., “What was the score of the <sports team> game last night?”), and then immediately provided the verbal controlling prompt.

If the participant initiated asking Siri® within 5 s of the controlling prompt, the investigator waited and marked if Siri® responded and the participant's engagement with the answer as described in the dependent variable section. For prompted correct responses, the investigator provided behavior specific praise (e.g., "Great job asking Siri® if you don't know the answer!"). If a participant began to initiate an incorrect response directly after the delay interval, the investigator immediately repeated the controlling prompt recorded a prompted incorrect response. For no responses, the investigator waited 5 s and then ensured the participant's attention before running the trial again. If still no response after the second attempt, mark as no response and move on to the next trial. If the participant responded correctly within 5 s of controlling prompt for 80% of trials, the delay interval was increased by 1 s for the next session. This differed from technology training to provide a cushion for participant's motivation.

Delay trials. During delay trials, the investigator ensured the participant's attention, asked the unknown question, waited the specified time delay (i.e., 1 s, 2 s, 3 s, 4 s, 5 s) for participant's response and then provided the correct consequence (e.g., controlling prompt, behavior specific praise). The terminal delay interval used was 5 s. If the participant responded correctly before the prompt or within 5 s of controlling prompt for 80% of trials, the delay interval increased by 1 s for the next session. Prompted correct responses, prompted incorrect responses, and no response consequences were the same as the 0-s delay trials. For unprompted responses, the investigator provided behavior specific praise (e.g., "I liked how you asked Siri® when you didn't know the answer!"). If a participant began to initiate an incorrect response before after the delay interval, the investigator immediately delivered the controlling prompt and recorded an

unprompted incorrect response. Mastery criteria was set at three consecutive sessions of manding Siri® for unknown information. Due to COVID-19, delay sessions only reached 2 s delay during intervention.

Maintenance and generalization. Maintenance probe sessions were planned but did not occur due to COVID-19. Maintenance probe sessions were planned to be identical to baseline probe sessions for previously mastered conditions, and were planned to occur weekly once subsequent tiers reached mastery criterion. Generalization probe sessions were identical to baseline probe sessions. Sessions occurred intermittently throughout baseline probes and intervention sessions at least weekly. Generalization probes were conducted by either a teacher or peer. The investigator sat down with the teachers and peers prior to sessions to review probe procedures. They had an opportunity to practice and ask questions prior to running a session.

Reliability and Fidelity

IOA and PF. IOA and PF were collected for at least 20% of sessions in all conditions across participants. During IOA and PF sessions, a second observer was present collecting data. IOA were collected for the participant's initiation of manding Siri® for unknown information, Siri® responses, and the participant's response to Siri®. IOA data were calculated using the point-by-point agreement by dividing the number of agreements by the number of agreements plus disagreements and multiplied by 100 (Ledford, Lane, & Gast, 2018). PF data were calculated by dividing the correct number of planned behaviors of the implementer (i.e., investigator, teacher, peer) by the total number of planned behaviors and multiplied by 100 (Barton, Meadan-Kaplansky, & Ledford, 2018). The following behaviors were recorded for each trial within a session

across all participants and conditions: (a) iPod® in student's possession at least 1 min before the start of a session, (b) secured the participant's attention, (c) asked the unknown/known question, (d) waited the specified time delay, provide prompt if needed (e) delivered appropriate consequence. See Appendix D for sample data sheet.

Section 4: Results

The results of this study are based on tier 1 results only, and therefore no functional relation was possible. This was due to COVID-19 global pandemic that shut down school systems and forced a premature end to the study. Prior to technology training, no participants accessed Siri® independently. Prior to baseline, all participants participated in technology training using PTD and reached criterion of independently accessing Siri® when verbally prompted.

Figure 1 shows the percentage of trials independently manding Siri® for unknown information across communication partners. The closed triangles represent the sessions with the investigator, the open squares represent sessions with a teacher, and the open circles represent sessions with a peer.

Ashley had 0% trials unprompted correct manding Siri® for unknown information for nine consecutive baseline sessions with all communication partners. After all participants had stable (zero-celerating) data, the investigator introduced PTD session. Table 2 shows percentages of prompted correct, prompted incorrect, unprompted correct, unprompted incorrect, and no response for each session of intervention. Ashley had two sessions at a 0 s delay interval with 0% of trials unprompted correct. In the first 0 s session, Ashley got 75% prompted correct. In the second 0 s session, Ashley got 100% prompted correct, therefore increased delay trials. On the first 1 s delay session, her data had an immediate change in level to 80% of trials unprompted correct in the therapeutic direction. On the next session, 2 s delay, she independently manded Siri® for information 100% of trials with the trend continuing in the therapeutic direction. Ashley received one generalization session after PTD was introduced. With a peer, Ashley independently

manded Siri® for unknown information for 60% of trials. Once Ashley met mastery to introduce the next tier, probes were conducted with Jason and David. Their levels remained at 0% of trials for manding Siri® for unknown information. Throughout baseline and intervention Ashley vocalized the known questions 100% of trials independently.

Jason had 0% of trials manding Siri® for unknown information for ten consecutive baseline probe sessions with all communication partners. In baseline, there was one instance when Jason answered a presumed unknown question correctly and a backup question was used. David had 0% of trials manding Siri® for unknown information for ten consecutive baseline probe sessions with all communication partners. Jason and David vocalized the known questions 100% of trials independently.

Matthew had 0% of trials manding Siri® for unknown information for four baseline sessions. Due to absences and his modified school schedule, Matthew's sessions were not consecutive. He had a total of four sessions. Throughout baseline Matthew vocalized the known questions 100% of trials independently.

Table 2. Intervention Session Data for Ashley

Session 10		Session 11		Session 12		Session 13	
PC	75%	PC	100%	PC	20%	PC	0%
PI	25%	PI	0%	PI	0%	PI	0%
UC	0%	UC	0%	UC	80%	UC	100%
UI	0%	UI	0%	UI	0%	UI	0%
NR	0%	NR	0%	NR	0%	NR	0%

Key: unprompted correct (UC), unprompted incorrect (UI), prompted correct (PC), prompted incorrect (PI), no response (NR)

Secondary Dependent Variables

Table 3 shows the percentage of trials of (a) how Siri® responded and (b) how Ashely engaged with the answer once she manded Siri® for unknown information.

Table 3. Secondary Variable of Ashley

Siri® Responses		Student Engagement	
Linked to information	9%	Scanned Information	26%
Answered directly	61%	Vocalized Answer	57%
Did not understand	4%	Indicated wrong answer	17%
Provided wrong answer	26%	No engagement	0%
No response	0%		

Reliability

IOA data were collected 23% of baseline sessions with 100% agreement. PF data were collected for 48% of baseline sessions across communication partners and was 100%. Out of the four intervention sessions, IOA and PF were not collected. On session 15 of intervention for Ashley, IOA and PF data were planned to be recorded but were not collected due to school closures and the study not being able to be completed.

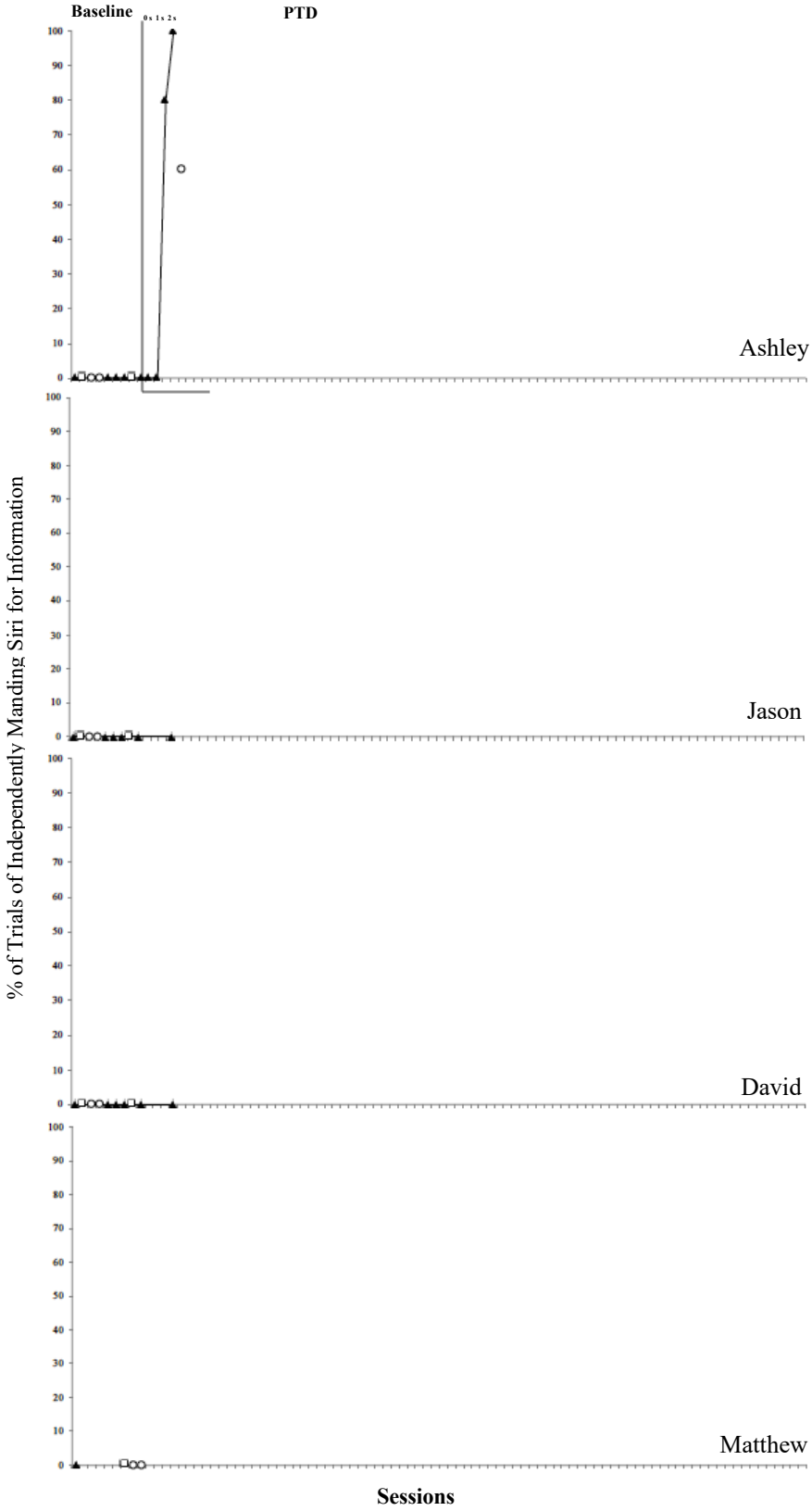

Figure 1: Graph of Results. Closed triangles represent sessions with the investigator. Open square represents sessions with a teacher. Open circles represent sessions with a peer.

Section 5: Discussion

The purpose of this study was to examine if PTD would be effective in teaching high school students with ID to initiate using Siri® when asked an unknown question and if the participants would generalize this skill to other communication partners. Due to the COVID-19 global pandemic, the government mandated that schools across the nation close in-person instruction in early March. This inhibited the study from being completed. A functional relation was not possible because there were not three demonstrations of effect across the participants prior to school closures.

Based on tier 1, if Ashley's data remained stable and the generalization sessions continued to move in the therapeutic direction, mastery of criterion would have been met. In the beginning sessions of PTD, there was an immediate change in the data (i.e., 0% to 80% unprompted correct responses) once the delay interval increased to 1 s. She began restating the different controlling prompts in her own words (e.g., "We should ask Siri®!", "Maybe Siri® knows!") before accessing Siri®. Social validity was not measured in this study. One anecdotal social validity component was observed when Ashley began using Siri® outside of session on two occasions. She continued the conversation with the investigator, and came up with questions she did not know that were to related to the current topic of conversation (e.g., facts about a pop singer). Future research could formally assess the generalized use of manding Siri® for information outside of session. There were two instances when after the controlling prompt was delivered and Ashley accessed Siri®, she asked the investigator to repeat the question. After the question was repeated, she continued to then initiate Siri® and ask the question independently. When this occurred, it was marked as prompted correct. All participants

continued to verbally answer the questions that were identified as known questions. This is important because the participants differentiated between known and unknown questions.

The students in this classroom had their own iPod Touch® devices prior to this study and used this device throughout their school day. Schools may not have access to these devices for their students to each have their own. Classrooms could share any Apple® device that has Siri® with their participants since only one participant is in a session at a time. This could also be done with any device that has an AI system such as Google Home® or Alexa®.

One implication of this study included the positive social interactions between participants, peers, and teachers. The classroom teacher reported that during question screening, she learned new things about her students in particular about Jason's interests outside of the classroom. This study provided opportunities for the participants to engage in conversations around topics their same aged peers would discuss as well as their own preferred topics. Each session (i.e., baseline, intervention) with the communication partners were naturally occurring conversations throughout different parts of their daily schedule (e.g., transitions, free-time, 1:1 work). This was opposed to having sessions in the form of 1:1 instruction. This provided opportunities for the participants to hopefully generalization this skill once they left the classroom and were in different settings and with different communication partners.

Limitations and Conclusions

One limitation for this study is that only tier 1 entered intervention and the study was unable to be completed as planned. Only a small portion of the study was completed

allowing only an analysis of the data based on tier 1. A second limitation includes Wi-Fi accessibility. During most sessions with Ashley, her Wi-Fi connection had to be reconnected prior to and occasionally throughout sessions. She would check the Wi-Fi and reconnect if needed independently. None of the other participants experienced trouble with Wi-Fi on their devices. Siri® requires Wi-Fi to be connected if there is no cellular data. This is an issue because if students do not know how to reconnect their Wi-Fi or if Siri® is unavailable they would not be able to access unknown information. A second limitation for this study is that IOA and PF data were not collected during intervention. This was due to the study not being completed as planned.

The data collected on the secondary variable, Siri's® responses and student engagement with the answer, presented in Table 2 provides valuable information for future studies but also may not fully represent the outcomes if the study was completed as planned. Though this is a limitation, throughout the study there was valuable information gathered. For the most part, Siri® understood all of the participants even when participants would mispronounce certain words. During technology training and intervention, David and Ashley reacted when Siri® misunderstood what they were saying. Most of the time when Siri® misunderstood them, they would independently try activating Siri® again so it would pick up what they intended to say.

This study provided valuable information based on tier 1 that students with ID could be successful in using Siri® to be independent when searching for unknown information. This study furthered the previous research from Smith et al. (2010) that PTD was effective in teaching individuals with ID to initiate the use of their mobile device. Based on tier 1 of this current study, it showed that PTD could also be effective in

teaching individuals with ID to initiate and use embedded accessibility features (e.g., Siri®) on an iPod Touch® to independently gain access to information. If this study was completed as planned and data for all participants were similar to Ashely's performance, future research questions include (a) after asking Siri® an unknown question, can they find the correct answer, (b) when in the community setting, can individuals with ID use Siri® to find unknown information, (c) when working on academic goals in the general education or special education setting, can students with ID find answers to unknown questions.

In conclusion, the increase of technology in society's everyday life provides many opportunities and ways to teach individuals with disabilities how to use technology as a support to increase independence. This study attempted to examine the effects of teaching students with ID to use Siri® when asked an unknown question. Since this study was unable to be completed and results from tier 1 were promising, investigators should consider replicating the procedures above to answer the research questions.

Appendix A: Sample of Presumed Unknown Questions

1. When is <special event>?
2. Who sings <song>?
3. What is <band> latest album?
4. Who is in <band>?
5. What genre of music is <artist>?
6. What is <singer> popular song?
7. Who performed at <special event>?
8. Who is the actor in <new movie>?
9. What movie won <award show>?
10. What actor plays <character in movie>?
11. Who is the host of <tv show>?
12. When does <tv show> start?
13. Who won <show> this year?
14. How old is <famous actor>?
15. Who is <actor> married to?
16. Who are the judges on <show>?
17. What sport does <athlete> play?
18. Who plays for <sports team>?
19. What is the mascot for <sports team>?
20. What team does <athlete> play for?
21. Who coaches <sports team>?
22. Where does <sports team> play?
23. Who won <sports game> last night?
24. What was score of <sports game> last night?
25. Who did <sports team> last play?
26. What sports are in the summer Olympics?
27. When is <sports event> this year?
28. Who is president?
29. Who is running for president?
30. Who is <political office> of <area>?

Appendix B: Baseline and Intervention Data Sheet

	Session:		Condition:
	Implementer:		
		UC/UI /PC/PI /NR	**If (+) circle below if applicable**
	Unknown questions		
1	Manding Siri® for unknown information		
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
2	Manding Siri® for unknown information		
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
3	Manding Siri® for unknown information		
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
4	Manding Siri® for unknown information		
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
5	Manding Siri® for unknown information		
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
6	Manding Siri® for unknown information		
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
	Total % Manding Siri®		
	Siri® responds to question		Link to information Answers directly Does not understand Provides wrong answer _____% _____% _____% _____%
	Student engages with answer		Scans information Vocalizes answer Indicates wrong answer _____% _____% _____%

Key: unprompted correct (UC), unprompted incorrect (UI), prompted correct (PC), prompted incorrect (PI), no response (NR), occurrence (+), nonoccurrence (-).

	Known questions		
1		+ - NR	Vocalizes answer Initiates Siri® No response/provided incorrect answer
2		+ - NR	Vocalizes answer Initiates Siri® No response/provided incorrect answer
	Total %		

Key: no response (NR), occurrence (+), nonoccurrence (-).

Appendix C: Technology Training Data Sheet

	Session:						
	Condition:						
	Task Analysis	B	A	B	A	B	A
1	Pick up iPod®						
2	Press down home button						
3	Wait for line at bottom of screen and two-tone sound						
4	Vocally ask question						
	% Correct						

Key: correct (+), incorrect (-), no response (0).

Appendix D: Reliability Data Sheet

	Session:		Condition:
	Implementer:		
		UC/UI /PC/PI /NR	**If (+) circle below if applicable**
	iPod® in student's possession at least 1 min before session	+ -	
	Unknown questions		
1	Manding Siri® for unknown information		Secured attention Asked unknown question Waited delay Delivered consequence
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
2	Manding Siri® for unknown information		Secured attention Asked unknown question Waited delay Delivered consequence
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
3	Manding Siri® for unknown information		Secured attention Asked unknown question Waited delay Delivered consequence
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
4	Manding Siri® for unknown information		Secured attention Asked unknown question Waited delay Delivered consequence
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
5	Manding Siri® for unknown information		Secured attention Asked unknown question Waited delay Delivered consequence
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
6	Manding Siri® for unknown information		Secured attention Asked unknown question Waited delay Delivered consequence
	Siri® responds to question	+ - NR	Link to information Answers directly Does not understand Provides wrong answer
	Student engages with answer	+ - NR	Scans information Vocalizes answer Indicates wrong answer
	Total % Manding Siri®		
	Siri® responds to question		Link to information Answers directly Does not understand Provides wrong answer _____% _____% _____% _____%
	Student engages with answer		Scans information Vocalizes answer Indicates wrong answer _____% _____% _____%

Key: unprompted correct (UC), unprompted incorrect (UI), prompted correct (PC), prompted incorrect (PI), no response (NR), occurrence (+), nonoccurrence (-).

	Known questions		
			Secured attention Asked unknown question Waited delay Delivered consequence
1		+ - NR	Vocalizes answer Initiates Siri® No response/provided incorrect answer
2		+ - NR	Vocalizes answer Initiates Siri® No response/provided incorrect answer
	Total %		

Key: no response (NR), occurrence (+), nonoccurrence (-).

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