Constant Time Delay to Teach Answering Questions via an iPad-Based Speech-Generating Device for a Child with ASD

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Abstract

Background: This study aimed to investigate the effectiveness of constant time delay (CTD) in teaching a child with autism spectrum disorder (ASD) to answer three "Wh"-questions—"What," "Who," and "Where"—using an iPad-based speech-generating device (SGD).

Method: A multiple-probe design across questions was employed to evaluate the efficacy of CTD in facilitating question-answering via an iPad-based SGD.

Findings: The results of this study indicate a significant improvement. After an average of six sessions, the participant successfully mastered all three "Wh" questions. Furthermore, the participant maintained mastery of the skills at an 80% accuracy level following the withdrawal of the intervention.

Conclusion: The findings suggest that CTD when combined with an iPad-based SGD, can effectively enhance question-answering abilities in children with ASD. This study underscores the importance of technology in supporting individuals with ASD by improving their functional communication skills, particularly in responding to essential social and academic questions.

Keywords: Constant time delay (CTD); autism spectrum disorder; communication; augmentee communication devices; Speech generating device; iPad

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استراتيجية التأخير الزمني الثابت لتعليم مهارة الإجابة على الأسئلة عبر جهاز توليد الكلام (الآيباد) لطفل مصاب باضطراب طيف التوحد

الملخص العربي:

هدفت الدراسة الحالية إلى التحقق من فعالية استراتيجية التأخير الزمني الثابت (Constant Time Delay – CTD) في تعليم طفل مصاب باضطراب طيف التوحد (ASD) مهارة الإجابة على أسئلة "ماذا"، و"من"، و"أين"، باستخدام جهاز توليد الكلام (Speech–Generating Device – SGD) المعتمد على جهاز الآيباد. اعتمدت الدراسة على تصميم الخطوط القاعدية المتعددة عبر السلوك ضمن منهج دراسة الحالة الواحدة، بهدف قياس أثر التدخل على اكتساب المهارة. أظهرت النتائج أن المشارك تمكن من إتقان الإجابة على الأسئلة الثلاثة المستهدفة بعد متوسط ست جلسات تدريبية، كما أظهر قدرة على الحفاظ على الأداء بدقة بلغت 80% خلال مرحلة المتابعة بعد سحب الدعم. تعكس هذه النتائج فعالية الجمع بين استراتيجية التأخير الزمني الثابت والتقنيات الحديثة القائمة على أجهزة الاتصال المعزز، مثل الآيباد، في تطوير مهارات التواصل الوظيفي لدى الأطفال ذوي اضطراب طيف التوحد، خاصة في جانب الإجابة على الأسئلة ذات الطابع الاجتماعي والتعليمي. الكلمات المفتاحية: التأخير الزمني الثابت؛ اضطراب طيف التوحد؛ التواصل الوظيفي؛ أجهزة التواصل المعزز والبديل؛ جهاز توليد الكلام؛ آيباد.

الكلمات المفتاحية: التأخير الزمني الثابت (CTD)؛ اضطراب طيف التوحد؛ التواصل؛ أجهزة التواصل المعززة؛ أجهزة توليد الكلام؛ آيباد.

Constant Time Delay to Teach Answering Questions via an iPad-Based Speech-Generating Device for a Child with ASD

According to the most recent report by the Centers for Disease Control and Prevention (2024), approximately one in 36 children is diagnosed with autism spectrum disorder (ASD). Autism spectrum disorder is defined as a developmental condition characterized by social and communication difficulties, restricted interests, and repetitive behaviours (American Psychiatric Association [APA], 2013). Deficits in social and communication abilities vary among individuals, depending on the severity of the condition. While some children with ASD develop vocal communication, either clearly or unclearly, approximately one-third do not show significant improvement in vocal communication. This results in the continued use of very simple vocal language or, in some cases, reliance on non-vocal means of communication (Koegel et al., 2019). The severity of communication deficits can range widely; some individuals with ASD may develop functional speech, while others may not use functional speech at all (Wendt et al., 2019). Furthermore, approximately 25–30% of children with ASD remain minimally verbal and do not develop functional verbal language (Posar & Visconti, 2021).

Social and communication skills are among the most critical abilities for individuals to develop. Effective communication enables individuals to navigate life, interact with others, build relationships, and succeed in various areas (Badiah, 2018). Children with strong social and communication skills are more likely to express their needs, succeed academically, interact positively with peers, and exhibit fewer problem behaviours (Alzrayer et al., 2014). These skills also support the development and maintenance of friendships, enhance classroom engagement, and facilitate effective conversations, including asking and responding to questions.

The ability to ask and answer questions is an essential component of daily communication and verbal behaviour (Jahr, 2001). Skinner (1957) defined verbal behaviour as social behaviour produced by a speaker and influenced or facilitated by a listener. The elements of verbal behaviour include mand, tact, echoic, intraverbal, textual, and transcription, all of which are utilized in social interactions (Cooper et al., 2007). From a behavioural perspective, questions are defined by their functional role, which can vary depending on the situation (Raulston et al., 2013). For example, when a teacher asks a student, “What colour is that?” and the student responds, “Red”, the

response is considered a tact. Alternatively, if a child asks a peer to borrow a pen, it is considered a mand. Given the significance of social and communication skills as fundamental aspects of human interaction and development, it is crucial to provide support to individuals with ASD to help them maximize their potential and improve their communication abilities (APA, 2013).

Augmentative and Alternative Communication and Speech-Generating Devices

According to the American Speech-Language-Hearing Association (ASHA), approximately 5 million individuals in the United States and 97 million individuals globally could benefit from augmentative and alternative communication (AAC) (Beukelman & Light, 2020). ASHA defines AAC as a method designed to support individuals with speech and language difficulties by aiding speech production and comprehension. AAC encompasses both spoken and written forms of communication and includes tools such as manual signs, picture or letter boards, and speech-generating devices (Elsahar et al., 2019).

As numerous studies have suggested, more than half of individuals with ASD face daily communication challenges as a complication of the condition. AAC can improve verbal behaviour and serve as a viable solution for individuals requiring alternative communication methods (Lorah et al., 2015). AAC systems can be classified into unaided systems, which do not require tools (e.g., manual sign language), and aided systems, which require tools (e.g., devices or pictures) (Wendt et al., 2019). AAC tools, such as picture exchange systems and speech-generating devices (SGDs), have been shown to effectively improve communication skills for individuals with ASD (Alzrayer et al., 2014; Lorah et al., 2013). SGDs are portable electronic devices that display various graphic symbols or written text and produce digitized or synthesized speech (Wendt et al., 2019). According to Alzrayer et al. (2014), the iPad and iPod Touch are among the most commonly cited devices in the literature. These devices offer significant advantages over traditional AAC systems, such as immediate speech output, which enhances understanding for communication partners and promotes improved social interaction (Wendt et al., 2019). Additionally, handheld technology, such as SGDs, is increasingly accepted in classrooms and is generally considered less stigmatizing compared to traditional tools like picture boards (Lorah et al., 2013).

Time Delay

Time delay is defined as "a practice used to systematically fade the use of prompts during instructional activities by using a brief delay between the initial instruction and any additional instructions or prompts" (Steinbrenner et al., 2020, p. 29) The time delay procedure, as described by Ault et al. (1988), can be implemented as either a progressive time delay or a constant time delay. Both methods have been demonstrated to be effective in teaching various tasks.

In the progressive time delay procedure, the delay interval between the presentation of a question or task direction increases incrementally by 1 s per trial following the initial 0-s session. For example, during the initial 0-s delay session, the teacher might present a picture and ask the learner, "What does she do?" while immediately providing the controlling prompt by saying, "She eats salad". In subsequent sessions, the teacher waits for 1 s before providing the prompt (e.g., 1-s delay), gradually increasing the delay over sessions (e.g., 2 s, 3 s, 4 s, 5 s, 6 s, etc.). Conversely, the constant time delay procedure begins similarly with an initial 0-s session. However, after the delay is introduced, it remains constant across subsequent sessions (e.g., 3–5 s) (Ault et al., 1988).

The immediate delivery of the prompt during the 0-s delay interval is highly effective because it allows the learner to quickly access the reinforcer at the beginning of the process (Demchak & Sutter, 2024). However, as the delay interval increases (typically to 3–5 s), this time frame enables the learner to respond correctly and independently to the target stimulus while allowing the teacher to present the controlling prompt as needed. Constant time delay (CTD) is considered a near-errorless teaching method (Demchak & Sutter, 2024). Time delay procedures are prompting techniques designed to minimize errors by systematically transferring control of the response from the trainer's prompt to the natural stimulus over time (Schuster et al., 1992). This method benefits both students and teachers by reducing instruction time due to faster task mastery. Time delay is an evidence-based method that can be used to teach various skills, including functional sight words (Swain et al., 2015), reading product warning labels (Dogoe et al., 2011), teaching multiplication facts (Alig-Cybriwsky et al., 1990), academic sight words (Akcin, 2013), and increasing levels of peer imitation during sculpting play (Sweeney et al., 2018).

Social validity, a critical component in the evaluation of the intervention, is considered a significant part in determining the applicability of an intervention among individuals with ASD (Callahan et al., 2017). Given the

importance of social validity, the study will use a survey and questionnaires to assess social validity from the viewpoint of the teacher in a school setting. The study aims to determine the applicability of the intervention by evaluating social validity from the teacher's perspective. Findings will provide valuable information about the intervention's relevance to classroom practice and its potential for broad implementation in inclusive and special education settings.

The study is expected to add to the literature on the use of constant time delay (CTD) to promote language for minimally verbal children with ASD, to increase "wh-" question answering skills, and to include iPad-based speech-generating devices (SGDs). The study focuses on evaluating the effective implementation of CTD to teach a child with ASD to answer "wh-" questions using an iPad-based SGD. This focus directly addresses the importance of functional communication interventions that integrate evidence-based teaching practices with modern AAC technologies (Alzrayer & Banda, 2017).

Research Questions

- Q1. Does CTD delivered via an iPad improve the ability of a child with ASD to answer questions?
- Q2. Do teachers report an improvement in the participant's skills following the intervention?

Method

Research Design

A multiple-probe design across question sets (Cooper et al., 2007) was employed to evaluate the effectiveness of the CTD procedure in teaching a child with ASD to answer three specific "Wh-questions": "What", "Who", and "Where" using an iPad. This research design involved systematically collecting and analysing data across multiple phases, including baseline, intervention, and post-intervention conditions. Data were gathered for each question set to monitor the child's progress and assess the impact of the CTD procedure. This method provided a comprehensive evaluation of the child's ability to learn and respond to the targeted questions at various stages of the intervention.

Participant

The participant was a 7-year-old boy diagnosed with ASD. He exhibited limited verbal communication and primarily relied on the Picture Exchange Communication System (PECS) to express basic needs. His total score on the Verbal Behaviour Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2008) was 65. The participant attended an elementary school in a self-contained special education setting and received applied behaviour analysis therapy at a private clinic after school.

The inclusion criteria for the study were as follows: (a) a diagnosis of ASD, (b) deficits in communication skills, (c) adequate vision and hearing abilities, (d) non-vocal communication status, (e) fine motor skills (e.g., the ability to press and navigate an iPad screen), (f) the ability to sit, (g) the ability to attend to a visual stimulus for at least 10 minutes, (h) the ability to follow verbal and gestural prompts, and (i) parental permission, the participant's informed assent, and Institutional Review Board approval.

Settings

The study was conducted in the participant's classroom within a school setting. To create a distraction-free environment conducive to focused learning, the sessions were held in a quiet area of the classroom, partitioned on both sides to minimize potential distractions. This arrangement ensured that the participant was not disturbed by external noise or visual stimuli during the sessions. Before each session, all materials required for the intervention, including the laptop and iPad, were carefully organized and placed on a table. The table setup allowed for easy access to the devices, ensuring that all items were within reach to facilitate smooth transitions between tasks. This controlled environment was designed to enhance concentration and minimize external variables that could potentially interfere with the study's objectives.

Materials

The materials used in the study included a laptop with a 15-inch screen to present PowerPoint slides, a PowerPoint presentation consisting of 15 slides (five slides for each question), and an iPad for participant use. Each slide in the PowerPoint presentation featured a written question in 16-point black font at the top (e.g., “What does she eat?”) and a corresponding picture (e.g., a woman eating salad). The slides were designed with a plain white background to minimize distractions and ensure clarity. The iPad, equipped with the

Proloquo2Go® communication application, allowed the participant to answer the questions effectively, facilitating communication and engagement during the intervention.

Research Procedure

Dependent and Independent Variables

The independent variables in this study included: (a) the constant time delay teaching method, (b) an iPad equipped with the Proloquo2Go application, (c) prompts, and (d) social reinforcement (e.g., verbal praise such as "Good job!" and gestures like hand clapping). The dependent variables were the percentages of correct responses to the three "Wh"-question sets—"What", "Who", and "Where"—as outlined in Table 1.

Each question in Table 1 was scored as "Independent" (I) if the participant responded correctly and independently without a prompt. A response was scored as "Incorrect" (IC) if the participant did not respond correctly. The percentage of correct responses for each question was calculated by dividing the number of correct responses by the total number of questions and multiplying the result by 100.

Data Collection

Baseline

During the baseline phase, the therapist guided the participant to an individual session in a quiet corner of the classroom, a routine the participant was familiar with as part of their daily schedule. The materials, including the PowerPoint presentation and iPad, were already set up on the table. The session began with the therapist providing instructions to the participant: "I am going to show you some pictures and ask questions". The therapist then pointed to the first slide (a picture of a woman eating salad) and asked, "What does she eat?" The therapist waited for the participant to respond. If the participant did not respond, the therapist moved to the next question in the "What?" set, continuing until all questions in the "What?" category were assessed. The therapist recorded the participant's responses as either correct or incorrect. A response was scored as correct (C) if the participant selected the correct icon on the iPad (e.g., "salads"). Correct responses were immediately followed by social praise, such as "Good job". If the participant did not respond or answered incorrectly, the response was recorded as incorrect (I).

The therapist then proceeded to the second set of "Wh"-questions, "Who?" and "Where?" repeating the same process for each question set until all questions were evaluated.

Intervention

During the intervention phase, the environment was identical to the baseline phase. The therapist used the same approach as in the baseline, guiding the participant to an individual session in the designated quiet corner. The materials, including the laptop with the PowerPoint presentation and the iPad, were prepared in advance. The session began with the therapist providing instructions to the participant: "I am going to show you some pictures and ask questions". The therapist pointed to the first slide (a picture of a woman eating salad) and asked, "What does she eat?" Immediately (0-s delay), the therapist verbally provided the answer, "Salads", while simultaneously pressing the "Salads" icon on the iPad app. The icon was then reset to allow the participant to press the "Salads" icon independently. Once the participant pressed the correct icon, the therapist delivered social praise, such as "Good job" or "Nice".

Data were collected for both prompted and non-prompted responses during the 0-s delay. In the ideal scenario, the participant would answer the question correctly (e.g., press the "Salads" icon) after the therapist demonstrated the correct answer. Since the therapist had already modelled the correct response, this trial was considered a correct prompted response and recorded as a (+) in the "after-prompt" section. If the participant did not respond correctly before the prompt, a (-) was recorded in the "before-prompt" section. If the participant still failed to respond correctly after the prompt was provided, a (-) was recorded in the "after-prompt" section.

The therapist continued the session by asking the remaining four questions (e.g., "What does she carry?" and "What does he do?"; see Table 1 for details about the question sets). After all five questions in the set were completed, the session ended. The following two sessions were conducted in the same manner as the 0-s delay sessions. After completing several 0-s delay sessions, the intervention progressed to a 4-s delay. During the 4-s delay, the therapist pointed to the PowerPoint screen and asked the participant, "What does she eat?" The therapist then waited for the participant to respond independently and correctly within the 4-s time frame. If the participant answered the question correctly by clicking on the correct icon (e.g., "Salads")

within the allotted time, a significant amount of social praise was provided (e.g., “Good job”, clapping hands, high fives, etc.). If the participant did not respond within the time frame, the therapist verbally provided the correct answer (“Salads”) and pressed the correct icon on the iPad. If the participant responded correctly after the prompt, praise was given, but to a lesser extent than for independent responses. After completing the first set of questions and reaching mastery, the therapist began teaching the second set of questions (“Who”, e.g., “Who drinks water?”) using the same procedure as the first set. The participant progressed through each set of questions until mastery was achieved before moving on to the next set. While teaching each set of questions, the other two sets were probed intermittently to monitor retention and ensure generalization.

Interobserver Agreement

Interobserver agreement (IOA) was assessed during 50% of the sessions, achieving 100% agreement. The teacher or researcher, acting as the IOA data collector, recorded the participant's responses by directly observing the sessions. Before the study, the researcher trained the teacher on how to conduct the sessions, document data accurately, and maintain procedural fidelity. Both data collectors independently completed their data sheets during the sessions. IOA was calculated using the point-by-point method (Cooper et al., 2007). The percentage of agreement was determined by dividing the number of agreements by the total number of opportunities and multiplying the result by 100.

Procedural Fidelity

Procedural fidelity data were collected for at least 20% of the sessions, achieving a perfect score of 100% fidelity. To ensure consistent and accurate implementation of the intervention, procedural fidelity was assessed separately for each phase of the study. During the assessment, fidelity was calculated by counting the total number of “Yes” responses (indicating correct implementation of procedural steps) and dividing this by the total number of expected actions for that session. This ratio was then multiplied by 100 to determine the fidelity percentage for each phase. The data confirmed that the study's procedures were followed with precision, which is critical for ensuring the reliability and validity of the results. By maintaining high procedural

fidelity, the research team ensured that any observed effects were attributable to the intervention itself, rather than inconsistencies in its implementation.

Social Fidelity

Social validity was assessed through an interview with the teacher to obtain detailed feedback on the intervention and its effectiveness. The interview focused on several key areas, including the teacher's overall satisfaction with the intervention, her observations of any improvements in the participant's skills, and her perception of the intervention's utility. The teacher was specifically asked whether she observed any positive changes in the participant's ability to answer questions or communicate effectively. In addition, the interview explored the teacher's views on the broader applicability of the intervention. Questions addressed whether the teacher found the intervention useful not only for the specific skills targeted in the study but also for its potential application in teaching other skills in the future.

Data Analysis

The participant's performance on the dependent variables was assessed by reviewing the data sheets from each session. The number of correct responses for each question set in every session was graphed (Figure 1) to provide a clear visual representation of the data and to support decision-making regarding subsequent steps in the intervention. The graph was used for visual analysis to monitor the participant's progress over time. Adjustments to the intervention were made as needed based on trends and patterns observed in the data. Additionally, decisions about transitioning between phases were informed by the visual analysis, ensuring that each phase was implemented appropriately based on the participant's performance and responsiveness.

Results

Figure 1 illustrates the participant's scores for each "Wh"-question set across the different phases of the experiment. The three dependent measures included the "What?" question sets, "Who?" question sets, and "Where?" question sets. Each "Wh"-question set was examined across three phases: baseline, intervention (with 0-s and 2-s delays), and a withdrawal phase in which the intervention was no longer implemented.

Upon starting to teach the first "Wh"-question set, "What?", using the 0-s time delay, the participant's performance was 100% for prompted responses and 0% for unprompted responses. This result is expected, as there was no delay between the presentation of the question and the prompt. The 0-s phase continued for three consecutive sessions, yielding consistent results of 100% prompted and 0% unprompted responses. The intervention then progressed to the 2-s delay phase. During this phase, the participant's performance improved, with 20% correct independent responses and 80% prompted responses in the first session. This pattern was repeated in the second session. In subsequent sessions, the participant's performance increased further, eventually achieving 100% correct independent responses across three consecutive sessions. Following three consecutive sessions of 100% independent performance, the intervention for the first "Wh"-question set, "What?", was withdrawn, and instruction began on the second question set, "Who?". Concurrently, all "Wh"-question sets continued to be probed.

When teaching the second "Wh"-question set, "Who?", using the 0-s time delay, the participant's performance was 100% for prompted responses and 0% for unprompted responses. This result is expected, as there was no delay between the question being asked and the prompt being provided. The 0-s phase continued for three consecutive sessions, consistently yielding 100% prompted and 0% unprompted responses. The intervention then progressed to the 2-s delay phase. During this phase, the participant's performance improved, with 40% correct independent responses and 60% prompted responses in the first session. In subsequent sessions, independent correct responses increased to 60%, with 40% prompted responses, followed by 80% independent responses for two sessions. Finally, the participant achieved 100% correct independent responses for three consecutive sessions. After these three sessions of 100% independent performance, the intervention for the second "Wh"-question set, "Who?", was withdrawn, and instruction began on the final question set, "Where?". Concurrently, all "Wh"-question sets continued to be probed.

When instruction began for the second "Wh"-question set, "Where?", using the 0-s time delay, the participant's performance was 100% for prompted responses and 0% for unprompted responses. This outcome was expected, as no time elapsed between the question being asked and the prompt being provided. The 0-s phase continued for three consecutive sessions, consistently yielding 100% prompted and 0% unprompted responses. The intervention then

progressed to the 2-s delay phase. During this phase, the participant's performance improved, with 60% correct independent responses and 40% prompted responses in the first session. Independent responses further increased to 80% over the next two sessions and eventually reached 100% correct independent responses for three consecutive sessions. Throughout this process, all "Wh"-question sets continued to be probed to monitor retention and generalization.

The probe data for the "Wh"-question set "What?" showed 100% correct responses during the first probe and 60% during the second probe. For the "Who?" question set, the participant achieved 80% correct responses during the first probe and 60% during the second probe. The "Where?" question set demonstrated 100% correct responses during the probe.

Findings of Teachers Survey and Interview

An interview was conducted with the teacher to evaluate the social validity of the intervention. The questions focused on several key areas, including the teacher's overall satisfaction with the intervention, her observations of any improvements in the participant's skills, and her perception of the intervention's utility. The teacher expressed high satisfaction with the intervention, particularly noting the quick mastery of the targeted skill. She found the intervention to be useful not only for the specific skill addressed in the study but also for its potential application in teaching other skills in the future. Additionally, the teacher expressed strong approval of using technology, such as the iPad-based communication system, and indicated that she might prefer it over traditional physical PECS pictures.

Discussion

The purpose of this study was to evaluate the effectiveness of the CTD procedure in teaching a child with ASD to answer three "Wh"-questions—"What?", "Who?", and "Where?"—using an iPad-based speech-generating device. The results of this study, along with findings from (Genc-Tosun et al., 2023), suggest that time delay is an effective method for teaching various skills to children with ASD. As CTD is considered a near-errorless teaching method, its implementation in classroom settings should be expanded. Teachers may benefit from training on how to effectively use this method to maximize its impact. In this study, the teacher indicated that she had not previously used the

time delay method but, after observing its effectiveness, expressed a greater likelihood of incorporating it into her teaching practices in the future. Raising awareness about the benefits of the time delay method and other errorless teaching strategies could lead to faster learning for students and reduced stress for both teachers and learners.

The use of iPads as communication and learning tools in the classroom has significantly increased over the last decade. However, some schools still primarily use iPads for entertainment purposes, such as watching cartoons, listening to songs, or playing games. Observations from this study indicate that the use of iPads as learning tools in school settings is considerably less prevalent compared to their use in clinical environments.

The observed acquisition and maintenance of question-answering responses as an errorless teaching strategy minimizes learner frustration and promotes independence by systematically reducing the need for prompts. This approach is particularly beneficial for children with ASD, who often struggle with prompt dependency. This study extends the literature by demonstrating that CTD can be effectively adapted for use with high-tech SGDs, allowing learners to independently select and generate spoken responses.

Beyond promoting skill acquisition, this intervention has broader communication and developmental implications. The ability to answer "wh-" questions is fundamental to both academic and social functioning. These skills facilitate access to instruction and support the improvement of students' social skills, which are often an area needed to development for individuals with ASD.

In educational environments, teachers play a fundamental role in implementing and supporting interventions. Therefore, measuring social validity is essential for ensuring long-term sustainability in school settings. Teachers' perspectives in the school setting are essential for determining whether an instructional method is feasible within the classroom and meets students' needs. Therefore, this study focuses on assessing the intervention's social validity from the classroom teacher's viewpoint using CTD paired with an iPad-based SGD. Teacher's opinion supported effectiveness of the intervention, the student's communication improved, and the errorless method was valuable for teaching communication skills and could also be applied to various skills. However, the intervention can face obstacles when

applied in the classroom setting. The concept of using devices such as iPads for learning may not yet be adopted by all teachers. Additionally, some teachers may feel more comfortable using physical pictures instead of technology for teaching communication. Effective implementation of iPads or other SGDs requires adequate training of teachers or therapists to ensure proficiency in the use of these tools. Mastery of the devices is essential for effectively teaching students communication skills through technology; lack of training can significantly hinder the effective integration of these devices into instruction (Alzrayer et al., 2014). Training should include developing fluency in navigating various apps and customizing devices to suit individual student needs and preferences. Addressing barriers to the use of technology, such as insufficient teacher training, limited access to resources, or resistance to adopting new methods, is also crucial.

The current study aligns with existing research (Genc-Tosun et al., 2023) demonstrating the effectiveness of using iPads as speech-generating augmentative and AAC devices in school environments to improve answering questions. Future research should investigate the effectiveness of using iPads in home settings, specifically without modifying the icon folders, leaving them in their natural state, to assess the intervention's impact in a more naturalistic environment. Additionally, future studies should compare the effectiveness of the time delay method when implemented by family members and explore the feasibility of training teachers to apply these methods with children and adolescents with ASD. Such research could provide valuable insights into expanding the applicability and accessibility of time delay interventions across various settings and populations.

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Table 1

List of "Wh"-Questions with Possible Answers

"What" questions included	Possible answer
1. What does she eat?	Salads
2. What does she carry?	A box
3. What does he do?	Sleep
4. What does she grill?	Beef
5. What does he fold?	t-shirt
"who" questions included	
1. Who drinks water?	The man
2. Who eats chicken?	The girl
3. Who plays with puzzles?	The boy
4. Who does the laundry?	The woman
5. Who swim?	The dog
"Where" questions included	
1. Where does he sleep?	The bed
2. Where is the dog?	Under the table
3. Where do they eat?	In the restaurant
4. Where does she stand?	On the chair
5. Where does he jump?	The trampoline

Figure 1

Participant Scores for Each "Wh"-Question Set Across Baseline, Intervention (0-S And 2-S Delay), and Withdrawal Sessions.