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EVALUATION OF ONLINE TRAINING ON PRE-SERVICE GENERAL EDUCATION TEACHERS' CASE APPLICATION OF VISUAL SCHEDULES FOR INDIVIDUALS WITH INTELLECTUAL AND DEVELOPMENTAL DISABILITIES

A Dissertation in

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ABSTRACT

The present study evaluated the effects of online training on pre-service teachers' case application of the visual schedules strategy ("CHECK") to support individuals with intellectual and developmental disabilities. A pre/post-test control group design was utilized. Results indicated that the self-paced online training was effective in increasing pre-service general education teachers' case application of the visual schedules strategy. However, the results also indicated that participants did not apply all of the steps of the strategy, especially those steps of using visual schedules. In addition, participants agreed that the online module was socially acceptable and beneficial. The results are discussed from a perspective of training effect and social validity. Limitations and implications for future research are also discussed.

Keywords: online training, pre-service teacher, visual schedules, intellectual and developmental disability

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CHAPTER 1

INTRODUCTION

Intellectual and developmental disabilities (IDDs) generally refer to disorders or disabilities present at birth that have significant effects on the developmental trajectory, which can include intellectual disability (ID) or other developmental disabilities such as autism and Down syndrome (Biggs & Robison, 2023; Schalock et al., 2019). IDDs are characterized by individual limitations in reasoning, learning, problem-solving, language development, social interaction, emotion regulation, self-care, and behavioral regulation that not only affect a range of everyday social and practical skills of individuals but also severely impact cognitive and physical abilities (Sun, 2022; Zheng & Genaro Motti, 2018). In the U.S., IDDs affect 1 in 6 children (Boyle et al., 2011).

When attending schools or educational programs, individuals with IDDs (e.g., intellectual disability and autism) share some common challenges. One challenge is an overreliance on others to provide cues regarding the next step or activity in a sequence, completing tasks, or transitioning from one activity or setting to another independently (Smith et al., 2015; Spriggs et al., 2017; van Dijk & Gage, 2019). These issues can be exacerbated in general education settings where general education teachers often lack training on working with individuals with disabilities (Al Jaffal, 2022). In the short term, these difficulties may lead to challenging behavior and lower academic and functional achievement. In the long term, these issues may negatively impact social engagement (Gadaire et al., 2018), community access (Nord et al., 2016), and employment opportunities (National Core Indicators, 2020; Sun & Brock, 2022; Winsor et al., 2021).

Supporting students with IDDs in educational settings is a crucial first step. Methods that are self-directed and provide prompting without direct intervention from teachers may ameliorate issues with prompt dependency. To that end, visual schedules have been used to support students with IDDs in becoming increasingly independent. Researchers have found that visual schedules are an effective way to increase a range of skills (e.g., make smooth transitions and engage in class activities) and decrease challenging behaviors across age groups and settings for individuals with IDDs including autism spectrum disorder (ASD) and intellectual disabilities (Hume et al., 2021; Knight et al., 2015; Koyama &Wang, 2011; Lequia et al., 2012; Spriggs et al., 2017; van Dijk & Gage, 2018).

Visual Schedules

Visual schedules (VS) use a series of images, pictures, photographs, or line drawings to illustrate a sequence of events to visually prepare an individual for the next action or step within an activity or chain of activities and prompt them to follow a series of activities or tasks independently (Bryan & Gast, 2000; Knight et al., 2015; Koyama & Wang, 2011). By enhancing self-management skills for a wide range of individuals with ASD (Koyama &Wang, 2011) and engaging individuals in habilitative routines in the absence of other people (Kimball et al., 2004). Researchers have found that VS could be an effective way to perform a simple action, or a complex behavior chain. Enhanced self-management may promote the successful inclusion of students in general education classrooms by permitting teachers to spend more time on instructional tasks rather than behavior management (Lee et al., 2007) and decreasing teacher stress (Smolkowski et al., 2023). In the long term, self-management may also facilitate students' self-determination, a core dimension of quality of life (Lee et al., 2007; Turnbull & Turnbull, 2001). Most empirical studies of VS interventions have been conducted with individuals with

ASD. However, there is increasing evidence to show that VS can be effectively used for individuals with intellectual disabilities (including Down syndrome) as well.

Evidence-based practices (EBPs) have drawn considerable attention from both researchers and practitioners in the field of special education (Cook & Odom, 2013). Researchers applied the proposed quality indicators for high-quality research and standards for evidence-based practices to bodies of empirical literature (Cook et al., 2009). Based on this, visual schedules are evaluated as one of the EBPs that were widely used in different settings across age groups and a range of skills and behaviors for individuals with IDDs (e.g., autism and intellectual disability) by multiple, high-quality, experimental studies. Therefore, teachers (including general education teachers) could feel confident to use this method to support their students with IDDs. However, as EBPs in education began to be identified, relatively little attention has been given to implementation (Cook & Odom, 2013). Researchers suggest that teacher preparation may be a way to help bridge the gap between research and practice related to EBPs and prepare the pre-service teachers for implementing the VS and other EBPs in their future work (Golder et al., 2005; McLeskey & Billingsley, 2008; McLeskey et al., 2018).

Challenges for General Education Teachers and Teacher Preparation

Researchers have developed multiple EBPs (e.g., visual schedules) and identified other effective practices that show promise for improving outcomes for students with disabilities. However, these practices are all too frequently not used by general education teachers in inclusive classrooms (McLeskey et al., 2018).

Challenges

An increasing number of students with IDDs who have behavioral challenges are now being served in general education classrooms (Flower et al., 2017; McLeskey et al., 2012) which

requires that teachers adapt their approaches of teaching to meet the needs of all students (Alexander & Byrd, 2020). However, many general education teachers are not fully aware of how to support students with special needs effectively in inclusive environments (Alexander & Byrd, 2020; Al Jaffal, 2022; Barned et al., 2011; Bruggink et al., 2016; Merle et al., 2022). As one example, previous surveys indicated that new teachers report inadequate skills to manage a classroom and their teacher preparation programs often fail to properly prepare them to manage behavior (Flower et al., 2017). Therefore, these unprepared teachers reported diminished student learning outcomes associated with poor classroom management, increased stress resulting from student behavior problems, low levels of job satisfaction, and high rates of teacher turnover (Brunsting et al., 2014; Flower et al., 2017).

Teacher Preparation

Based on the situations of insufficient professional development for general education teachers who serve students with IDDs and the gap between research and practice regarding evidence-based practices, many researchers contend that teacher preparation is an important way to bridge the research-to-practice gap and improve teacher effectiveness (Cook et al., 2013; Golder et al., 2005; McLeskey & Billingsley, 2008; McLeskey et al., 2018). Teachers are one of the most important school-based resources in determining students' future academic success and lifetime outcomes (Burroughs et al., 2019; Chetty et al., 2014). To this end, there has been a strong emphasis on improving teacher effectiveness to enhance student learning (Burroughs et al., 2019). However, in most teacher preparation programs (e.g., university coursework), there is a limited emphasis on carefully designing the experiences necessary for pre-service teachers to learn to use complex practices in classroom settings (McLeskey & Brownell, 2015). Instead, teacher preparation emphasizes reflection and investigation which provides pre-service teachers

with some knowledge about effective instructional practices, but with very limited classroom-ready skills that they may need to implement when beginning to teach in real classroom settings (Grossman et al., 2009; McLeskey & Brownell, 2015).

To address the need to improve teacher effectiveness, teacher preparation has been undergoing a major shift. Teacher educators in teacher preparation programs have recognized the need to specify practices that all teachers should learn to use in the classroom to improve student outcomes (McLeskey et al., 2019; McLeskey et al., 2022). In addition, teacher preparation has started to highlight the practice of teaching in the classroom, provide opportunities for teachers to learn classroom practices, and tend to prepare more effective teachers (Boyd et al., 2009; Burroughs et al., 2019; McDonald et al., 2013; McLeskey et al., 2022).

Asynchronous Online EBP Training for Pre-service Professionals

Traditionally, face-to-face instruction is the main delivery method for teacher preparation or teacher education. As technology advances, there has been a significant increase in the number of available online resources and educational technologies (Ebner & Gegenfurtner, 2019; Testers et al., 2019), which have gained importance in higher education and professional training contexts (Ebner & Gegenfurtner, 2019). According to the latest report detailing statistics on online education enrollment, 61 percent (9.4 million) of all undergraduate students were enrolled in at least one online course, 28 percent (4.4 million) of all undergraduate students exclusively took online courses in the fall of 2021 (National Center for Education Statistics, 2023).

Compared with face-to-face traditional instruction, online training allows professionals to deliver interventions remotely by using communication technology such as the web and mobile applications (Ebner & Gegenfurtner, 2019), which has the potential to replace or improve traditional service models to increase access to evidence-based intervention (Baggett et al.,

2010). Asynchronous online training (e.g., self-paced telepractice and self-directed online modules) provides information via websites and encourages learners to independently review and learn the material without communicating with trained professionals in real-time, which could be more flexible to access, time-independent, learner-controlled, cost-effective, and globally accessible (Johnson, 2004; McCoy & McNaughton, 2021).

In published research, asynchronous online training has been successfully provided for pre-service professionals (e.g., special and general education teachers, speech-language therapists) on instructional methods or collaboration strategies that can be used for individuals with disabilities including the system of least prompts (McCoy & McNaughton, 2021), discrete trials teaching (Geiger et al., 2018; Higbee et al., 2016; Nosik & Williams, 2011; Pollard et al., 2014), backward chaining (Nosik & Williams, 2011), incidental teaching (Neely et al., 2016), reciprocal imitation training (Wainer & Ingersoll, 2013), universal design for learning (Courey et al., 2013; Lee & Griffin, 2021), data-based instructional decision (Wolfe et al., 2023), and family-centered relational skills (Mandak et al., 2020). When organizing and providing online training for pre-service professionals, strategy instruction could be used to deliver asynchronous online training.

Strategy Instruction

Strategy instruction is a method for teaching individuals to apply a series of multi-step procedures to address a specified challenge and it has been closely associated with long-term generalized use of new skills (Ellis et al., 1991; Kent-Walsh & Mcnaughton, 2005). When using a strategy instruction framework, the goal is for instructors to identify the component skills of a strategy and then teach learners to sequence, demonstrate, and master the strategy in an efficient manner (Mandak et al., 2020). Ellis et al. (1991) introduced and specified a sequence of eight

instructional stages. The strategy instruction model of Ellis et al. (1991) provided evidence-based instructional guidelines to assist learners in acquiring targeted strategies, implementing these strategies across a variety of activities, and maintaining their long-term use (Ellis et al., 1991; Kent-Walsh & McNaughton, 2005). Although strategy instruction has primarily been implemented and evaluated in traditional classroom learning environments (i.e., in-person instruction), there is some evidence of its effectiveness in an online environment (Douglas et al., 2013, 2017) as well. The instructional sequence outlined by Kent-Walsh and McNaughton (2005) was adapted for use in an online environment and included the following stages: pretest and commitment to learning the strategy, description of strategy, demonstration of strategy, verbal practice of strategy steps, controlled practice and feedback, advanced practice and feedback, posttest, and commitment to implementing the strategy, and generalization. In addition, there is some specific evidence of its effectiveness in an asynchronous way to deliver training for pre-service professionals (Liang et al., 2023; Mandak et al., 2020; McCoy & McNaughton, 2021).

Current Study

Given the increasing number of students with IDDs served in general education classrooms and the established effectiveness of visual schedules for those groups of students, there are no known peer-reviewed investigations that explicitly developed and evaluated online training to increase the skills of visual schedules for pre-service general education teachers who would serve students with IDDs in inclusive classrooms. As the popularity of online courses and programs continues to rise, more attention should be paid to the ways in which students approach and experience these courses, how to guarantee the quality of information offered to teacher candidates in an online format, and how student characteristics (e.g., motivation) and activities

(how they study and approach the material) relate to their success (Stark, 2019; Vernon-Dotson et al., 2014). To this end, evidence-based practices in online learning design and training methods were used in the current study to improve the quality and effectiveness of online training.

Researchers in the current study created a self-paced online training module of visual schedules. There have been no known attempts in the literature to systematically evaluate an instructional intervention for teaching pre-service teachers to make and use visual schedules that incorporate all the steps typically identified as important in strategy instruction. The instructional sequence outlined by Kent-Walsh and McNaughton (2005) based on the model of Ellis et al. (1991) was adapted for use in the self-paced online training environment and included the following stages: pretest, strategy description, strategy demonstration, and guided practice and independent practice, and posttest.

The current study sought to evaluate the effects of a self-paced online training module on the pre-service general education teachers' case applications of visual schedules strategy. Together, it was hypothesized that the self-paced online training will increase the accuracy of applying the visual schedules strategy for pre-service general education teachers to address the challenging situations in the cases. The current study sought to address the following questions:

1. What were the effects of online training on the pre-service general education teachers' application of key steps of making and using the visual schedules based on given cases?

2. What was the reported social validity of the online training for visual schedules strategy?

CHAPTER 2

METHOD

Participants and Setting

Participants were recruited from in-person courses taught at a large, public university in the Northeast. Undergraduate students who majored in general education were enrolled in the courses. Sixty-five students provided informed consent to have their data included in the current study and are referred to as participants. At the beginning of the study, all participants completed a demographic questionnaire (See Table 1). Participants ranged in age from 20 to 22 years old (mean age 20.5 years). All participants were required to complete assessments (pre- and post-probe) in the classroom setting. All instructional content on the visual schedule was delivered online (AAC Learning Center Moodle).

Table 1

Demographic information

Characteristic	**n**	**%**
Gender		
Female	50	77%
Male	15	23%
Major		
Elementary Education	32	49%
Secondary Education	18	28%
Middle-Level Education	7	11%
Early Education	5	8%
Music Education	2	3%
World Language Education	1	1%
Race		
White	55	85%
Asian	4	6%
Black or African American	2	3%
American Indian or Alaska Native	1	1%
Prefer not to say	3	5%
Ethnicity		
Not Hispanic or Latino	53	82%
Hispanic or Latino	7	10%

Prefer not to say	5	8%

Research Design

The current study utilized a quasi-experimental, pre/post-test group design (Edmonds & Kennedy, 2017). Participants were randomly assigned to either the experimental or control group. Participants in the experimental group were required to complete the VS module, and participants in the control group were required to complete another online module (Introduction to Augmentative and Alternative Communication). Within their respective groups (control or experimental), the participants were further subdivided, randomly, into subsets 1 and 2. The purpose of the subsets within the groups was to reduce the effects of potential differences between cases used in the assessments. As shown in Table 2, all participants completed the pre-probe (probe#1). Then the experimental group immediately engaged with the visual schedule instructional module online, followed again by both groups receiving post-probe (probe#2; a post-test for the experimental group, and a second pre-test for the control group).

Table 2

Research design and procedures

Group	Probe#1	Online Training	Probe#2
EXP	Case 1	X	Case 2
	Case 2	X	Case 1
CNTL	Case 1		Case 2
	Case 2		Case 1

Independent Variable

The study made use of Moodle 4.1, an online open-source learning management system (AAC Learning Center Moodle). The independent variable was a self-paced online training module for delivering strategy instruction on visual schedules strategy “CHECK” (see Appendix A for details). The steps of the “CHECK” strategy are as follows:

- **Make visual schedules.**
    - **C**onsider the steps, preferences, and/or choices for the learner.
    - **H**elp the learner with meaningful representations and layouts that support self-monitoring.
- **Use visual schedules.**
    - **E**ngage the learner using model, guided practice, and independent practice.
    - **C**ollaborate to support widespread use.
    - **K**eep data and make changes as needed.

Strategy Development

Learning strategies are principles, procedures, or rules for solving problems and independently completing tasks (Conderman & Hedin, 2014; Friend & Bursuck, 2012). An effective strategy (Conderman & Hedin, 2014) should: (1) contain a series of steps leading to a successful outcome, (2) steps should be sequenced for efficient task completion, (3) steps should cue cognitive and/or metacognitive processing (e.g., Why do I do this?), (4) steps should cue the learner to take some type of overt action (e.g., write, say), (5) each step should begin with a verb, (6) contain no more than seven steps to limit processing or memory load, and (7) strategy steps should include words that learners can easily understand.

Mnemonic strategy instruction is based on the premise that concrete information that is meaningful or familiar may be elaborated and made easier to learn than abstract and seemingly unrelated information (Fontana et al., 2007; Scruggs & Mastropieri, 1990b). As one of the mnemonic strategies, acronyms can facilitate the recall of lists of information (Fontana et al., 2007). Therefore, researchers in this study summarized the key steps of making and using visual schedules based on the published literature reviews (e.g., Banda & Grimmett, 2008; Knight et al.,

2015; Koyama &Wang, 2011; Lequia et al., 2012; Stromer et al., 2006). Then researchers developed the steps of the visual schedules strategy by using the acronym “CHECK” based on the requirement of an effective strategy. Expert practitioners in special education who had experience working with students with IDDs and using visual schedules reviewed the case examples and “CHECK” strategies. Based on the feedback, the researchers revised and further confirmed the strategy.

The Rationale and Development of the “CHECK” Strategy

Consider the steps, preferences, and/or choices for the learner.

Breaking down a task or a complex or “chained” behavioral skill into smaller steps is an evidence-based strategy to teach a skill (Leaf et al., 2021). As the smaller steps are mastered, the learner becomes more independent in his/her ability to perform the larger skill (Steinbrenner et al., 2020). In addition, the primary purpose of giving a person choice or offering a person preferred items or activities is to provide them with some control over certain situations. Previous studies demonstrated that providing choice-making opportunities as an intervention within visual schedules could promote adaptive behavior and task engagement and reduce challenging behavior in individuals with autism spectrum disorder and other developmental disabilities. Schedules can and should include times for free choice by the individual, because making choices strengthens communication skills, increases the person's willingness to cooperate with the schedule, and provides the person with control and pleasure (Lory et al., 2020).

Help the learner with meaningful representations and layouts that support self-monitoring.

Self-monitoring is the most commonly used self-management intervention for students with disabilities which is often utilized in conjunction with visual support. By accurately monitoring and recording their own behaviors, and delivering reinforcers to themselves for

behaving appropriately, the self-monitoring strategy has been used to improve on-task behavior, academic productivity, and various social behaviors (Davis et al., 2016; Schulze, 2016).

Key aspects of effective self-monitoring are choosing the visual representation form and considering students' level of symbolic communication (including written words, picture symbols, real-life pictures, or objects). The student should be able to understand what each step of the visual schedule represents with little to no guidance. Unfamiliar words or images that the student does not already know or that will require intensive teaching to understand should not be used (Hugh et al., 2018; Elliott & Swain, 2021; Spriggs et al., 2015). Considering the appropriate methods of manipulating the schedule after completing each step or task during creating a VS could provide students with opportunities to monitor their own behaviors. Researchers in the present study used words and concepts familiar to participants to support self-monitoring.

Engage the learner using model, guided practice, and independent practice.

Explicit instruction (EI) has been defined as a series of research-supported instructional behaviors used to design and deliver instruction that provides needed support for successful learning through clarity of language and purpose, and reduction of cognitive load. It promotes active student engagement by requiring frequent and varied responses followed by appropriate affirmative and corrective feedback and assists long-term retention through the use of purposeful practice strategies. Model, guided practice, and independent practice are essential components of EI (Morris et al., 2021; Hughes et al., 2019; Riccomini et al., 2017).

Collaborate to support widespread use.

With increased expectations for inclusive models of K-12 education for students with disabilities, there has been an emphasis on effective collaboration among general and special education teachers (Da Fonte & Barton-Arwood, 2017). Effective teachers collaborate with a

wide range of professionals to ensure that educational programs are effectively designed and implemented to meet the needs of each student with a disability. Effective collaboration ensures that students' learning experiences are planned, taught, and enhanced in ways that support positive student outcomes (McLeskey et al., 2019).

Keep data and make changes as needed.

Data-based decision-making is a process of gathering data about how students are progressing toward specific goals in academic or behavioral performance. Collecting data is an important part of the educational process. Such procedures help educators, caregivers, and other important stakeholders make data-based decisions to accelerate student progress. Collecting data has been associated with more frequent instructional changes to better meet students' needs, increased quality of Individual Education Plan (IEP) objectives, and increased student performance (Gischlar et al., 2009; Hojnoski et al., 2009).

Strategy Instruction Model for Visual Schedules

Researchers in this study proposed an instructional model for visual schedules strategy ("CHECK"). The following briefly describes how each stage of strategy instruction (See Table 3) was utilized within the self-paced online module in the current study.

Table 3

Overview of the sections and stages of CHECK strategy instruction

Sections	Stage	Description
Introduction	Strategy description	Text and images were provided to introduce and describe the situations in which the target strategy could be used, the benefits of using the target strategy and its component skills, as well as the method for remembering the steps involved in implementing the strategy.
	Strategy demonstration	The case application of the targeted strategy was modeled step-by-step via text and image based on one case scenario.

Model and Guided Practice	Controlled practice and feedback	Pre-service teachers practice implementing the targeted strategy based on case scenarios with gradual fading of prompting. The learners would receive general feedback (e.g., correct or incorrect) after completing each practice.
Independent Practice	Advanced practice and feedback	Pre-service teachers practice implementing the targeted strategy in multiple real-life case scenarios without prompting. The learners would receive the general feedback (e.g., correct or incorrect) after completing each practice.

Introduction to VS and CHECK

This section of the module began with the introduction of the visual schedules (e.g., definition and key considerations) and a description of the "CHECK" strategy. Descriptions were a combination of text and images. In addition, each step of the "CHECK" strategy was explained separately, and multiple-choice questions were posed and required participants to answer prior to moving on to the subsequent section.

Model and Guided Practice

After the instruction of key concepts and instructional steps, the "CHECK" strategy was modeled step-by-step using a case example. Guided practice, referred to as controlled practice by Kent-Walsh and McNaughton (2005), provided practice "with gradual fading of instructor prompting and feedback". Three new case examples were introduced in the guided practice section and participants were provided with the opportunity to practice describing the required instructional steps (fill in the blanks or multiple choice) based on "CHECK" (Kent-Walsh & McNaughton, 2005; McCoy & McNaughton, 2021).

Independent Practice

Independent practice activities were included at the end of the online module. The independent practice was also based on a case example that was adapted from a published study (Cohen & Demchak, 2018). In this section, the participants were expected to apply the newly acquired "CHECK" strategy to address the problem in the case examples.

Online Module Development

Researchers used Moodle and H5P to develop and deliver the training materials. All training materials were presented as a combination of written text, pictures, and videos within the Moodle platform. The Moodle Learning Management System (LMS) is widely used in online teaching and learning, which is one of the commonly used technology-based learning platforms to manage online learning in schools, universities, workplaces, and other sectors (Athaya et al., 2021; Gamage et al., 2022). By using the Moodle system, students were encouraged to actively engage in learning by themselves instead of only following the instructors' requests (Athaya et al., 2021). To effectively facilitate engagement in this online module, the researchers created interactive practice by using the H5P. H5P is free software, and open source to assist in creating, sharing, and using interactive content (Amali et al., 2019).

In addition to the use of a strategy instruction framework, general guidelines from EBPs in e-learning design and instructional design were utilized to create the online training materials. First, the explanations in each section were short and succinct with relevant visuals and examples (Clark, 2020; Clark & Mayer, 2016). Second, for each section, there were frequent opportunities for participants to engage with the content (e.g., multiple choice questions, questions linked with case examples, and questions embedded in the videos; Clark, 2020; Clark & Mayer, 2016). Third, instructional design and principles for multimedia (Clark, 2020; Clark & Mayer, 2016)

were applied including (a) contiguity, presenting words and graphics near one another on-screen, (b) coherence, limiting the quantity of information presented (e.g., less is more), and (c) segmenting and pretraining, breaking complex lessons down into smaller parts and teaching important concepts and facts prior to procedures.

Within each section of the online module, some self-check practices were provided to help the participants learn the key points or principles of VS and the "CHECK" strategy. Such activities were designed to be answered in different ways: (a) multiple-choice questions based on case examples, (b) interactive videos with embedded questions, and (c) short answer questions based on case examples. The applied case examples used in case application assessments and self-check practices were created by the researchers based on real-life situations in different educational settings and some of them were adapted from published peer-review studies (e.g., Cohen & Demchak, 2018).

Procedures

Assessment Procedures

Based on the research design, all the participants in both study groups (control and experimental) produced hand-written responses in a classroom setting for pre-probe (probe#1). Half of the participants in each study group (control and experimental) were randomly assigned to Case One and the others were assigned to Case Two in order to control for possible case-based effects. Next, the participants in the experimental group started the VS module while the participants in the control group worked on another module (Introduction to Augmentative and Alternative Communication) on the AAC Learning Center Moodle. Finally, all participants completed the post-probe (probe#2) in the classroom. At this stage, the participants who completed Case One in pre-probe received Case Two, and vice versa.

Training Procedures

The online training in this study was self-paced and participants could complete the 40-minute training independently at any time within a one-week period. The training did not need to be completed in one sitting, but participants had to successfully complete all activities in order to complete the training. The participants in the experimental and control group learned the contents of the self-paced online module section by section without additional feedback from the instructor.

Dependent Variable and Measurement

The dependent variable was the accuracy of the strategy steps as used in the applied case application of making and using the visual schedule. The *case application assessment* (See Appendix B and C for cases one and two along with participant instructions) consisted of two cases. In each case, detailed background information on an individual with IDD was provided. The individual needed ongoing support (e.g., teachers or teaching aides) to initiate and complete academic tasks or routine activities independently in school settings and were also potential users of VS. Based on the background information, study participants were required to provide a short-written description of how to implement the "CHECK" strategy (see the Appendix B and C for the instruction of case example). The descriptions were evaluated by determining if the participants applied the steps of VS strategy correctly in each situation. If the participants identified that a VS could be a potential strategy for support, then researchers compared the participant response with a standard of correct steps for making and using VS. The participants could also choose to draw diagram of the VS that they planned to make.

The researcher developed the case examples and questions after reviewing multiple sources on visual schedules (e.g., Bryan & Gast, 2000; Cohen & Demchak, 2018; Koyama

&Wang, 2011; Pierce et al., 2013). The case examples and short-written questions were piloted with a small group (n = 5) of Ph.D. and master's students in special education and communication science and disorders programs. Furthermore, to strengthen the validity of the case application assessment questions, two faculty members with experience in intervention for individuals with IDDs reviewed the case examples and questions and confirmed that the test items appropriately addressed the concept, procedure, and conditions for making and using visual schedules strategy for individuals with IDDs.

Data Collection and Analysis

The dependent variable was the accuracy of the strategy steps in the applied case application of making and using the visual schedule. For scoring the response on the case application assessment, researchers created a rubric (see Appendix D) based on the "CHECK" strategy. The case response was evaluated by scoring the steps (a total of 9 points) written in the responses. The gain scores (i.e., the pretest subtracted from the posttest) of the experimental and control groups were analyzed using an independent samples t-test. This test allowed for the comparison of gain scores from posttest and pretest interactions of the experimental and control groups to determine if there was a statistically significant difference between the groups. To ensure the appropriateness of this test for answering the research question, assumptions about outliers, normality, and homogeneity of variances were tested. To determine the size of the difference between the two groups, an effect size (Cohen's d) was calculated (Cohen, 1988). An effect size greater than .8 is considered large. The analysis was completed using IBM Statistical Package for the Social Sciences (SPSS) Statistics.

Training of Data Coder

A graduate student pursuing a doctoral degree in special education, who was naïve to the treatment condition, independently scored case application assessments. The training was provided individually and consisted of description, model, practice, and feedback. The coder practiced until performance reached at least 90% agreement with the researcher across two consecutive practice trials. The point-by-point agreement was used to calculate reliability (total number of agreements/total number of agreements and disagreements *100). Interobserver reliability for the dependent variable was calculated as 98% (range of 92 to 100%).

Social Validity

Participants completed a social validity questionnaire developed by the researchers based on the framework of social validation by Schlosser (1999). Participants were asked to evaluate elements of social validity and to provide their perceptions on the importance of learning VS, the acceptability of the instructional methods used, and the impact of the instruction. Participants provided information by responding to the questions on a Likert scale of 1-5 (with 1: strongly disagree and 5: strongly agree) as well as open-ended responses. The social validity assessment was the last section of the online module. All participants had to submit social validity information before receiving the completion certificate for this module.

CHAPTER 3

RESULTS

The aim of the current study was to evaluate the effects of online training on pre-service general education teachers' case application of visual schedules strategy. The dependent variable was the accuracy of the strategy steps in the applied case application of making and using the visual schedule. Results for the dependent variable are presented below. The means (*M*) and standard deviations (*SD*) for the dependent variable across groups are reported in Table 4, the case application of each step of the "CHECK" strategy is reported in Figure 1, and the results of social validity are reported in Table 5.

Case Applications of CHECK Strategy

At pre-probe assessment, the participants in the control group accurately implemented a mean of 0.2 out of 9 steps, and participants in the experimental group accurately implemented a mean of 0.4 out of 9 steps. Without training, participants across groups completed a mean of less than 5% of the strategy steps. At post-probe assessment, the participants in the control group accurately implemented a mean of 0.2 out of 9 steps, and participants in the experimental group accurately implemented a mean of 4 out of 9 steps. The experimental group (who completed the training) showed a gain of +3.6 (range +1 to +8) in steps completed accurately from the pre-probe to post-probe interactions. In comparison, the control group (who did not complete the training) did not demonstrate a gain from the pre-probe to post-probe interactions.

An independent samples t-test confirmed the difference between the gain scores of the experimental group and the control group. The results indicated no statistically significant difference for the pre-probe between the experimental and the control group, $t(63) = .962$, $p = .074$, indicating initial group equivalence. The gain scores were higher for the experimental

group (M = 3.67, SD = 1.84) than the control group (M = -.08, SD = 0.59), with a statistically significant difference, t (63) = 11.767, p <0.001. These data indicated an increase in the case application of visual schedules for participants in the experimental group after receiving the online training. Cohen's *d* was calculated to determine the magnitude of the effect of the training. Results indicated a large effect (d = 1.26) (Cohen, 1988).

Table 4

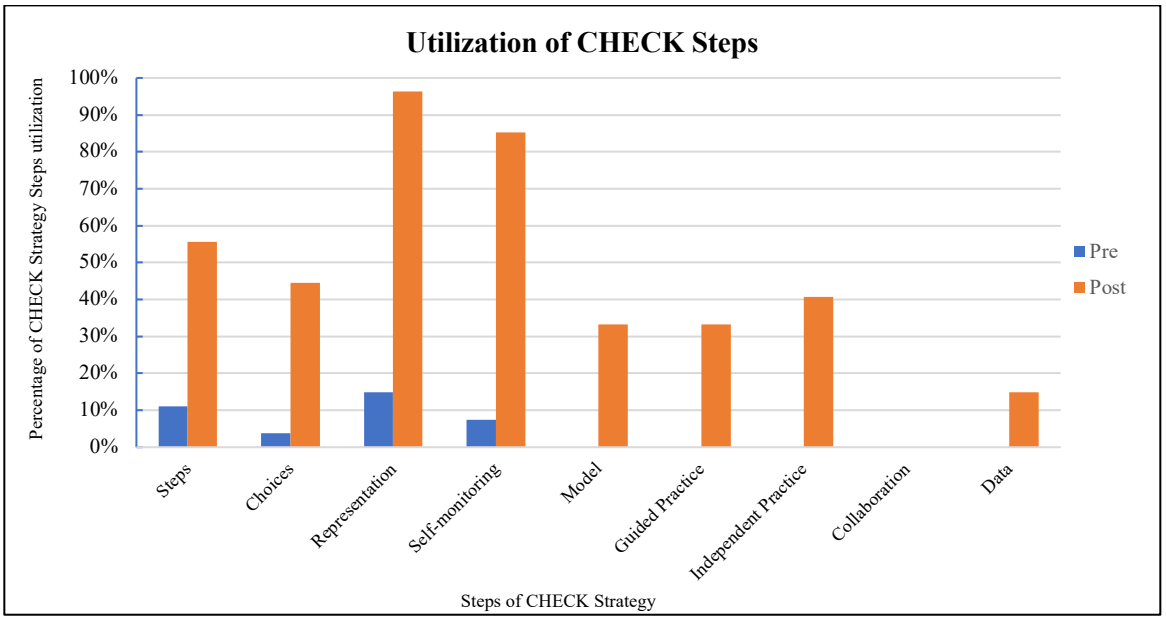
Means and SD of participants by the group

	EXP			CNTL		
Measure	n	M	SD	n	M	SD
Pre-probe	27	0.4	0.63	38	0.2	0.49
Post-probe	27	4.0	1.56	38	0.2	0.44

As shown in Figure 1, the majority of the participants in the experimental group applied steps of helping learners with meaningful representations (96%) and layouts that support self-monitoring (85%), more than half of the participants utilized the step of considering steps (56%), less than half of participants applied the steps of considering the opportunities for choices (44%), engaging learners with the model (33%), guided practice (33%), and independent practice (41%), and keeping data and making changes as needed (15%). No participant applied the step of collaborating to support widespread use (0%).

Figure 1

Case application of CHECK strategy steps in experimental group



Social Validity

Participants were provided with an opportunity to provide feedback on the online training goals, materials, and procedures anonymously. Most of the participants rated all social validity statements between a 4 (agree or improved or recommended) and a 5 (strongly agree or strongly improved or strongly recommended) on a 5-point scale. The percentage of participants' ratings can be found in Table 5. The highest-rated questions indicated that participants felt the goals of learning the knowledge of making and using a VS were very important, and their skills had improved through the online training program on visual schedules. Participants indicated that they would also recommend this online training module to other people. In addition, 65% of the participants reported that they used guided notes during the online learning.

Table 5

Participants' social validity responses

Rating	Skills improved	Important goal	Effective methods	Module recommended
5	54%	57%	44%	45%
4	44%	40%	46%	46%
3	0%	1%	2%	5%
2	2%	1%	4%	2%
1	0%	1%	4%	2%

In addition to rating four questions on a 5-point scale, participants were provided with three open-ended questions (See Table 6). Students reported satisfaction or liked most with the instructional activities specifically related to interactive videos with embedded questions; a self-paced and simple style of the online module that was easy to follow; downloadable guided notes to support the online learning and future use; use of multiple ways (e.g., text, visuals, and video) to deliver the instructional materials and repeated opportunities to practice (answer questions along the way to ensure understanding). In addition, participants suggested the following for improvement including adding more videos and interactive content and more independent practices. Furthermore, participants would like to see certain topics (e.g., behavior management) to be addressed with online learning modules.

Table 6

Responses to open-ended questions

Questions and responses	**n**	**%**
What did you like the most about this module?		
Interactive activities (e.g., videos with embedded questions)	25	63%
Guided notes	20	50%
Self-paced activities	10	25%
Simple instruction style	8	20%
Multiple types of materials	5	13%

Repeated practice opportunities	4	10%
What recommendation do you have for improving this module?		
More interactive videos	26	65%
More engaging content	15	38%
More independent practices	4	10%
More variation of practices	4	10%
What other topics would you like to see addressed with online learning?		
Behavior management	10	67%
Classroom management	4	27%
Course and unit organizer	1	6%
IEP	1	6%
Task analysis	1	6%

CHAPTER 4

DISCUSSION

The current study sought to address the following questions: (a) What were the effects of online training on the pre-service general education teachers' application of key steps of making and using the visual schedules based on given cases? and (b) What was the reported social validity of the online training for visual schedules strategy? Results indicated that the self-paced online training was effective in increasing pre-service general education teachers' case application of the "CHECK" strategy in terms of making and using visual schedules. Furthermore, participants were in agreement on the social acceptability of this online module.

Although the overall results of the study were promising, the participants did not apply *all* the steps of the strategy ("CHECK") to address the post-test case study. Researchers considered potential reasons that participants demonstrated improvement but also those for whom the training did not result in the desired outcome to create training that is effective for all individuals. The results are discussed further regarding the immediate training effect and social validity from a perspective of effective online training and socially valid online training, potential reasons for the gaps of results, future implications, and limitations.

Effective Online Training

There is a clear need for educators and other professionals, particularly those who work with individuals with disabilities, to have effective training on evidence-based intervention strategies. Implementing EBPs with high levels of fidelity can significantly improve academic and social outcomes for students with disabilities (Sawyer et al., 2017; Vaughn & Dammann, 2001). However, providing meaningful training opportunities to educators has historically been difficult (McCoy & McNaughton, 2021; Rakap et al., 2015). To bridge the gap and prepare pre-

service general education teachers to use EBPs in their future jobs, the current study evaluated the effectiveness of a self-paced online training module on pre-service general education teachers' case application of visual schedules strategy.

The case application assessments emphasized how to implement the "CHECK" strategy. The results demonstrated a statistically significant increase in case application of the strategy ("CHECK") for participants in the experimental group through the online training module. In the present study, researchers utilized multiple strategies to ensure the effectiveness of the online training program. Despite the novelty of e-learning, it is important to note that it is not the online environment that makes instruction effective, but rather the instructional methods that are delivered through the online medium. In this study, instructional procedures drawn from strategy instruction (Ellis et al., 1991; Kent-Walsh & McNaughton, 2005) were paired with principles of effective e-learning (Clark, 2020; Clark & Mayer, 2016) to teach visual schedules strategy to pre-service general education teachers.

Strategy Development and Strategy Instruction

Researchers in this study created an acronym ("CHECK") to summarize the key steps of strategy in terms of making and using VS. The "CHECK" strategy contained a series of sequenced steps leading to the successful utilization of VS. The steps of the strategy begin with a verb, cue learners' actions, and include words that learners can easily understand. In this way, the acronym of the strategy could limit the processing or memory load, support the memorization of the key steps, mastery of the key steps, and more "structured" application of VS.

The current study also added evidence that strategy instruction can be effectively utilized in an online environment. Researchers created a strategy instruction model for the "CHECK" strategy which provides evidence-based instructional guidelines to assist learners in acquiring the

strategy and implementing the strategy across multiple individuals and activities in the case examples. As the first stage of this strategy instruction model, the researchers described and demonstrated each step of the strategy with concise text and related images. Following this, researchers also used multiple stages of practice with gradually decreasing levels of prompting and feedback.

EBPs in e-learning Design

Researchers utilized general guidelines from EBPs in e-learning design when creating the online training module. Instructions in this module were short and succinct explanations with relevant visuals and examples that may help learners understand the key concepts and steps easily and clearly. The frequent follow-up activities for each section supported the mastery of learning concepts and steps and also engaged participants, especially the interactive video with embedded questions as participants responded in the social validity survey. Furthermore, the instructional design and principles for multimedia used in this online module, presenting words and graphics near one another on-screen and limiting the quantity of information presented, likely reduced the cognitive load associated with the task (Clark, 2020).

Socially Valid Online Training

Results from this study extended the work of recent research utilizing online instruction to teach specific EBPs, which have reported practitioner satisfaction with the training delivery format (e.g., online module; McCoy & McNaughton, 2021; Neely et al., 2016). In addition to the online training materials and delivery format, participants in the present study agreed about the training outcomes. Specifically, participants responded that: (a) online training improved the utilization of VS strategy, (b) they had learned an important skill for future work as a result of participation in this online training, (c) the methods used to teach in this online lesson were

effective and (d) they preferred to recommend this self-paced online module to another person. In addition, some participants responded to open-ended questions and agreed that the way of organizing the online training module made the content easy to follow and understand, the guided notes were helpful for learning and using in the future, and the interactive videos with embedded questions were engaging. That said, some participants also suggested adding more videos and interactive content, and more independent practice could be helpful.

Potential Reasons for the Gaps in the Results

Researchers expected that learners could respond to the case example in terms of making and using the visual schedules based on the "CHECK" strategy. In this way, learners were required to use all the steps of the "CHECK" strategy. The results of the current study indicated that participants did not apply ***all*** the steps of the "CHECK" strategy in the case example. Specifically, participants failed to apply those steps of using visual schedules to the case including engaging learners with the model, guided practice, and independent practice, collaborating to support widespread use, and keeping data and making changes as needed.

Based on participants' responses to case applications and feedback on the social validity survey, the researchers analyzed the potential reasons for the difficulties. First, and most importantly, participants did not generalize the CHECK strategy they learned in the self-paced online module to the case response (post-probe assessment). Generalization is a crucial component or stage of learning knowledge and skills (Haring et al., 1978; Stokes & Baer, 1977). The students could use the target skills accurately and fluently. However, they did not typically use it in different situations or settings or may have confused the target skill with "similar" skills. The goal of the generalization phase is to help the student use skills in the widest possible range of settings and situations (Haring et al., 1978) or emit a target behavior in a setting or stimulus

situation that differs from the instructional setting in any meaningful way (Copper et al., 2020). In this study, researchers utilized a model of strategy instruction to create and deliver instructional materials. Multiple cases with different challenging situations were provided to support the participants in learning the target strategy and expected that they could use this strategy to address the other challenging situations in the case response (post-probe assessment). However, the controlled practices (guided practices) in this online module may have differed from responses required in case probes, leading to issues with generalization. The controlled practice required the participants to identify steps of the CHECK strategy by filling in the missing words of the target strategy and dragging and matching the steps of the target strategy. On the contrary, the participants were asked to provide short-written responses on how to use the strategy in the post-probe assessment. Additionally, the advanced practices section (independent practice) in the strategy instruction included only one practice item that had the same requirement as the post-probe assessment, which was not enough to support learners to generalize the strategy.

Secondly, the model of strategy instruction was typically utilized in the live environment or delivered in person. In the live session, trained professionals could communicate with learners and provide effective feedback that is goal- or task-directed, specific, and neutral. Feedback has long been recognized as an effective tool for student learning. Instructional feedback is essential for learning, as it provides students with key information about their progress toward a learning goal, including what they know, what they still need to know, and how they can learn it. Research consistently indicates that providing students with effective instructional feedback has a powerful effect on their learning and is an essential core teaching practice (American Psychological Association, 2015; O'Brien et al., 2022). When used in the self-paced online

environment in the current study, the feedback component of the strategy instruction was general words or short phrases. Such feedback may not be supportive for the learners to master the key steps of the CHECK strategy and impede the generalization of the target strategy.

Furthermore, there is a need to distinguish between the training and measures. The measures of this study focused more on the participants' descriptions or writing about the CHECK strategy instead of implementing the strategy step-by-step. However, the self-paced online training in this study was focused on procedural knowledge. In addition, the question in the probe assessment was general which may lead to the participants' responses in a more general way. Some participants responded that VS could be a better choice to solve challenging situations in the case response, but they failed to describe how to use the target strategy step-by-step.

Finally, the post-probe assessment in the current study was not a gradable assignment. Learners' motivation to learn and use the strategy was one of the most important factors that may affect the ultimate success of strategy instruction (Ellis et al., 1991). Although the easy-to-follow instructional style and highly interactive content could engage the learners, credit for learning the online module based on the performance may help to motivate the learners.

Future Implications

Higher-education faculty should integrate performance skills training procedures into their college teaching methods if students (i.e., pre-service teachers) are to be equipped with EBPs for use on the job (Sawyer et al., 2017). As the current study identified some missing steps of the CHECK strategy when participants applied to the case example, especially those steps that were difficult to apply to the case example, future studies are necessary to find ways to improve the effectiveness of the self-paced online training for pre-service professionals as they learn how

to use visual schedules or other EBPs for individuals with IDDs. Several recommendations could be drawn from the results of this empirical study for future practice and research.

Professionals who work in teacher preparation could use multiple methods or strategies to create and deliver self-paced online training to support their students in mastering the EBPs. To better guarantee the effectiveness of the online training, faculty or professionals who work in teacher preparation should: (1) use principles of strategy development to summarize the key steps of the strategy. Based on these, professionals could use a series of sequenced steps leading to the successful utilization of a certain strategy. The steps of the strategy begin with a verb, cue learners' actions, and include words that learners can easily understand. Also, the mnemonic strategy (e.g., acronym) could be used to help learners memorize the key steps; (2) use EBPs in instructional design to create online training materials. In this way, professionals could use short and succinct explanations with relevant visuals or examples and frequent follow-up activities for each section. Some suggestions for the activities include making the learning assignments or activities gradable to increase motivation and engagement, providing the learners with guided notes and encouraging learners to use the notes while learning online, and using interactive content (e.g., interactive videos with embedded questions); (3) utilize the strategy instruction model in the online environment. First, in the strategy description, professionals can describe each step of the strategy by using a combination of text and images and require learners to complete multiple-choice questions. Second, in the strategy demonstration, each step of the strategy could be demonstrated via a limited quantity of information. Also, each step could be demonstrated by using texts, and images or shown via videos that are taped by experienced teachers or professionals. Third, in the controlled and advanced practice with feedback, professionals could provide written case examples in which the situations are similar to real

educational settings or adapt the case examples based on peer-reviewed empirical studies. To maximize generalization, the response of learners in the online environment should be as similar as possible to the response when implementing the procedure in real settings. After that, use different types of practices (e.g., fill in the blank, drag and match) with decreasing levels of prompting. Based on the responses and performance, the automatic feedback in the self-paced online module should be created in a goal- or task-directed, specific, and neutral way.

Researchers in future studies can (1) add live video in which experienced teachers or professionals introduce how they successfully use those steps with their students with IDDs, (2) use cases or videos of challenging situations in real educational settings to help learners identify the importance and usefulness of a certain strategy. Then, introduce the situations or conditions in which the strategy could be used and benefit the learners, (3) provide more practice for those missing steps in multiple ways (e.g., interactive videos) and (4) provide goal-directed, positive, and corrective feedback on the learners' response or performance in the section on controlled and advanced practices. In addition, researchers should consider how to purposely support learners to generalize the strategy to different settings and activities. In this way, they could further examine the outcomes in terms of generalization of the training effect. These implications not only apply to the CHECK model, but to training on similar models as well. Researchers could also use the above-mentioned methods or strategies to create self-paced online training programs on other EBPs and examine the effects of the training.

Limitations

Although positive, the results of the work must be viewed through the limitations of the study. First, and most importantly, the researcher in the current study did not purposely provide training for generalization and evaluate generalization in real classroom settings. The practice in

this online module was not enough to help learners generalize the application of the visual schedules strategy to address the different challenging situations in the cases. This limitation of the practical significance of online training in the current study is unclear, and it is more challenging to predict it. Also, we could not know what differences the participants could make for the students with IDDs when using the visual schedules strategy in the classrooms. Multiple steps or studies could make this online training module comprehensive and link acquisition to applied settings. This study is the first step and future work will make the connection. For future studies, researchers could develop and provide more controlled and advanced practice in the online module to support learners in generalizing the strategy to address different challenging situations in the cases. Researchers could also provide extra case examples (probe#3) in which different settings or situations were presented to examine if learners could generalize the use of the "CHECK" strategy. Furthermore, researchers could further create a more comprehensive online module by adding an extra section or module to demonstrate how to implement the "CHECK" strategy in real settings via video modeling. Before examining the generalization effects in the classrooms, researchers should consider if live follow-up sessions are needed to enhance the accuracy of implementation and generalization. Based on this, researchers could also require learners to create video recordings of themselves implementing the VS they made during their student teaching placements.

Conclusion

To summarize, the present study added preliminary evidence that self-paced online training was effective in increasing pre-service general education teachers' case application of visual schedules strategy for individuals with IDDs. The present work also added to the extant literature by extending the effectiveness and social validity of online instruction when teaching

evidence-based practice for pre-service general education teachers. In addition, the current study also added evidence that strategy instruction can be effectively utilized in an online environment. However, the study indicated that learners did not apply all the steps of the strategy to the case, especially those steps of using visual schedules. Future research is needed to improve the effectiveness of this online training and to evaluate the generalization of training effect on the application of visual schedules for pre-service professionals.

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APPENDIX A

Guided Notes for Making and Using Visual Schedules

A visual schedule is most likely to be of benefit when the activity:

- is a predictable event.
- follows a predictable sequence.
- Requires ongoing adult support and/or causes anxiety.
- is easier to understand when images or text are provided.

The CHECK Strategy

Consider the steps, preferences, and/or choices for the learner.

- Each step should be
  - small enough that it can be easily represented as a meaningful step.
  - big enough that each desired activity can be represented in 4-6 steps.
- Preference
  - Intersperse highly preferred with non-preferred activities.
- Making choices
  - Provide choice boards or two choices on the visual schedules.

Help the learner with meaningful representations and layouts that support self-monitoring.

- Representations
  - Real photos are the easiest to understand.
  - Line drawings or symbols can be used if familiar to the learner.
  - Label the images with text or phrases.
- Self-monitoring
  - Put the cue in a "Finished" (or "All Done") location, or mark off cues as completed.

Engage the learner using model, guided practice, and independent practice.

- **Model (I Do)**
  - introduce and demonstrate the use of the visual schedule.
- **Guided Practice (We Do)**
  - provide support to support success.
  - gradually fade support.
- **Independent Practice (You Do)**
  - monitor the learner's response.
  - provide appropriate feedback.
    - provide positive feedback (if independent)
    - provide corrective feedback (if prompt needed)

Collaborate to support widespread use.

- Meet with other team members to demonstrate the use of the visual schedules.
- Share information on the learner's expected use of visual schedules (share high expectations) across settings and activities.

Keep data and make changes as needed.

- Use a simple and efficient way to record the performance.
- Make changes based on the data.

APPENDIX B

PROBE CASE ONE

Please read the following case example carefully and answer question.

Robert is a 7-year-old Hispanic boy on the autism spectrum. He likes to play with puzzles and look at cartoon books. He currently attends an inclusive classroom, and he especially enjoys PE class, computer class, music class, and art class.

Ms. Carol is one of Robert's favorite teachers, and she thoroughly enjoys having Robert in her class. It is often a busy day, however as she has 20 students with a wide variety of needs.

There are times that are challenging, especially when Robert is asked to begin an academic activity (e.g., math class). He often demonstrates significant frustration: crying, throwing paper, and sometimes lying on the ground. This creates challenges for everyone, as Ms. Carol must stop teaching the class to address this issue. Ms. Carol regularly needs to tell him, step-by-step, what to do: "please clean up the work area", "walk to the math table", " get out a math activity", etc.

Although this approach works, it takes about 10 minutes of one-to-one attention each time. With 19 other students in the classroom, Ms. Carol would like to find a better approach!

Question: Please describe how Ms. Carol could create a more positive and productive experience for Robert and herself during the morning routine. You can support your response with a picture if you like. Please draw it on this paper.

Please write at least 80 words in your response.

APPENDIX C

PROBE CASE TWO

Please read the following case example carefully and answer question.

Claire is a 16-year-old Asian American girl on the autism spectrum. She likes to play games on her iPad, draw pictures about dinosaurs, and watch cartoon videos. She currently attends an inclusive classroom, and she especially enjoys science class, computer class, music class, and art class.

Ms. Sara is one of Claire's favorite teachers, and she thoroughly enjoys having Claire in her class. It is often a busy day, however as she has 25 students with a wide variety of needs.

There are times that are challenging, especially when Claire is asked to begin an academic activity (e.g., math class). She often demonstrates significant frustration: crying, throwing paper, and sometimes lying on the ground. This creates challenges for everyone, as Ms. Sara must stop teaching the class to address this issue. Ms. Sara regularly needs to tell her, step-by-step, what to do: "please clean up the work area", "walk to the math table", " get out a math activity", etc.

Although this approach works, it takes about 10 minutes of one-to-one attention each time. With 24 other students in the classroom, Ms. Sara would like to find a better approach!

Question: Please describe how Ms. Sara could create a more positive and productive experience for Claire and herself during the academic activity. You can support your response with a picture if you like. Please draw it on this paper.

Please write at least 80 words in your response.

APPENDIX D

Rubric for Visual Schedules Probes

Participants need to describe (draw pictures if applicable) what actions or steps they have taken to address the following criteria.

Criteria	Ratings		Pts
Steps: list all the relevant steps/tasks/activities in sequence.	1 Pts Steps/tasks/ activities are shown in the drawing of a visual schedule or short answer.	0 Pts No steps/ tasks/ activities are listed.	1
Preferences and/or choices: provide the chance to access preferred activities and/or make choices of activities	1 Pts Preferences and/or choices are shown in the drawing of a visual schedule or short answer.	0 Pts No preferences and/or choices are provided.	1
Representations: use the appropriate and meaningful form of images and text.	1 Pts Images and/or text are shown in the drawing of a visual schedule or short answer	0 Pts No images and/or text are used.	1
Self-monitoring: use clear methods to support the self-monitoring use of a visual schedule.	1 Pts A clear method of supporting self-monitoring is shown in the drawing of a visual schedule or short answer.	0 Pts No method of supporting self-monitoring is provided.	1
Provide systematic instruction: use model (I do), guided practice (We do), and independent practice (You do)	3 Pts: Use all three components of instruction. 2 Pts: Use two of the components of instruction. 1 Pts: Use only one of the components of instruction. 0 Pts: No component of systematic instruction is used.		3
Collaborate to support widespread use: talk with colleagues, encourage them to use the visual schedule.	1 Pts Describe this step in the short answer.	0 Pts Do not describe this step in the short answer.	1
Keep data and make changes as needed: use a simple data sheet to collect data and make data-based changes to instructions.	1 Pts: Demonstrate this step in short answer and/or provide a data sheet. 0 Pts: Do not mention this step in short answer or no data sheet is provided.		1
			Total: 9 Pts

APPENDIX E

LITERATURE REVIEW

Intellectual and developmental disabilities (IDDs) generally refer to disorders or disabilities present at birth that have significant effects on the developmental trajectory, which can include intellectual disability (ID) or other developmental disabilities such as autism and Down syndrome (Biggs & Robison, 2023; Schalock et al., 2019). IDDs are characterized by individual limitations in reasoning, learning, problem-solving, language development, social interaction, emotion regulation, self-care, and behavioral regulation which not only affect a range of everyday social and practical skills of individuals but also severely impact cognitive and physical abilities (Sun, 2022; Zheng & Genaro Motti, 2018). In the U.S., IDDs affect 1 in 6 children (Boyle et al., 2011).

When attending schools or educational programs, individuals with IDDs (e.g., intellectual disability and autism) share some common challenges. One challenge is an overreliance on teacher prompts to provide cues regarding the next step or activity in a sequence, completing tasks, or transitioning from one activity or setting to another independently (Smith et al., 2015; Spriggs et al., 2017; van Dijk & Gage, 2019). These issues can be exacerbated in general education settings where general education teachers lack training on working with individuals with disabilities. In the short term, these difficulties may lead to challenging behavior and lower academic and functional achievement. In the long term, these issues may negatively impact social engagement (Gadaire et al., 2018), community access (Nord et al., 2016), and employment opportunities (National Core Indicators, 2020; Sun & Brock, 2022; Winsor et al., 2021). Supporting students with IDDs in educational settings is a crucial first step. Methods that are self-directed and provide prompting without direct intervention from teachers may ameliorate

issues with prompt dependency. To that end, visual schedules have been used to support students with IDDs in becoming increasingly independent. Researchers found that visual schedules could be an effective way to increase a range of skills (e.g., make smooth transitions and engage in class activities) and decrease challenging behaviors across age groups and settings for individuals with IDDs including autism spectrum disorder, intellectual disabilities, and Down syndrome (Hume et al., 2021; Knight et al., 2015; Koyama &Wang, 2011; Lequia et al., 2012; Spriggs et al., 2017; van Dijk & Gage, 2019).

Visual Schedules

Visual schedules (VS) are a series of images, pictures, photographs, or line drawings that illustrate a sequence of events with the goal of visually preparing the individual for the next action or step within an activity or chain of activities and prompting them to follow a series of activities or tasks independently (Bryan & Gast, 2000; Knight et al., 2015; Koyama & Wang, 2011). Researchers found that VS could be an effective way to perform a simple action or a complex behavior chain by enhancing self-management skills for a wide range of individuals with ASD (Koyama &Wang, 2011) and engaging individuals in habilitative routines in the absence of other people (Kimball et al., 2004). Self-management in the educational context comprises students' ability to take responsibility for their academic and social behavior in the classroom (Smolkowski et al., 2023). Self-management may promote the successful inclusion of students in general education classrooms by permitting teachers to spend more time on instructional tasks rather than behavior management (Lee et al., 2007). In the long term, self-management may also facilitate students' self-determination, a core dimension of quality of life (Lee et al., 2007; Turnbull & Turnbull, 2001). Most empirical studies of VS interventions are

conducted with individuals with ASD. However, there is increasing evidence to show that VS can be effectively used for individuals with intellectual disabilities (including Down syndrome).

Visual schedules for individuals with autism

Visual schedules may provide external support by leveraging a potential area of strength of individuals with autism, visual information processing. Research has demonstrated that some individuals with autism process and retain information better if it is presented in a format where it is written down and can be seen (Tissot & Evans, 2003). Individuals with autism with stimulus over-selectivity respond only to a subset of possible stimuli and may fail to respond to important cues present in the environment (Kelly & Reed, 2021). More specifically, many students with autism are unable to attend to multiple stimuli (Kelly & Reed, 2021), which influences engagement and independent task performance (Carnahan et al., 2009) and exerts a negative influence on focusing on key information of tasks and activities (Walpole et al., 2007). Difficulties in executive functioning may influence the cognitive and behavioral patterns of individuals in this group (de Jager & Condy, 2020), which in turn could negatively impact engagement. For example, individuals with autism could experience difficulties in transitioning from one activity to another (Banda & Kubina, 2006) and experience difficulties with planning, organizing, attention, and sequencing multiple pieces of information (Friedman & Sterling, 2019; Mesibov et al., 2005). Furthermore, individuals with autism experience difficulties identifying key tasks to accomplish, determining where to start, and sequencing/implementing specific steps to achieve a goal (Fisher & Happe, 2005). Given these difficulties, methods to support information processing, stimulus selectivity, and executive function could be a promising way to enhance participation in the activities.

Visual schedules have been evaluated for individuals with ASD (Hume et al., 2021) from preschool through adulthood across multiple skills and behaviors (Ledbetter-Cho et al., 2017; Knight et al., 2015; Koyama &Wang, 2011; Lequia et al., 2012; Liang & Lee, under review; Steinbrenner et al., 2020). Specifically, multiple empirical studies have shown the positive effects of VS on individuals with ASD including appropriate engagement in play activities and transition periods (Akers et al., 2016; Blair et al., 2010; MacDuff et al., 1993), participation in social initiations (Krantz & McClannahan, 1993), independent play (Morrison et al., 2002), reduction in challenging behaviors (Lequia et al., 2012; Massey & Wheeler, 2000) and latency to initiate transitions (Dettmer et al., 2000).

Literature reviews have shown positive effects of VS focused on reducing challenging behaviors (Lequia et al., 2012), improving independence (Koyama &Wang, 2011; Stromer et al., 2006), and enhancing social and transition behaviors (Banda & Grimmett, 2008). Liang and Lee (under review) conducted a literature review to further demonstrate that VS could be effectively used to increase the academic-related on-task behaviors of students with ASD. In addition, Knight et al. (2015) concluded that VS can be used to increase, maintain, and generalize a range of skills (e.g., play skills, daily living skills, cooking skills, and independent academic skills) of individuals with ASD. In addition, studies demonstrated that VS interventions could be used for individuals with ASD in a variety of settings (e.g., general education classrooms, self-contained classrooms, community, clinic, and home) and implemented by multiple intervention agents (e.g., teachers, caregivers, and paraprofessionals; Ledbetter-Cho et al., 2017; Knight et al., 2015; Koyama &Wang, 2011).

Visual schedules for individuals with intellectual disabilities

Findings suggest that VS is an evidence-based practice (EBP) for teaching a variety of daily living, navigation, vocational, recreation, and academic skills and increasing independence and on-task behaviors to adolescents and adults with intellectual disabilities (including some participants with Down syndrome; Koyama &Wang, 2011; Spriggs et al., 2017; van Dijk & Gage, 2019). In addition, studies indicated that VS interventions could be effectively used for individuals with intellectual disabilities in multiple settings (e.g., school, home, and job site) and implemented by several intervention agents (e.g., teachers or instructors and paraprofessionals; Koyama &Wang, 2011; Spriggs et al., 2017; van Dijk & Gage, 2019).

Evidence-based practice has drawn considerable attention from both researchers and practitioners in the field of special education (Cook & Odom, 2013). Researchers applied the proposed quality indicators for high-quality research and standards for EBPs to bodies of empirical literature (Cook et al., 2009). Based on this, visual schedules are evaluated as one of the EBPs that were widely used in different settings across age groups and a range of skills and behaviors for individuals with IDDs (especially autism and intellectual disability) by multiple, high-quality, experimental studies. Therefore, teachers (including general education teachers) and paraprofessionals could feel confident to use this method to support their students with IDDs.

Intervention Agents

Researchers have demonstrated the positive impact of visual schedules on individuals with IDDs. The increase in independence and student self-management promoted independent management of behaviors across social, occupational, and academic domains, and understanding self-management as a discrete set of responses that can be taught to individuals with disabilities allows for the expansion of independence in a variety of settings (Reinecke et al., 2018). General

education teachers play an important role in teaching and supporting individuals with disabilities and face great stress or challenges in meeting the needs of students with disabilities, especially with autism or other developmental disabilities (Al Jaffal, 2022). The increase in independence and student self-management holds promise for decreasing teacher stress (Smolkowski et al., 2023).

However, many of the studies were conducted using research personnel to deliver the VS intervention. Researchers have consistently shown that an implementation gap exists, with numerous barriers impeding the successful translation of EBPs into routine practice in schools, leading to uneven, inconsistent, and incomplete implementation (Merle et al., 2022). For this EBP to be widely implemented, work must be done to translate research findings to the everyday practices of teachers in classrooms (Cook & Odom, 2013). As EBPs in education began to be identified, relatively little attention has been given to implementation (Cook & Odom, 2013). The journey from evidence to application of evidence is often slow (Clark, 2020) and diffusion of information without a systematic procedure is likely inefficient. Researchers suggested that teacher preparation may be a way to help bridge the gap between research and practice related to EBPs and prepare the pre-service teachers for implementing the VS in their future work (Golder et al., 2005; McLeskey & Billingsley, 2008; McLeskey et al., 2018).

General Education Teacher Preparation for Inclusive Setting

Researchers have developed multiple evidence-based practices (e.g., visual schedules) and identified other effective practices that show promise for improving outcomes for students with disabilities. However, these practices are all too frequently not used by general education teachers in inclusive classrooms (McLeskey et al., 2018).

An increasing number of students with IDDs who have behavioral challenges are now being served in general education classrooms (Flower et al., 2017; McLeskey et al., 2012) which requires that teachers adapt their approaches to teaching to meet all students' needs (Alexander & Byrd, 2020). The number of students with IDDs (especially autism) who are provided services under the IDEA has increased from 93,000 in 2001 to 760,000 in 2020 and currently accounts for 11.6% of students receiving special education services (Office of Special Education and Rehabilitative Services, 2022). Moreover, approximately 58.7% of these students spend over 80% of their school day in general education settings and 80.7% spend at least 40% (Office of Special Education and Rehabilitative Services, 2022). With these numbers, it is clear that support for general educators is critical. However, studies demonstrated that many general education teachers are not fully aware of how to support and serve the needs of students with special needs effectively and appropriately in inclusive environments (e.g., Alexander & Byrd, 2020; Al Jaffal, 2022; Barned et al., 2011; Bruggink et al., 2016; Merle et al., 2022). Researchers in these studies further examined the knowledge and skills that general education teachers should master or what factors impede the implementation of EBPs in the school setting.

Alexander and Byrd (2020) examined skills and knowledge general education teachers should have from the perspective of special education educators. The findings demonstrated that teacher preparation programs should provide a continuum of learning opportunities in three important areas including data-based decisions, appropriate understanding for students with special needs and their situations, and effective communication in and out of the classroom with all parties involved in educating this specific group of students.

Al Jaffal (2022) investigated the barriers that prevent general education teachers from successfully implementing an inclusive environment. The findings showed that general

education teachers lack university-level training in how to work with students with autism, lack collaboration opportunities with their special education colleagues to better support their students with autism, and are not provided sufficient resources by their schools and programs to create an appropriate inclusive environment. Similarly, Barned et al. (2011) conducted a study to analyze and assess the knowledge and attitudes of pre-service general education teachers about the inclusion of students with autism. The findings revealed a lack of awareness of ASD among pre-service teachers, as well as some misconceptions about the condition and the needs of students with ASD in inclusive classrooms. The participants expressed an interest in learning more about ASD and expressed support for the inclusive classroom. According to the conclusions of this study, pre-service teacher training programs should be expanded to provide more information about ASD and to promote more inclusive attitudes toward these students.

Bruggink et al. (2016) suggested that meeting a variety of students' needs is a challenge for general education teachers and it remains unknown what is of help or hindrance to them. Results showed that four sources of help or hindrance to which teachers could achieve their success in meeting students' needs, including the teacher him/herself, student characteristics, and school/working conditions. Attributions at the teacher and school levels were mostly related to teacher-perceived capacities rather than to teachers' self-efficacy beliefs.

Merle et al. (2022) suggested that teachers often insufficiently implement established EBPs with fidelity to produce beneficial outcomes for students with disabilities. Researchers in this synthesis examined the types and magnitude of the effect of implementation strategies that have been designed and tested to improve teacher adherence to EBPs. Results indicated that effective and active implementation strategies (e.g., performance feedback, implementation planning, and prompts/reminders) were associated with increases in teacher adherence to EBPs.

Also, previous surveys indicated that new teachers report inadequate skills to manage a classroom and their teacher preparation programs often fail to properly prepare them to manage behavior (Flower et al., 2017). Therefore, these unprepared teachers reported diminished student learning outcomes associated with poor classroom management, increased stress resulting from student behavior problems, low levels of job satisfaction, and high rates of teacher turnover (Brunsting et al., 2014; Flower et al., 2017).

Based on the situations of insufficient professional development for general education teachers who serve students with IDDs and the gap between research and practice regarding evidence-based practices, many researchers contend that teacher preparation is an important way to bridge the research-to-practice gap and improve teacher effectiveness (Cook et al., 2013; Golder et al., 2005; McLeskey & Billingsley, 2008; McLeskey et al., 2018). Teachers are one of the most important school-based resources in determining students' future academic success and lifetime outcomes (Burroughs et al., 2019; Chetty et al., 2014). To this end, there has been a strong emphasis on improving teacher effectiveness to enhance student learning (Burroughs et al., 2019). However, in most teacher preparation programs (e.g., university coursework), there is a limited emphasis on carefully designing the experiences necessary for pre-service teachers to learn to use complex practices in classroom settings (McLeskey & Brownell, 2015). Instead, teacher preparation emphasizes reflection and investigation which provides pre-service teachers with a substantial range of knowledge about effective instructional practices, but with very limited classroom-ready skills that they may need to implement when beginning to teach in real classroom settings (Grossman et al., 2009; McLeskey & Brownell, 2015).

To address the need to improve teacher effectiveness, teacher preparation programs have been undergoing a major shift. Teacher educators in teacher preparation programs have

recognized the need to specify practices that all teachers should learn to use in the classroom to improve student outcomes (McLeskey et al., 2019; McLeskey et al., 2022). In addition, teacher preparation programs have started to highlight the practice of teaching in the classroom, provide opportunities for teachers to learn classroom practices, and tend to prepare more effective teachers (Boyd et al., 2009; Burroughs et al., 2019; McDonald et al., 2013; McLeskey et al., 2022).

Asynchronous Online Training for Pre-service Professionals

Traditionally, face-to-face instruction is the main delivery method for teacher preparation or teacher education. As technology advances, there has been a significant increase in the number of available online resources and educational technologies (Ebner & Gegenfurtner, 2019; Testers et al., 2019), which have gained importance in higher education and professional training contexts (Ebner & Gegenfurtner, 2019). According to the latest report detailing statistics on online education enrollment, 61 percent (9.4 million) of all undergraduate students were enrolled in at least one online course, 28 percent (4.4 million) of all undergraduate students exclusively took online courses in the fall of 2021(National Center for Education Statistics, 2023).

Compared with face-to-face traditional instruction, online training allows professionals to deliver interventions remotely by using communication technology such as the web and mobile applications (Ebner & Gegenfurtner, 2019), which has the potential to replace or improve traditional service models to increase access to evidence-based intervention (Baggett et al., 2010). Asynchronous online training (e.g., self-paced telepractice and self-directed online module) provides information via websites and encourages learners to independently review and learn the material without communicating with trained professionals in real-time, which could be

more flexible to access, time-independent, learner-controlled, cost-effective, and globally accessible (Johnson, 2004; McCoy & McNaughton, 2021).

In published research, asynchronous online training has been successfully provided for pre-service professionals (e.g., special and general education teachers, interventionists, speech-language therapists) on instructional methods or collaboration strategies that can be used for individuals with disabilities including the system of least prompts (McCoy & McNaughton, 2021), discrete trials teaching (Geiger et al., 2018; Higbee et al., 2016; Nosik & Williams, 2011; Pollard et al., 2014), backward chaining (Nosik & Williams, 2011), incidental teaching (Neely et al., 2016), reciprocal imitation training (Wainer & Ingersoll, 2013), universal design for learning (Courey et al., 2013; Lee & Griffin, 2021), data-based instructional decision (Wolfe et al., 2023), and family-centered relational skills (Mandak et al., 2020). When organizing and providing online training for pre-service professionals, strategy instruction could be used to deliver asynchronous online training.

Strategy Instruction via Asynchronous Online Training

Strategy instruction is a method for teaching individuals to apply a series of multi-step procedures to address a specified challenge and it has been closely associated with long-term generalized use of new skills (Ellis et al., 1991; Kent-Walsh & Mcnaughton, 2005). When using a strategy instruction framework, the goal is for instructors to identify the component skills of a strategy and then teach learners to sequence, demonstrate, and master the strategy in an efficient manner (Mandak et al., 2020). Ellis et al. (1991) introduced and specified a sequence of eight instructional stages that have been identified to denote different emphases in the instructional process. The strategy instruction model of Ellis et al. (1991) provided evidence-based instructional guidelines to assist learners in acquiring targeted strategies, implementing these

strategies across a variety of activities, and maintaining their long-term use (Ellis et al., 1991; Kent-Walsh & McNaughton, 2005). Although strategy instruction has primarily been implemented and evaluated in traditional classroom environments (i.e., in-person instruction), there is some evidence of its effectiveness in an online environment (Douglas et al., 2013, 2017) as well. The instructional sequence outlined by Kent-Walsh and McNaughton (2005) was adapted for use in an online environment and included the following stages: pretest and commitment to learning the strategy, description of strategy, demonstration of strategy, verbal practice of strategy steps, controlled practice and feedback, advanced practice and feedback, posttest and commitment to implementing the strategy, and generalization. In addition, there is some specific evidence of its effectiveness in an asynchronous way to deliver training for pre-service professionals (Liang et al., 2023; Mandak et al., 2020; McCoy & McNaughton, 2021).

Mandak et al. (2020) utilized the strategy instruction to deliver the self-paced online training to teach family-centered, relational skill strategy for pre-service speech-language pathologists (SLPs). Key components of the strategy instruction framework in this study included pretest and make commitment, strategy description, modeling, verbal practice of strategy, controlled practice and feedback, advanced practice and feedback, posttest and commitment, and generalization. McCoy and McNaughton (2021) used the strategy instruction to deliver self-paced online training to teach pre-service teachers the use of a system of least prompts to support augmentative and alternative communication (AAC). Key components of the strategy instruction framework in this study included a description of the strategy, modeling, verbal practice, guided practice, and independent practice. Liang et al. (2023) provided the self-paced online training to teach pre-service teachers the creation and use of visual schedules. Key components of the strategy instruction framework in this study also included a description of the

strategy, modeling, verbal practice, guided practice, and independent practice. The results of these studies indicated that self-paced online training based on the model of strategy instruction was effective in increasing knowledge and skills for pre-service professionals and participants highly rated the way of learning in the online environment and recommendations for others to use the modules.

In summary, an increasing number of students with IDDs were enrolled and spent most of their school days in general education classrooms. The overreliance on teacher prompts poses challenges for general education teachers that are exacerbated in general education settings where general education teachers lack training on working with individuals with disabilities. As one of the established EBPs, visual schedules have been used to support students with IDDs in becoming increasingly independent and an effective way to increase a range of skills and decrease challenging behaviors across age groups and settings for individuals with IDDs. However, as EBPs (e.g., visual schedules) in education began to be identified, relatively little attention has been given to implementation, and diffusion of information without a systematic procedure is likely inefficient. Based on the situations of insufficient professional development for general education teachers who serve students with IDDs and the gap between research and practice regarding evidence-based practices, many researchers contended that teacher preparation is an important way to bridge the research-to-practice gap and improve teacher effectiveness. As technology advances, asynchronous online training has been successfully provided for pre-service professionals on multiple EBPs in an effective and efficient way that can be used for individuals with disabilities. Strategy instruction could be adapted to organize and deliver asynchronous online training for pre-service professionals based on the framework of instructional sequence outlined by Kent-Walsh and McNaughton (2005).

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