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TEACHING PARAPROFESSIONALS TO IMPLEMENT AND GENERALIZE MATHEMATICS INSTUCTION USING SYSTEM OF LEAST PROMPTS

A Dissertation in

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Michele Marie Brown

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The dissertation of Michele Marie Brown was reviewed and approved by the following:

Pamela S. Wolfe
Associate Professor of Education
Dissertation Advisor
Chair of Committee

David L. Lee
Professor in Charge, Special Education
Professor of Education

Richard M. Kubina
Professor of Education

Chad E. Shenk
Associate Professor of Human Development and Family Studies
Associate Professor of Pediatrics

ABSTRACT

Paraprofessionals frequently are responsible for delivering instruction to students with disabilities but often do not have training related to how to implement instructional strategies accurately and effectively. In this experiment online modules were created to increase the accuracy of paraprofessional implementation of system of least prompts (SLP) with students having ID for a math task. The online modules included information about SLP, video models, self-checks, and quizzes as well as a delayed feedback component. Specific content included defining prompts and prompt systems, how to implement SLP, and how to deliver reinforcement. Accuracy of implementation of SLP and the extension of implementation to a novel mathematics task was evaluated. The results suggest that paraprofessionals learned how to implement SLP after completing the online modules and receiving delayed feedback. Further, paraprofessionals were able to extend accurate implementation of SLP to a novel/related math task. These results suggest that online modules that include relevant content, effective instructional design elements, and feedback may be an effective way to increase accurate implementation of evidence-based practices such as SLP to students with ID. Limitations, implications, and suggestions for future research are discussed.

Keywords: paraprofessionals, system of least prompts, online modules, distance education

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Chapter 1

Introduction

The number of paraprofessionals serving the academic and behavioral needs of students with intellectual disabilities (ID) has increased dramatically. In 2018, 825,632 full time special education paraprofessionals served students aged 3–21 (US Department of Education, 2018). Paraprofessional jobs are projected to grow by 116,000 before 2030, higher than the projected growth of special education teachers at 37,600 (US Bureau of Labor Statistics, 2021). The employment of paraprofessionals to deliver support and instruction to students with ID has emerged as an effective way to meet the goals and objectives of student individualized education plans (IEPs) in special education classrooms (Suter & Giangreco, 2009). Paraprofessionals routinely perform tasks previously regarded as only the purview of the special education teacher. These roles include delivering one-on-one instruction and providing behavioral support (Brock & Carter, 2013; Giangreco et al., 2001; Reddy et al., 2020).

System of Least Prompts

Because paraprofessionals frequently conduct one-on-one instruction, they need training in the use of evidence-based practices (EBP) to improve student outcomes (Douglas et al., 2013; McColloch & Noonan, 2013; Mason et al., 2017). EBPs are identified by organizations such as the National Autism Center as practices that meet the criteria for rigor and positive student outcomes (Cook & Cook, 2013). One EBP is a system of least prompts (SLP). SLP is widely used with students having ID (Walker et al., 2020a) and has been identified in the literature as an error correction procedure and useful for transferring control from prompts to a discriminative stimulus (Doyle et al., 1988). When implementing SLP, an instructor uses three or more prompts delivered simultaneously with a task direction (e.g., saying "it's time to work on math"). Instructors arrange prompts in a hierarchy related to the level of intrusiveness from less intrusive (i.e., gesture) to most intrusive (i.e., full physical prompt). The instructor delivers a prompt from a predetermined hierarchy that allows the student the most independence in completing the task successfully. The final prompt used in SLP instruction ensures correct responses from students (Brock et al., 2021; Walker et al., 2020a). Eventually, stimulus control is transferred from the response prompt to a naturally occurring prompt (e.g., the task direction). The use of prompting allows the instructor to control responses to a stimulus so that they contact positive reinforcement (Cooper et al., 2020). The use of reinforcement has led to increased correct responding in a variety of context for a variety of learners and is critical when teaching a new skill (Cooper et al., 2020). Implementation of SLP requires systemization when delivered. Without careful adherence to prompt hierarchies, students may become prompt dependent (Shepley et al., 2019); inadvertently attend to unnecessary stimuli related to producing a correct response (Cooper et al., 2020); learn chained tasks at a slower rate (Slocum & Ault, 2022); and impede the ability of the instructor to fade the prompts effectively (Alberto & Troutman, 2022).

Use of SLP has been identified as effective to teach chained skills with multiple steps (Shepley et al., 2019; Westling & Fox, 2009). SLP is a particularly useful instructional strategy for students with ID because it guides students through a task with carefully structured prompts to increase student responding. Further, it provides built-in fading of prompts due to the order in which the prompts are delivered (Cengher et al., 2018; Shepley et al., 2019). SLP has been used to teach students with ID activities of daily living (ADL) (Probst & Walker, 2017), vocational tasks, (Seaman-Tullis et al., 2019) and social skills (Brock & Carter, 2016). SLP has been used less frequently with academic skills although it is deemed appropriate due to the chained nature of many tasks. Chained tasks are commonly found in academic skill instruction such as mathematics (Brock et al., 2021) which often involve a series of discrete steps that must be completed in order.

Online Instruction

Few opportunities and inadequate methods for paraprofessional training have been discussed in the professional literature. For example, many paraprofessional trainings are offered as a group or one-day training (Mason et al., 2021), even though research suggests this is the least effective means of training for the implementation of skills (Brock & Carter, 2016; Rispoli et al., 2011). Some research recommends that paraprofessionals should be trained in a pre-service environment, but this often does not happen due to budgetary restraints (Trautman, 2004). Instead, paraprofessionals often are trained on the job by teachers who do not feel confident in providing this training (Morgan et al., 2004).

To increase opportunities for training, researchers have begun to focus on the use of online training methods using distance learning (Capizzi & Da Fonte, 2015; Higbee et al., 2016; McCulloch & Noonan, 2013). Distance education, or eLearning, has grown significantly in the last 15 years. In 2003–2004, approximately 15.6% of undergraduate students had at least one distance learning class; by 2015–2016, that number had risen to 43.1 % (U.S. Department of Education, 2019). Distance education is defined in the literature as "institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors" (Schlosser & Simonson, 2009, p. 1). Although distance learning is deemed desirable due to its ability to increase access to education in a cost-effective manner (Benson, 2010), it must be conducted well using established elements of instructional design (Simonson et al., 2012; Simonson et al., 2019). Elements of effective instructional design typically include content related to the topic and techniques to enhance learning such as exemplars and non-exemplars of concepts/skills, modeling of key behaviors, opportunities to practice skills, and feedback (Brock & Carter, 2015). The use of online modules delivered directly to paraprofessionals limit costs related to hiring an expert trainer (Gerencser et al., 2018) and allows paraprofessionals to view training whenever they wish, either from the work or home setting. This increased accessibility may lead to better maintenance of skills learned from training (McCulloch & Noonan, 2013).

Online Instruction of SLP

Several experiments have investigated online training for paraprofessionals such as teaching paraprofessionals how to train students to mand (i.e., requesting) (McCulloch & Noonan, 2013) and how to implement discrete trail training (Mason et al., 2017). In these experiments, paraprofessionals implemented behavior analytic interventions with fidelity when trained via online modules. Researchers also have examined the online training of SLP. McCoy & McNaughton (2021) targeted online training of paraprofessionals to increase communication skills for AAC. These authors included content about SLP such as basic knowledge and how to plan to implement the procedure.

They measured paraprofessional ability to implement SLP in a role-play situation. Brown et al. (2021) examined paraprofessional knowledge of SLP and paraprofessional accuracy of implementation for teaching math to students with ID. Content in their online modules included similar information such as defining prompts, prompt systems, and how to implement SLP. Because Brown et al. (2021) focused specifically on the accuracy of implementation of SLP, the authors included detailed information related to the creation of a task analysis, delivery of reinforcement, and evaluation of learner progress. Paraprofessionals in the Brown et al., (2021) experiment successfully implemented SLP with accuracy when teaching a mathematics task. Although successful, the authors noted that the use of feedback in online training may enhance learning of the material and suggested future research be conducted. They suggested that performance feedback or feedback specific to the actual skill (Brock & Anderson, 2020; Brock & Carter, 2013; Walker et al., 2020a) be used with paraprofessionals to increase the accuracy of SLP implementation.

Current Experiment

The current experiment extended the research of Brown et al., (2021) and others by adding a performance feedback condition to the online training. Specifically, the current experiment addressed two research questions: What are the effects of an online training package on the accuracy of implementation of SLP to teach an academic task to students with ID? Can paraprofessionals extend the accuracy of implementation of SLP to a novel academic task?

Chapter 2

Methods

Participants

The primary experimenter recruited participants from a rural school district in the Mid-Atlantic region of the United States. A classroom teacher who participated in prior research with the experimenter agreed to recruit participants for the experiment. The teacher recruited two participant types: paraprofessionals and students with ID and/or concomitant diagnosis of autism spectrum disorder (ASD). First, the teacher recruited three paraprofessionals assigned to her classroom based on the following inclusion criteria: (a) spoke and wrote English; (b) provided services and support to students with ID in a self-contained special education classroom; and (c) were 18 years of age or older at the time of the experiment. After obtaining informed consent from the paraprofessionals, the teacher recruited three student participants who met the following criteria: (a) were between 12 and 19 years old at the time of the experiment; (b) had a documented medical diagnosis or special education eligibility of ID or ASD per record review; and (c) were placed in a special education classroom with increased academic supports. Academic supports included one-on-one instruction, modifications to curriculum based on current levels of functioning, and accommodations as stated in their IEPs. Once student participants were selected and informed consent granted, paraprofessionals were placed in dyads with students based on teacher recommendations and existing relationships (i.e.), had worked with the student participant in the past with success).

Three paraprofessionals participated in the experiment. All three were white females in their 50s with 20 or more years of experience in the classroom as a paraprofessional. All three were high school graduates and reported no experiences with in vivo training. One paraprofessional engaged in online training videos provided by the intermediate unit (IU) (KP). Two paraprofessionals, MY and KP, reported going to a local IU for trainings that included crisis prevention and intervention training (CPI). All three completed book studies, where they read a book recommended by members of the local IU and then discussed the book content in a group setting once a week as a means of training. All three paraprofessionals received at least 12 hours towards their paraprofessional required training from the school district for participating in this study. None of the paraprofessionals had instruction in SLP or response prompting before entering this experiment.

Three student participants with ID took part in the experiment: J. C., I. P., and K. R. (see Table 1). J. C. were diagnosed with ID via a school multi-disciplinary team evaluation. J. C. had extensive accommodations including the use of an iPad with Co-Writer Universal application as a writing assistive technology (Johnston, 2016). Possible reinforcers identified by the classroom teacher for J. C. included the use of an iPad, watching videos, or time on a computer to play a game. I. P had a diagnosis of mild intellectual disability and ASD. I. P. used Math 180 and was assessed at the 3rd grade level for math using CBM assessments. Possible reinforcers identified by the classroom teacher for I. P. included Scooby-Doo toys and snacks, chips (Doritos or Fritos), and cookies. K. R. had a diagnosis of multiple disabilities, including ID and ASD. K. R. had extensive accommodations in reading, math, and written expression. Possible reinforcers listed by the teacher for K. R. included time on the iPad, working as a class helper, and candy bars such as KitKats. To form dyads, paraprofessional KP was placed with student K. R., paraprofessional MY was placed with I. P., and paraprofessional TO was placed with J. C. Table 1 contains information for both paraprofessional and student participants.

Setting

The setting of this experiment was a self-contained special education classroom for students with ID and concomitant ID/other disabilities in a rural combined junior/senior high school classroom. Ten students in the classroom had ID, ASD, and/or cerebral palsy. Sessions were conducted in a small room adjacent to the main classroom connected by a door with no windows. This smaller room measured approximately 10' by 12' and had one student desk in the center. When not used for data collection for this experiment, the room was used to teach other students how to complete laundry, so there was a washer and dryer in the room during all sessions. Only the paraprofessional and student members of a dyad were present in this room during each session under all conditions.

Materials

Instructional modules

Three instructional modules were developed into a treatment package to train paraprofessionals to implement SLP when teaching math. The treatment package included three instructional modules with embedded video models (VMs) of implementation techniques and self-checks of learning. The modules each took an average of 1 hour and 12 minutes to complete. Module one defined the terms used in SLP such as prompt types (e.g., verbal) and different hierarchies (e.g., least to most vs. most to least). Module two illustrated how to implement SLP. This included instruction on selecting cues or task directions, how to deliver task directions, selecting reinforcers, why instructors should choose the types of prompts to use from the hierarchy, completion of a task analysis (TA) form, and why student responses should always end in reinforcement after the most intrusive prompt needed. Module three provided instruction on how to respond to learner errors, non-responses, or correct responses (i.e., rules for reinforcement of learning responding) and how to deliver reinforcement within 1–3 seconds of a correct response (see Table 2). Embedded in each instructional module were VMs that either provided an example or non-example of a term (e.g., a verbal prompt for each type of prompt in module one) or to provide VMs of the implementation of each part of SLP (e.g., how to reinforce a correct response in module three). VMs were experimenter created, specific to the type of content or task, and lasted no more than five minutes each. Each module had multiple VMs. Self-check items included multiple choice questions, short answer questions, and questions about the accuracy of implementation while watching a VM (see Appendix E).

End of Module Quizzes

At the end of each module, each paraprofessional was required to take an end-of-module quiz. The quizzes included 10 questions in either multiple choice or short answer format to assess paraprofessional knowledge of the concepts taught. The questions for each module were drawn from a pool of 140 questions used by Brown et al. (2021) and were vetted by outside raters for accuracy (i.e., did the question have a correct answer) and validity (i.e., did the question assess the content included in the video module). For each quiz, paraprofessionals had to reach 100% mastery before moving forward to subsequent modules. For examples of quiz questions see Appendix E.

Audio-Visual Equipment

This experiment primarily used computer equipment already present in the special education classroom. The equipment included the teacher's district-issued Dell laptop with an internal microphone and camera, and Microsoft Team's software for video conferencing. This equipment and software were used to record all baseline, intervention, and extension sessions, as well as most of the feedback sessions. The teacher recorded and uploaded all sessions to the district's secure server. The teacher, the paraprofessionals, the experimenter, and a trained independent observer accessed the recordings. Paraprofessionals also had access to the modules on their home computers or tablets.

Experimental Design

The experiment used a multiple probe across participants design with three paraprofessional dyads run in three legs (one per participant dyad). In this multiple probe design, a target behavior (accuracy of implementation of SLP) was measured for all paraprofessional dyads in a staggered fashion. After paraprofessional data in leg one demonstrated a steady state of responding in baseline (determined as either trend, level, or both during visual analysis), that paraprofessional began the intervention condition while all other paraprofessionals continued in baseline (Horner et al., 2012; Ledford & Gast, 2018). This sequence continued until all paraprofessionals were introduced to the independent variable (i.e., online modules). This experiment included three phases:

baseline, intervention, and extension. Each phase included a minimum of five data points in a minimum of six phases per WWC standards (What Works Clearinghouse, 2020).

Dependent Variable

The dependent variable was the number of steps the paraprofessional accurately implemented when using SLP to teach a preselected chained mathematics task as outlined on an experimenter-developed task analysis and measured by the Implementation Checklist for a System of Least Prompts (see Appendix D). The number of steps implemented with accuracy were determined by a frequency count with a behavioral objective for the dependent variable: "given a predesigned task analysis (TA), paraprofessionals will implement 100% of all steps of the implementation checklist with their student participant in no less than 4 out of 5 trials."

Independent Variable

The independent variable for this experiment was a technologically delivered treatment package consisting of two components. The first component was three online modules that contained written content, VMs, self-checks, and end-of-module quizzes (see Table 2). Samples of module content and VMs can be found in Appendix E. The second component was performance feedback delivered by the experimenter related to each paraprofessional's performance while implementing SLP. This feedback included the use of praise, behavior specific correction, and goal setting and was systematic, following the Procedural Fidelity Checklist for Feedback (see Appendix D).

Procedures

Development of Task Analysis

After dyads were arranged, the experimenter met with the classroom teacher to determine appropriately chained academic tasks in mathematics for each student participant based on current goals in the student's IEP. All students had a long-term goal of being able to use money to purchase items in a store. This goal was determined relevant for each student to enable them to live independently post-school. The teacher and experimenter analyzed the prerequisite skills necessary for adding money. These skills included being able to add 2-, 3-, and 4-digit numbers with and without regrouping, as well as adding numbers with decimals (Browder et al., 2018). Based on prior student progress, the teacher identified two academic tasks relevant to all three student participants related to mathematics and their IEP goals. The first academic task was three-digit addition with regrouping (intervention task). The second academic task was adding 3- or 4-digit numbers with decimal points with or without regrouping (extension task). These problems were then analyzed and the steps necessary for completion were written in chronological order on the experimenter created task analysis (TA). The task analysis for both the intervention task and extension task can be found in Appendix D.

Technology Training and Pre-Baseline Activities

The primary experimenter met with the classroom teacher and paraprofessional participants for two hours in the special education classroom. The experimenter interviewed paraprofessionals to collect demographic data and ask why they were interested in participating. The primary experimenter then delivered training with the classroom teacher on how to record sessions with her laptop computer and run procedural checks to confirm email correspondence was successful with the classroom teacher, the experimenter, and all paraprofessionals. Individual training on how to access the modules was delivered to each paraprofessional with a test item. After confirming access to technologically delivered components, the experimenter reviewed the proposed study calendar, including the criterion necessary for a participant to move from baseline to intervention, the proposed length of study, and answered questions about the study. The classroom teacher and experimenter agreed to hold weekly meetings via Microsoft Teams to discuss barriers to implementation, including paraprofessionals who missed a data collection session due to illness, and policies to continue data collection that were impacted by Covid-19 (i.e., data sessions held remotely with students).

Experimental Phases

Baseline

Each paraprofessional was given a pre-developed, chained academic mathematics task (i.e., adding three-digit numbers with regrouping) to teach their student based on "business as usual" conditions (see Appendix D). Baseline data were collected for a minimum of five data probes per paraprofessional before access to the instructional modules was permitted. Baseline data for paraprofessional participants continued until there were at least five data points and a steady state of responding was achieved (Ledford & Gast, 2018). Stability can be described as where data values within the condition are consistent and predictable (Ledford & Gast, 2018). Baseline stability was achieved by either trend, level, or both. Once paraprofessional one's baseline data met these criteria, she began the instructional modules while participants two and three continued to have baseline conditions extended with two probes per week.

Intervention

Accuracy of Implementation. After all modules were completed, paraprofessionals entered the intervention phase of the experiment, which assessed their accuracy of implementation of SLP. Intervention sessions consisted of the paraprofessional teaching three-digit addition with regrouping to the student. Sessions were recorded and then sent to the experimenter. Sessions were coded using the Implementation Checklist for a System of Least Prompts for all steps (see Appendix D). For each step, paraprofessional implementation was coded as either (a) accurate, (b) inaccurate, or (c) no response. All instances of "no response" were coded as an inaccurately implemented step. To collect permanent product data, the classroom teacher took a picture of the TA used during the session and then emailed it to the experimenter at the end of each day. After completing at least five intervention sessions, participants were given a TA for the second extension task, adding three-digit and four-digit numbers with and without regrouping. Paraprofessional implementation was coded for the extension task the same as it was during the intervention task.

Feedback. The primary experimenter held feedback sessions concurrently with intervention and extension sessions with each paraprofessional to deliver performance feedback on their accuracy of implementation of SLP. Feedback sessions were held 24-48 hours after each session and were approximately 10 minutes in duration. Sessions primarily were held via video conferencing software; however, some feedback sessions were held via email, online chat, or a phone call due to connectivity issues with the video conferencing software. The Procedural Fidelity Checklist for Feedback (see Appendix D) was used to deliver specific feedback to the paraprofessionals. Feedback sessions for the paraprofessionals lasted approximately 15 minutes. Feedback focused on at least one positive step performed from each live session and at least one specific item for improvement (if needed). In addition, paraprofessionals were asked to identify a goal for the next feedback session. All paraprofessionals were sent electronic copies of their Implementation Checklist after each feedback session.

Extension

Accuracy of Implementation. After each paraprofessional completed at least five data sessions in intervention and achieved a steady state of responding, paraprofessional participants moved to the extension phase. To measure skill extension of accurate implementation of SLP, the primary experimenter created a second (new) TA for the skill of adding 3- or 4-digit numbers with decimals with or without regrouping and completed the Implementation Checklist for each session (see Appendix D). Extension data were collected for at least five sessions for each paraprofessional within one week of completing intervention probes.

Feedback. During extension, feedback was delivered by the primary experimenter to all three paraprofessionals specific to their implementation of the new skill in the task analysis. This feedback was delivered prior to the next extension session and included specific goals such as continuing to use reinforcement for every correct answer or using only one prompt at a time. Paraprofessionals were also asked to develop a goal for the next implementation session.

Measures

Data Collection

All baseline, intervention, and extension sessions were recorded and saved on the school district's secure server. The primary experimenter gathered permanent products from the data sheets throughout all phases. Data sheets included the Implementation Checklist and the TA for each session (see Appendix D) Feedback sessions were recorded, and procedural fidelity assessed.

Inter-Rater Reliability

To assure reliability in recording paraprofessional accuracy of implementation of SLP, a second coder was trained. The two-hour training was conducted using training materials including VMs, the Implementation Checklist, and examples of permanent products (see Appendix D). During training, the experimenter and second observer watched one example each of a baseline, intervention, and an extension session with a second rater. The experimenter paused the video after each step in the task analysis and compared results with the second rater. Finally, the second rater watched three videos independently. Inter-rater agreement was calculated by taking the number of agreements divided by the number of agreements plus disagreements plus omissions and multiplying by 100. Once agreement between both observers was greater than 90%, the second rater was sent random video recorded sessions to code. The second rater coded a total of 33% of all sessions in all conditions. In addition, the data were examined, and a Cohen's Kappa coefficient was calculated for all inter-rater observations using SPSS software. Kappa was calculated by subtracting observer two's scores from observer one's scores and then dividing this by the total number of observations (McHugh, 2012).

Procedural Fidelity

Procedural reliability was recorded with the use of the Procedural Fidelity Checklist for Feedback (see Appendix D). A third observer was trained to use the fidelity checklist when watching practice videos. The third observer then scored 33% of all feedback sessions, in both intervention and extension, and sent the collated results to the primary experimenter. The checklist asked questions such as, "Did the experimenter review all steps in the intervention session with the paraprofessional?"

Visual Analysis

Each phase of data collection was graphed using Microsoft Excel and Word software programs and then analyzed for within and between condition changes in level, trend, and variability. Data also were analyzed for changes in data patterns, immediacy of change, and any overlapping data.

Split Middle Data. Split middle data to estimate trends was calculated using procedures outlined by Cooper et al. (2020). First, data in each condition were split in half and then in quarters to find the mid-rate. Next, the mid-date score was calculated by finding the median of the data points. Then, the experimenter drew the quarter intersect line of progress by inserting a line segment to connect the intersection of the mid-date and mid-rate (Cooper et al., 2020; Gast & Ledford, 2018). These trend lines appear on Figure 1 as solid red lines.

Stability Envelopes. To calculate stability envelopes for each segment of data, the primary experimenter first found the median value in each data set per condition and then multiplied the median by .10%. This number was then subtracted from the mean for that phase. For example, if the mean percentage of steps in SLP implemented with accuracy was 10.8%, this was then multiplied by 10% (1.08). The lower band of the stability envelope was calculated by subtracting 1.08 from 10.8%, yielding 9.72%. Then the upper band of the stability envelope was calculated by adding 1.1 to the mean of 10.8%, for a level of 11.88%. These levels are marked on Figure 1 with a dashed horizontal line, and the procedure was replicated for all data in all conditions for all paraprofessionals (Ledford et al., 2018).

Percentage of Non-Overlapping Data. Percentage of non-overlapping data is one means of measuring the reliability of an intervention. If the data between conditions have little to no similarity, then it is more likely that the intervention could be effective (Scruggs & Mastropieri, 1987). Percentage of non-overlapping data were calculated for each phase adjacent to each other for all three paraprofessionals using an online PND calculator (Tarlow & Penland, 2016). The experimenter inputted data values for nA, nB, and k, and the calculator returned the values reported in the results (see Table 4).

Social Validity

At the end of the experiment, paraprofessional participants received a social validity questionnaire delivered through Google forms to be completed after the experiment ended (see Appendix D). Questions had 5-point Likert scaled items based on (a) difficulty of intervention, (b) quality of module content, (c) quality of video model content, (d) quantity and quality of feedback, and (e) likelihood of using intervention in the future. The questionnaire included open-ended items asking for specific comments and feedback not addressed in previous questions. Student participants completed a social validity questionnaire with all open-ended items. The classroom teacher administered the questionnaire to student participants using paper and pencil format (see Appendix D).

Chapter 3

Results

The purpose of the present study was to determine if a treatment package that included online modules and performance feedback could positively affect paraprofessional accuracy of implementation of SLP to teach an academic task to students with ID. The experiment also examined whether paraprofessionals could extend their ability to implement SLP to a novel academic task. Results begin with module analytics and baseline levels of accuracy of implementation. Next, accuracy of implementation, errors in implementation and feedback results in both intervention and extension are reported. Measures on data collection, inter-rater reliability, procedural fidelity, and visual analysis are presented and social validity measures are discussed. The results suggest that the use of a training package that included online modules and feedback improved the accuracy of paraprofessional delivered instruction using SLP and that paraprofessionals generalized these skills to a novel academic task.

Module Analytics

The average time needed to complete Module 1 was one hour and 18 minutes for all three paraprofessionals; the average time of completion of the module one quiz for all three paraprofessionals was 9.9 minutes. The average time needed to complete Module 2 was one hour and 12 minutes; the average time of completion for Module 2 quiz was 22 minutes. The average time to complete Module 3 was one hour and one minute with the average completion time of the Module 3 quiz at 6.5 minutes. Each module contained self-check items. The average time for completion of self-check items was four minutes three seconds for Module 1, 11 minutes 55 seconds for module 2, and 8 minutes 33 seconds for Module 3 (See Table 3).

Baseline

During baseline, all three paraprofessionals were given the same 10-item mathematics worksheet with 3-digit addition problems. During baseline, paraprofessionals were asked to deliver the task cue "solve the problem" and work with the student as they normally would.

Accuracy of Implementation

During baseline, paraprofessional accuracy of implementation of SLP ranged from 0-15% across all three paraprofessionals (see Figure 1). Paraprofessional KP had the highest average percentage of steps implemented with accuracy, with 11% across five baseline sessions. Paraprofessional MY averaged 6% of steps implemented accurately across six baseline sessions, and paraprofessional TO averaged 1% of steps implemented accurately across eight baseline sessions. Steps that were implemented accurately included asking the student to complete step one of the two-digit task analysis "Look at your paper" or the final step "What is the answer?" (see Appendix D). All three paraprofessionals brought pencils and the math worksheet to the session prior to delivering the task cue.

Errors in Implementation

During baseline, all three paraprofessionals did not complete step 1 (i.e., bringing tangible or edible reinforcers with them before beginning to teach). While all three paraprofessionals demonstrated errors during implementation, they varied by type and frequency. Paraprofessional KP and MY used social reinforcement (praise) during each baseline session but not after each step the student took to solve the problem. There were also errors in delivering instruction. Paraprofessional KP used several prompts together (i.e., delivered a verbal prompt at the same time as a gestural prompt, erased student errors instead of prompting to avoid student errors). Paraprofessional MY consistently used gestural prompts with every step of teaching and added the numbers for the student. Paraprofessional TO errored by repeating the student's name to gain attention and using full physical prompts on his arms and head during teaching; she did not use any reinforcement, including social praise, at any time during baseline sessions.

Intervention

Accuracy of Implementation

Paraprofessional accuracy of implementation of SLP increased in the intervention condition for all paraprofessionals. Paraprofessional KP's average percentage of steps implemented accurately rose from 11% in baseline to 73% in intervention. KP implemented 93% and 100% of steps with accuracy by the end of the condition. Similar patterns are seen for paraprofessionals MY and TO (see Figure 1). MY went from an average percentage accuracy of 6% in baseline to 93% in intervention. TO went from an average 1% accuracy in baseline to 81% in intervention. All three paraprofessionals had a low level of accuracy of implementation in their first intervention session, with an increase after their first feedback session and prior to their second intervention session.

Errors in Implementation

Paraprofessional KP's percentage of steps implemented inaccurately was 27%; MY had an average inaccurate implementation of 7%. Paraprofessional TO's average inaccurate implementation of SLP was 19%. The most common error during the experimental phase was the inclusion of a gestural prompt with a task direction or without giving the student 3–5 seconds to respond before delivering a more intrusive prompt. A second common error was for the paraprofessional to direct the student to "start over" if he made an error instead of using the next intrusive prompt in the hierarchy to make sure the student contacted reinforcement and as a means of error correction.

Feedback

KP received feedback related to using two prompts simultaneously and giving task direction on the TA. Feedback for MY focused on having her put down her pencil to prevent its use as part of a gestural prompt, and delivery of reinforcement at every stage. TO's feedback centered on the use of reinforcement of all types, particularly edible and tangible items. She also was given feedback regarding her completion of the TA form.

Extension Data

Accuracy of Implementation

Paraprofessional KP had an average accuracy of implementation of 90% in the extension phase. MY's average accuracy of implementation in extension was 81.6 %, and TO's average accuracy of implementation was 84%. Extension data demonstrated a similar pattern as in intervention. Namely, each paraprofessional had the lowest accuracy of implementation during their first extension session, with increases to 100% towards the end of the experimental condition.

Errors in Implementation

The most persistent error in the implementation of SLP across all three paraprofessionals in the extension phase was the exclusion of reinforcement for each step of the task analysis. Paraprofessional MY continued to deliver a gestural prompt with a task direction until the third extension session. Other errors for MY in implementation during the extension phase included not bringing reinforcement to the session (once) and delivering two prompts at the same time (three times).

Feedback

During extension, feedback specific to KP included reminders to read the TA every day before beginning an instructional session, counting 1–3 seconds before moving to the next prompt level, and allowing the student to make an error so that he could eventually be correct with prompting. MY feedback focused on refraining from using a gestural prompt with other prompts and reinforcing every correct response even if the correct response was prompted. Feedback for TO focused on delivering more reinforcement before the training session began and having reinforcement visible. She was coached to give more praise during instructional steps.

Measures

Data Collection

Data for all sessions included one copy of the TA for the intervention task per paraprofessional (three total) and one copy of the TA for the extension task per paraprofessional (three total). A total of 19 baseline, 16 intervention, and 15 extension sessions were recorded and stored, as well as 31 feedback videos. Social Validity paper/pencil questionnaires were sent to the primary experimenter via Google docs for paraprofessionals and US Mail for students.

Inter-Rater Reliability

Inter-rater reliability was calculated for 33% of all intervals across baseline, intervention, and extension conditions (Gast, 2010). Total inter-rater agreement was

100% for these sessions. Cohen's kappa was calculated at 1.00, or full agreement, for baseline, intervention, and extension phases.

Procedural Fidelity

To measure the procedural fidelity of the primary experimenter delivering feedback to paraprofessionals, a third observer used the Procedural Fidelity Checklist (see Appendix D) to rate the fidelity of feedback sessions. A total of 10 intervention feedback sessions and 10 extension sessions (33% of both sessions) were scored. Procedural fidelity was recorded as 100%.

Visual Analysis

A visual analysis of each instructional phase was conducted to assess changes in level, trend, and variability of the data (Ledford et al., 2018). Evidence points to an experimental effect present between baseline and intervention for all three participants. More uncertainty exists when data are examined between intervention and extension phases. Split middle values were calculated to determine changes in trend, stability envelopes to determine the degree of variability within each condition and level, and percentage of non-overlapping data to determine changes between conditions, if any.

Split Middle Data. Split middle trend lines are illustrated by a solid red line on Figure 1. Analysis of this figure demonstrates that for paraprofessional KP, baseline data showed a flat trend, with the mid-rate calculated as 8%. In intervention, the split-middle mid-rate value was 93% demonstrating a steep increase in trend. Her mid-rate value stayed the same when comparing the intervention condition to the extension condition, with extension data following a similar increase in trend. MY had a baseline mid-rate value of 8%, but the last datum of 0% demonstrated a slightly decreasing trend before intervention. Visual analysis of MY's adjacent intervention phase demonstrated a mid-rate of 100% for a steep increase in trend. The data in the extension phase indicated an increasing trend. Paraprofessional TO's baseline data showed a flat trend, with a mid-rate datum of 0%. For her intervention phase, the mid-rate datum was 92%, demonstrating a steep increase in trend for the intervention phase. A slight increase in trend appeared in the extension phase, with a mid-rate datum of 86%.

Stability Envelopes. Stability envelopes are illustrated in Figure 1 and illustrate stable data in the baseline for all three paraprofessionals but variable data in both the intervention and extension conditions. For KP, the data failed to be encapsulated within the stability envelope for baseline, intervention, and extension. Paraprofessional MY's baseline and intervention data were more stable, with only one outlier from the envelope in intervention. However, her extension data were highly variable. TO's data reflected a similar pattern to MY's, in that there was a slight decrease. However, given that her mean implementation accuracy in baseline was so low (1%), it was difficult to graph the stability envelope to illustrate the bands; the envelope for her data was .9-1.1%. In intervention, TO's data reflected the same trends as other participants. Few if any data points were enclosed in the stability envelopes.

Percentage Non-Overlapping Data. The results of the p values for data in each condition are summarized in Table 4. Due to the high rates of the accuracy of implementation in intervention and extension, PND for those phases was 100% with a corresponding p-value of 1. The p-value for baseline to intervention, for all three paraprofessionals, was statistically significant at 0.0159, 0.0014, and 0.0005, respectively.

Social Validity

Upon termination of the project, paraprofessionals were given an online, asynchronous questionnaire to complete. All three paraprofessionals rated the difficulty level of the intervention as "easy," a two out of five (2/5) in a Likert scaled item. All three participants said they would be "likely" (4/5) to recommend the intervention to another paraprofessional (see Figure 2).

Self-report of beginning levels of knowledge of SLP had the greatest variation, with paraprofessionals reporting they either had little to no knowledge, some knowledge, or they were knowledgeable prior to beginning the intervention. By the end of the intervention, all three paraprofessionals reported they were either knowledgeable or very knowledgeable about SLP and reinforcement (4/5) and that overall, they were satisfied or very satisfied with the intervention (3/4). Satisfaction with separate components of the intervention was measured on a scale of very satisfied (5) to extremely unsatisfied (1). Satisfaction with instructions from the primary experimenter, embedded activities within the modules, and feedback sessions scored the highest (i.e., 4 and 5). Two of the paraprofessionals stated that they were somewhat satisfied with the online modules (3/5), while one paraprofessional responded that she was extremely satisfied (5/5). The feedback sessions were considered relevant or very relevant (see Figure 2). Student social validity measures suggest students were happy with the intervention. Student responses state they liked the use of reinforcement the most. Participant I.P. said, “I liked the pace; I felt like I could do it,” and J.C. stated, “I think we should earn something.” All three student participants replied they would like to be taught using SLP in other subjects.

Chapter 4

Discussion

Because paraprofessionals are being called upon to teach academic content to students with ID (Suter & Giangreco, 2009), it is critical to provide them with training to increase their ability to accurately implement and generalize EBPs in one-on-one settings (Carter et al, 2009). The present experiment examined the effects of online training modules on paraprofessionals implementation and extension of the EBP of SLP to teach academic content to students with ID. Specifically, the current experiment examined two research questions: what are the effects of an online training package on accuracy of implementation of SLP to teach an academic task to students with ID, and can paraprofessionals extend their ability to implement SLP with a novel academic task?

Prior research conducted by Brown et al. (2021) examined the level of paraprofessional knowledge of SLP and accuracy of its implementation when teaching an academic task via online training. The authors found an experimental effect between paraprofessional completion of online instructional modules on the accuracy of implementation of SLP to teach mathematics word problems to students with ID and ASD. The paraprofessional participants demonstrated increases in the accuracy of implementation of SLP of 42% from baseline to the conclusion of the study. Brown et al.'s work extends previous research (Douglas et al., 2014; Gerencser et al., 2018) using online instruction to increase paraprofessional accuracy of implementation of SLP using instructional modules. Although effective, Brown et al. (2021) note that inclusion of feedback for participants during the training should be examined to see whether accuracy of implementation could be improved. The authors also state that extending implementation of SLP with a novel task be explored as a forerunner towards generalization to novel settings or academic subjects.

The current study sought to extend the research of Brown and others (2021) by adding a performance feedback condition to the online training. Further, data were collected on the ability of paraprofessionals to generalize the use of SLP to a novel academic task. The current study did not include a separate knowledge component related to SLP (i.e., pre-posttest) since the paraprofessional participants needed to demonstrate 100% mastery of content as measured by quizzes given at the end of each module before beginning to implement SLP instruction. The quizzes at the end of each module provided a natural opportunity to scaffold knowledge needed for implementation.

The results of the present experiment suggest that paraprofessionals can improve their accuracy of implementation after reviewing online instructional modules. Experimental control was demonstrated by an immediate change in level and trend of data with the introduction of the training. Further, the data suggest that paraprofessionals generalized the SLP training to a novel task with similarly high rates of accuracy of implementation. The experiment demonstrated that SLP can successfully be used in academic instruction such as math. The intervention was rated by paraprofessional participants to be valuable to their everyday practice in the classroom and stated they would recommend the training to other paraprofessionals. Below the composition of the online training are discussed including module content and instructional design features.

Module Content

Although relatively infrequent, paraprofessionals have been provided training related to instruction (Douglas et al., 2019; Fisher & Pleasants, 2012). When available, however, paraprofessionals have stated that trainings often are not sufficient to lead to changes in everyday practice (Ledford et al., 2017) nor are they given enough specific training to effectively implement instruction with the students they serve (Walker et al., 2016). The modules in the current experiment were created using the principles of efficiency and specificity. That is, to be efficient the instructional content of the online training focused on providing a basic level of knowledge specific to the task of SLP to allow paraprofessionals the ability to recognize key terms before demonstrating implementation of SLP (Banerjee et al., 2017; Brock & Anderson, 2021; Geier et al, 2018; Nosik & Williams, 2011; Stevens-Roseman & Leung, 2004) and to remove content unnecessary for implementation, thereby reducing cognitive load. (Gerenscer et al., 2018; Tempelman-Kluit, 2006). Regarding specificity, the modules in the current experiment also included three elements identified as critical to the implementation of SLP (Brown et al., 2021; Shepley et al., 2019; Wolery & Gast, 1984). First, the modules presented information related to prompt hierarchies and the progression of SLP, including the use of more restrictive prompts as needed. Second, modules included information about use of a task analysis in instruction, especially regarding the systematic application of prompts. Third, the modules contained information about reinforcement and how to implement it.

Prompts

A review of relevant research on SLP note a critical but common error among new practitioners who are prompting students- they aren't always systematic when choosing the order in which they give prompts. This finding was evident in the current experiment. As Shepley et al. (2019) note, a practitioner must know the distinct types of response prompts available to them and how to organize prompts based on their level of intrusiveness (Wolery et al., 1990). Using nonsystematic instruction can lead to prompt dependency by students; using a more restrictive prompt without giving the student an opportunity to correctly respond independently reinforces the student behavior of waiting for a paraprofessional or other adult to provide the correct answer (Hundert, 2009; West & Billingsley, 2005; Wolery & Gast, 1984). Another common error in implementation of SLP also demonstrated in the current experiments was the delivery of two prompts simultaneously. This type of error also can lead to prompt dependence. Since the student is given two prompts with more intrusive assistance at the same time, it is impossible to know if the less restrictive prompt was necessary to obtain a successful response (Grow et al., 2009; Garland et al., 2015). The instructional content of the modules of this experiment addressed using one prompt type at a time and in a systematic fashion, and only using a more restrictive prompt in case of student error.

Task Analysis

Module content for this experiment also focused on defining and providing examples of a task analysis (TA), specifically when to use the instructional strategy, how to create one, and how to collect data using a TA form. To promote extension, paraprofessionals also observed an expert create a task analysis for a similar mathematics task. Interestingly paraprofessionals often are not aware that most tasks they ask students to complete are chained tasks with discrete steps that must be performed in a specific order for the student to be successful (Browder et al., 2017). The research to practice gap in EBPs suggests that even when educators use a task analysis to teach students academic tasks (Seaman et al., 2018), they often do not effectively operationalize behaviors (Rosenberg et al., 2020). Many novices in implementation of EBPs have not had experience writing behavioral objectives, nor do they see how a skill can be broken into specific parts prior to teaching (Brock & Carter, 2015). It seems clear that paraprofessionals creating and collecting data with a TA must know how to operationalize behavior; without using operational behavior presented in discrete steps, accurate data collection is not possible. Using a researcher developed TA, paraprofessionals were able to see that, like other tasks, academic tasks can be broken down into discrete steps to help students with ID systematically approach task completion (Giangreco, 2010). Although it could be argued that requiring the paraprofessionals to develop their own TA might enhance understanding, the use of a researcher developed TA permitted them to see an accurate and well-designed example. Using concrete examples of a mastered concept is part of quality instructional design (Kameenui & Simmons, 1990). By seeing a well-designed sample of a TA, paraprofessionals may garner a greater understanding of why the accuracy in data collection is so important-to find areas students are struggling with embedded in the task, and to focus assistance only on those areas (Ault et al., 1989). In the experiment, paraprofessionals collected data using the preconstructed TA permitting them to see how to collect data accurately, identify specific skills in which students struggled, and that SLP can be applied to academic tasks such as math. The application of TAs to mathematical tasks are particularly appropriate due to their structured and chained nature. Math tasks typically involve several behaviors that are discrete and must be completed in a specific order to obtain the correct answer. SLP and the creation of relevant TAs provides an opportunity to overtly structure math tasks so that steps are completed in order, are not skipped, and permit the student to receive supported, scaffolded instruction.

Reinforcement

A critical attribute of all instruction is the programmed use of positive reinforcement for a correct response to a stimulus (Cooper et al., 2020). In the current experiment paraprofessionals were given information on distinguishing positive reinforcement from widely held concepts such as bribes or rewards ((Doroudi et al., 2019; Peters & Vollmer, 2014; Witzer & Mercer, 2003). Educators often confuse reinforcement, which is instructor controlled, with bribes, which are student controlled (Landrum & Kauffman, 2006). Research also indicates that educators do not use adequate amounts of reinforcement, including social praise (Jenkins et al., 2015; Wills et al., 2019), tangibles (Bear, 2013) or edible items such as chips (Hardy & McLeod, 2020) that are critical to bring about behavior change. One reason for low rates of positive reinforcement may be that educators have erroneous beliefs about what positive reinforcement is rather than what it is not. For example, Bear (2013) looked at the lack of reinforcement used by teachers not as lack of skill, but rather, a philosophical choice (i.e., behavioral vs. constructivist views of motivation). Helping teachers and paraprofessionals understand the impact of reinforcement is critical to implementing SLP, since many learners have not been successful with a task using other instructional techniques, and therefore may lack motivation to attempt the academic task without reinforcement (Shernoff et al., 2020; Wills et al., 2019).

To address issues related to reinforcement, the modules in this experiment specifically presented information to paraprofessionals about the concept of reinforcement, the different types of reinforcement typically used in classrooms, and how to use reinforcement in instruction (Cooper et al., 2020). Based on research about reinforcement implementation, the modules highlighted that information about immediacy, individualization, and contingency. Specifically, information was presented emphasizing that reinforcement is best given immediately after a correct response (i.e., within 1-3 seconds) and that some students may be more motivated by tangible or edible reinforcers rather than praise (Dozier et al., 2012). They also were presented information that reinforcement be given contingent upon the student emitting a correct answer, whether or not that answer necessitated the most restrictive prompt. Because the current online modules only focused on the delivery of reinforcement in the context of the TA, questions remain regarding paraprofessional use of reinforcement during other instructional tasks and settings beyond the scope of the current experiment; use of reinforcement across the educational day should be targeted for future research.

Module Instructional Design

The use of online instruction to convey educational instruction is increasing at a rapid pace (Paesani, 2020). Research indicates that online instruction design for paraprofessionals should include formats that are accessible to participants for ongoing training, use VMs (VM) to demonstrate how to implement specific skills addressed in the instruction, and provide effective feedback for skill acquisition (Brock & Carter, 2013; Douglass et al., 2018; Walker et al. 2020). The current study employed elements of effective instructional design by using VM, self-checks and end of module quizzes, and feedback. Each of the instructional strategies employed in the modules provided opportunities to see multiple video examples of the technique being discussed. Further, paraprofessionals monitored their own knowledge of content though the use of self-checks and were given feedback regarding specific instructional elements related to implementation.

Video Modeling

VM has been identified as an important element to train adults as part of Interactive Computer Training (ICT) or Computer Based Learning (CBL) packages (Brock et al., 2017; Gerencser et al., 2018; Mason et al., 2017; McCulloch & Noonan, 2013). The use of VM to teach new skills is empirically supported in the literature as an effective means of training adults in a wide variety of subject areas and contexts (Morgan et al., 2014). As part of a learning design package, the VMs included in the current modules provided examples and non-examples of concepts and skills (Di Paolo et al., 2017; Reiser, 2001). Research in instructional design suggests that for participants to understand a concept, they need to identify critical attributes of the concept (Markle & Tiemann, 1970). Doing this requires sets of positive and negative examples that are systematic and controlled (Kameenui & Simmons, 1990). In the experiment, paraprofessionals watched VMs that illustrated critical attributes of a positive example first. For example, they watched videos of an instructor delivering a gestural prompt after reading a textual description of the prompt. Then, paraprofessionals watched videos of a gestural prompt correctly implemented. Finally, they watched a video of a prompt and were asked to identify the type of prompt as a self-check activity. This process was repeated for all five prompts discussed in the modules, thus providing examples and non-examples of each prompt type. By including examples of a gestural prompt and a visual prompt, paraprofessionals learned the concept of a gestural prompt by critical attributes in comparison to the critical attributes of a visual prompts and vice versa. This use of example/problem pairs has been supported in the literature as a more effective means of instruction than problem solving independently (Coppens et al., 2019; Hoogerheide et al., 2014; Kant et al., 2017).

Consideration also was given toward the demographic makeup of the VMs in the modules. In the current experiment, paraprofessionals viewed models who were a white 52-year-old female acting as the instructor (e.g., like themselves) and an African American male approximately 30 years of age. Research on the use of VMs suggests that neither gender (Hoogerheide et al., 2016) nor setting (Merkt et al., 2020) affects the learning outcomes of participants. Additionally, adult models have been found to be more effective than peer models for children with disabilities (Hoogerheide et al., 2016) and adults receiving behavior specific training (Kumens et al., 2021). Utilizing adult models who followed a specific script developed prior to filming (Boyer et al., 2013; La Cava, 2008) suggests that the VMs in the current experiment were appropriate. Perhaps the most important aspect of VMs that the research has revealed is that the effectiveness of video modeling is correlated with the detail provided during instruction or specificity of instruction (Raedts et al., 2017). Specificity of instruction refers to the narrowing of concepts presented during a VM to only those necessary to complete the task (Mayer & Moreno, 2010). In the current experiment, VMs provided paraprofessionals with both background knowledge tailored to the implementation of SLP as well as VMs illustrating specific necessary steps for implementation. Because specificity of instruction is so important, it would be interesting for future research to focus on what information is deemed critical in the VMs. Examination of specificity would challenge researchers to identify the essential elements of VMs of steps in implementation tasks as well as those that inadvertently may serve to distract from instruction.

Self-Checks and End of Module Quizzes

From an instructional design standpoint, immediate feedback on correct and incorrect responding is critical to learner success (Kameenui & Simmons, 1990). One way of providing immediate feedback in online modules is incorporation of self-checks, also known as self-test questions or quizzes, into the materials. Self-checks typically are short formative assessments that include questions about content presented immediately after text or video delivery and are meant to focus the learner on relevant material and/or to signal errors in learning before the learner advances through material (Lewis et al., 2010). They also serve as a means for learners to gauge their own progress and efficacy (Bernard et al., 2009; Oncu and Cakir, 2011; Wittrock, 2010).

In the current experiment, self-checks were embedded in the modules and were placed immediately after the presentation of new content. Paraprofessionals did not need to meet a mastery criterion to move to the next section of a module. The self-checks allowed the paraprofessionals to monitor their own progress towards mastery and permitted the experimenter to monitor concerns with paraprofessional progress and understanding which might lead to inaccurate implementation in intervention (Anthonysamy, 2021). The use of self-check questions also served as a means of increasing engagement by incorporating multiple ways of interacting with content (Wilhelm-Chapin & Koszalka (2020). For example, paraprofessional MY incorrectly answered a critical question during a self-check, “Can you move on to the next step in the TA before a student emits a correct response to the current step?” Before allowing the paraprofessional to move on in content, the experimenter emailed MY and recommended she review the module content for this specific question.

To capitalize on paraprofessional engagement, the experimental modules used self-check questions that included a variety of formats including multiple choice options, true/false, and short answer responses. The short answer responses asked the paraprofessionals to define a concept in their own words, or to draw upon personal experience to create a new example of a concept (i.e., what strategies have you used in the past to gain learner attention?) Comments about the quality of the self-check activities on the social validity questionnaire suggest paraprofessional participants were satisfied or very satisfied with them.

At the end of each module, paraprofessionals were required to take a formative end of module quiz. In the event of getting a score of less than 100%, paraprofessionals were directed to review the material presented in the module prior to retaking the end of module quiz. As outlined in Table 3.

Feedback

Feedback is a critical component of learning and can vary in both content (i.e., performance) and timing (i.e., immediate or delayed) (Nelson & Schunn, 2009; Sinclair et al., 2020). Effective performance feedback (PF) includes an instructor who discusses the procedures or delivery of content during the session (Fallon et al.,2015) and then reviews what went well and what did not (Noell, 2010). In the current experiment, several components of effective PF were used. First, feedback included the experimenter using behavior specific praise (Ledford et al. (2107) to aid in establishing a positive relationship between the instructor and learner (Stockall, 2014). Second, in each session the Implementation Checklist (Appendix D) was reviewed with the paraprofessional thereby providing corrective feedback for steps with errors in a targeted manner (i.e., “In step two, you used a gestural prompt before allowing the student to attempt to complete the step without prompts”). Third, positive reinforcement was given for accurate completion (i.e., “you used this model effectively for the first time, I’m proud of your progress”). Perhaps most importantly, the experimenter ended each session with a goal for the next session. For example, paraprofessional MY inadvertently used gestural prompts on several occasions. Specifically, after the first two feedback sessions were completed, the experimenter and MY noticed that she was delivering instruction with a pencil in her hand and pointing the pencil to the paper. Consequently, the experimenter and MY established a goal for the next session to put the pencil down on her desk; after setting this goal, MY did not inadvertently add a gestural prompt during subsequent sessions. At the end of each session, paraprofessionals were asked if they had any questions. This, and referrals to specific videos or instructional content in the modules, created a self-reflective environment that likely increased paraprofessional engagement with the content (Crisp & Bonk, 2018). Future research should focus on evaluating paraprofessional motivation and its’ possible impact on performance feedback.

Each feedback session was delivered to the paraprofessional in a one-on-one environment through video conferencing software thus reducing reactivity or possible negative emotions such as embarrassment for being corrected in front of their supervising teacher (Bynum, 2015). Additionally, feedback was delivered via a specific script (see

Appendix D) that focused only on the paraprofessionals' performance of specific skills, not personal characteristics, or random statements (Thurlings et al., 2013).

Although the qualities of effective PF are similar across the research base, there are differences in research related to the timing of feedback. Sinclair et al. (2020) and others (Scheeler et al., 2018; Suhrheinrich & Chan, 2017; Wermer et al., 2018) suggest that immediate feedback leads to better learner outcomes; other researchers have demonstrated that delayed feedback also can improve performance if the feedback focuses on critical aspects of the task (Brock et al., 2017; Brock et al., 2020; Brock et al. 2021; Hall et al., 2009). In this experiment, delivery of feedback occurred between instruction sessions so that paraprofessionals could set new performance goals. Thus, feedback was delivered within 24 hours of an instructional session, not immediately. (Solomon et al., 2012). Based on the results found during this experiment, similar to Brock et al. (2015,2016, 2021), it appears that effective performance feedback which delivers behavior specific praise, corrective feedback, and engages paraprofessionals in evaluating their own progress is effective regardless of the immediacy of the feedback. This finding may have implications for future online trainings by reducing costs and increasing accessibility of trainings due to the need for personnel to be onsite or immediately available to provide feedback.

Accuracy of Implementation

Participants were able to implement SLP with a high degree of accuracy. Accuracy of implementation was measured by an implementation checklist (see Appendix D). The checklist was useful to promote systemization of paraprofessional instruction and permitted IOA to be determined with greater precision. Analysis of the data showed several patterns. Paraprofessional errors in implementation of SLP were like that of Brown et al (2021). First, the most common error committed by all three paraprofessionals was pairing a gesture prompt with the task cue. For example, the paraprofessional would say, “look at the problem” while simultaneously pointing to the problem with a pencil or finger. This error occurred in baseline, intervention, and extension sessions, and was discussed in 90% of feedback sessions. Eventually, all paraprofessionals were able to eliminate the simultaneous use gestural prompts with other prompts by the end of the intervention phase (KP) or extension phase (MY and TO).

Analysis revealed that the second most frequent error made by paraprofessionals was to skip steps outlined in the implementation checklist; however, this occurred predominately in baseline or in the first session of intervention. This error led to lower rates of implementation accuracy for the first session but was subsequently corrected via feedback (see Figure 1). The feedback, which reviewed each step in the TA, may be responsible for this increase. By reviewing each step, paraprofessionals were able to ask questions about the use of a TA and given behavior specific feedback. Additionally, during these feedback sessions paraprofessionals were directed to examine previously presented VMs. Complimenting didactic feedback with video modeling may have served to increase paraprofessional implementation and/or decrease errors in the use of the TA.

Finally, the third most frequent mistake made by paraprofessionals in baseline was lack of implementation of error-correction procedures. Often, paraprofessionals would erase student work (including errors) and either complete the problem for the student or give more intrusive visual or modeling prompts without using a less restrictive prompt first. For instance, when a student was unable to implement a step of the task analysis in baseline, paraprofessionals KP and MY began to solve the problem for the student or would “start over” by erasing all of the student’s previous work. These strategies very likely decrease student independence (Blair et al., 2018). By completing the student’s work for them, paraprofessionals also reduce the opportunity for the student to get performance feedback and limits the student’s opportunity to practice new concepts (Mason et al., 2021).

Of interest in accuracy of implementation is the issue of prompt fading. Although information related to prompt fading was not specifically addressed in the module content, all paraprofessionals faded prompts appropriately based on learner success. By design, SLP is “self-fading”. By allowing students to exhibit a step without a prompt (i.e., independently), correct implementation of SLP means the instructor fades a prompt by simply moving to the next step in the task analysis (Doyle et al., 1988; Obrusnikova et al., 2020; West & Billingsley, 2005). In this experiment, paraprofessionals effectively faded prompts by continuing to only use prompts as necessitated in the hierarchy; students were able to solve the target math problem without adding unnecessary prompts. Even though prompt fading is inherent in SLP, it likely would be necessary to address the fading issue without the additional stimuli of a “no” response, as used in error correction procedures alone (Leaf et al., 2013; Rodgers & Iwata, 1991).

Extension to a Novel Task

Developing training packages that lead to greater application of behavior specific skills by paraprofessionals is vital and may be considered goal for any training (Joyce & Cartwright, 2019; Stokes & Baer, 1977). However, many studies regarding paraprofessional training do not measure the application of training to two or more tasks in an academic area, nor to the generalization of skills (Brock & Anderson, 2021; Douglas et al., 2018; Walker et al., 2021). Novel tasks are those with changes related to critical features, such as a new objective (i.e., adding two numbers versus dividing three-digit numbers), a new domain (i.e., spelling, not math), or skills that require a new schedule of performance based on frequency or quantity (Kameenui & Simmons, l990; Richter, 2012). The current experiment examined whether paraprofessionals could extend their newly acquired SLP skills to implementation of a novel academic task based on a learning objective. Specifically, paraprofessional implementation of SLP was measured when teaching three-digit addition tasks with regrouping and then, in extension adding three-digit numbers with decimals with regrouping. The results suggest paraprofessionals can perform as well when teaching a novel academic task as they did in intervention, but only after additional performance feedback was provided. The need for additional feedback may possibly be due to the novel task itself. Specifically, paraprofessionals were not told of the nature of the new task before the extension phase. Being unaware of new steps included in the new task analysis may have decreased their comfort with the steps needed to complete the task.

In some self-check activities, paraprofessionals were asked to apply a concept to another situation or practice. However, module content and feedback may be enhanced by providing paraprofessionals with multiple examples of a concept within the modules to permit them to see applicability of the concepts more clearly to different settings, people, or activities. It stands to reason that if paraprofessionals can extend instructional skills to novel tasks, students, and subject matter, maximum efficiency and cost-effectiveness of training can be reached (Morgan et al., 2004). (Gist et al., 1990; Lerman et al., 2020).

Visual Analysis Considerations

The data collected during this experiment were analyzed to determine experimental effects based on changes in level, trend, and variability. Visual analysis suggests that each paraprofessional had baseline data with low variability evidenced by the corresponding stability envelopes (see Figure 1). There was an immediate change in level and trend between baseline and intervention for all three participants. However, there are some data that should be reviewed to examine possible threats to validity. First, a within-condition analysis was measured through the use stability envelopes. The stability envelopes for this experiment were designated as 80% of the data reported within +or – 20% of the median (Lane & Gast, 2014); however, data points for two baseline sessions, and all intervention and extension sessions did not fit within the 80/20 threshold. In baseline for paraprofessional MY, this may not be as concerning since the accuracy of implementation was decreasing prior to intervention; this pattern also was true of paraprofessional TO (Gast & Ledford, 2014). One possible explanation for not meeting criterion in intervention or extension phases is the inclusion of at least one data outlier point. Specifically, there was an immediate change in accuracy of implementation for each paraprofessional as they entered intervention, but their data did not increase to 80% or greater accuracy until they received their first feedback session. Since the stability envelopes were calculated by the median method, this outlier was enough to change the envelope. The presence of the outlier may suggest that feedback affected implementation accuracy, but this is unknown. This pattern was repeated for each paraprofessional's extension stage.

The percentage of non-overlapping data (PND) also were calculated between each condition. PND between each baseline and intervention phase was calculated at 0, with statistically significant p-values for each paraprofessional. The p-values became more statistically significant with the increase in the number of data points in baseline (i.e., paraprofessional TO's p-value demonstrated a statistically significant score of .0005 as opposed to 0. 0159 for KP). PND values between intervention and extension were 1.00. This is a positive result, suggesting that paraprofessional implementation accuracy was just as high in the extension condition as the intervention. This result suggests paraprofessional generalization towards implementation of SLP with novel settings, students or academic subjects may be possible.

Social Validity

Social validity of the online training was assessed by paraprofessionals and the students with whom they worked. The positive results of the social validity questionnaire were encouraging. Paraprofessionals reported high levels of satisfaction with the intervention, its applicability to their work environment and stated they would highly recommend the training to other paraprofessionals. Paraprofessionals expressed confidence in continuing to use SLP in future instructional, with one paraprofessional noting, "I can watch the modules anytime I want!" They also reported that the students with whom they worked expressed more confidence and willingness to begin an instructional session with them. Paraprofessional TO noted, "I dreaded working with my student because he can be so resistant to learning new tasks. Now, he asks me when we can do math."

Student participants also noted they liked the intervention by the end of the project, although JC remarked that he wasn't sure if he would like it when the intervention began. All student participants said their favorite part was getting reinforcement, specifically edibles like Doritos chips or tangibles such as access to computers. MY's student participant said that he felt more comfortable completing math problems and wanted MY to continue to use the procedure after the experiment ended. TO's student participant reported he liked that TO "didn't get as mad at me." These results may suggest that student participants felt their efficacy of completing math problems increased, possibly due to reinforcement and error correction procedures that prevented negative feedback.

Limitations

There were several limitations to the present study. First, there were only three paraprofessional and students in the experiment. Due to the limited number of participants the results must be tempered until replication studies can determine similar experimental effects. Another limitation was the demographic makeup of participants. All the paraprofessionals were white females in their 50s, while all student participants were white males. Restrictions in the overall population of the district where this experiment took place made diversity of participants impossible, however, these results cannot be said to extrapolate to other participants of color or different ages, or disabilities.. Additionally, the use of PND to measure change between conditions may not be a sensitive enough measure due to the relatively few data points in each phase (Parker et al., 2007; Scruggs & Mastopieri, 1987). Finally, this experiment also did not measure whether the paraprofessionals could maintain high rates of accuracy of implementation over time. It is possible that paraprofessionals may not be able to maintain high rates of accuracy of implementation over time.

Implications for Practice and Future Research

There are implications for future research that should be noted. The findings of this experiment suggest paraprofessionals can implement SLP with accuracy and can generalize training of SLP to a novel task. This experiment represents one of the few online trainings for paraprofessionals related to implementing SLP for an academic task; most other trainings have centered on chained behavior related to communication (McCoy & McNaughton, 2020) or daily living skills (Crites & Howard, 2017; Probst & Walker, 2017). Future research should examine whether similar online content would be applicable to other academic subjects/tasks that are comprised of chained behaviors. Further, given its focus on quality instruction it may prove useful to examine whether content presented in the modules could be applied to other instructional trainings; other trainings that seek to impart information on operationalization of behavior, reinforcement, or data collection via TAs might find the module content applicable due to the common elements of quality instruction. Instrumentation such as the Implementation Checklist created for this experiment also may be useful to evaluate other performance skills. The step-by-step components of the checklist could serve to aid those developing online training a means to systematically evaluate processes related to implementation instruction. Future studies that include a component analysis should be conducted to tease out the effectiveness of each part of the treatment package (Gerenscer et al., 2018).

The use of the online format offers promise for other trainings for educators including paraprofessionals. Online training may provide an efficient and cost-saving option to fill the need for paraprofessionals who frequently interact with students yet receive very limited training related to instruction (Giangreco et al., 2001). Further, this study is one of the first to examine the experimental effects of online modules provided directly to the paraprofessionals without input or training from the classroom teacher. The use of online modules that are delivered directly to paraprofessionals also may serve to reduce training costs as the modules are created in and provided through free software that is readily available not just in school but in the home (Gerenscer et al., 2018).

Research related to the type and timing of feedback provided in the online training also may prove beneficial. The results suggest that feedback via modules is a viable option that improves paraprofessional accuracy of implementation. Although extensive research has been conducted related to quality elements of feedback (Brock & Carter, 2013; Schaefer & Ottley, 2018), it would be interesting to see if, and how well, quality feedback can be offered in online formats. The advance in telehealth indicates that discussions and feedback are conducted effectively but it may be worth exploring whether actual performance feedback can adhere to quality components while in online formats. The current experiment indicated that delayed feedback related to accuracy of implementation was effective even when given 24-48 hours later. The results of this study suggest that immediate feedback may not be necessary for paraprofessional implementation of SLP. Some researchers (Sinclair et al., 2020) have suggested that the most important aspect of feedback is the immediacy with which it is delivered. As immediate feedback can be more expensive in terms of number of personnel and difficultly with scheduling, the use of delayed feedback that is equally effective may be attractive to those providing training by reducing costs in both time and money. Flexibility related to the timing of feedback may offer greater latitude to providers of instructional trainings.

Finally, as demonstrated in the current experiment, the extension of accurate implementation of SLP to a novel task is a promising finding. The ability to extend performance to the implementation of SLP to a novel task is noteworthy when considering the limited access paraprofessionals have to quality training (Douglas et al., 2019). In this experiment, extension was measured by having paraprofessionals use a common stimulus (a new TA with a similar mathematics task) to measure their ability to accurately implement what they learned in the modules to a second task. The findings may suggest that the online training providing instruction in an EBP that could be used with subject matter beyond only math; similar training may be conducive to teaching other EBP and academic subjects. This extension of an EBP skill such as SLP to a novel skill may cautiously suggest that implementation skills may be effective in other, similar untrained tasks after the online training where paraprofessionals can demonstrate generalization to new settings, students, or academic subjects. Of course, future research would be needed to verify under what conditions/tasks the training might be used with success. It also would be useful to examine how to explicitly program for generalization to other academic tasks through both the module content and feedback. Purposeful programming for generalization has been acknowledged a necessary step in the implementation of EBP (Green & Glasgow, 2006). Perhaps the use of multiple exemplars and examples of the applicability of concepts presented in the modules themselves may enhance paraprofessional generalization of implementation skills.

Conclusion

In summary, after receiving online training, paraprofessionals were able to implement SLP with accuracy. Further, they were able to generalize the SLP training to a novel task. This experiment extends previous research by applying SLP instruction to paraprofessionals in the academic area of mathematics, a subject matter in which SLP often is not used despite the chained nature of the tasks frequently undertaken. Importantly, the experiment focused on accuracy of implementation rather than simply knowledge of SLP. Although knowledge of an instructional technique such as SLP is useful, the ultimate outcome of training should be the ability of paraprofessionals to implement the strategy in an instructional setting. After receiving the online training paraprofessionals were able to use the strategy with accuracy and felt positively about their ability to implement the technique with their students. The current experiment further expands research related to SLP instruction for paraprofessionals by demonstrating that skills related to SLP instruction can be extended to a novel but related task. The current experiment provides initial evidence of the potential viability of online instruction of an EBP such as SLP to paraprofessionals. Through carefully designed online modules that use research-based information related to content and instructional design, the current experiment provides initial evidence of an effective training method for paraprofessionals that can positively affect the educational outcomes of the students with whom they work.

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Appendix A

Tables

Table 1

Paraprofessional and Student Characteristics

Participant	Age (years)	Race	Gender	Experience or grade	Degree obtained	Disability category
Paraprofessional						
Kristie	50	W	F	21	HS	
Marsha	52	W	F	20	HS	
Tammy	50	W	F	22	O	
Student						
John	12	W	M	7th		ASD
Ian	15	W	M	9th		ID
Logan	13	W	M	7th		ID/ASD

Note. W=white, F=Female, M=Male, ID=Intellectual Disability, ASD=Autism Spectrum Disorder, HS=High School, O=other/trade school

Table 2

Description of SLP module content

Module Topic	SLP content	Time to Complete	Additional Materials	Video Segments	Self-Check	Activities
Prompts and prompt systems	Define task cues, prompt types, prompting hierarchy, and SLP	1 hour 18 min	None	Twelve	Two	None
Implementation of SLP	Discrete vs chained tasks, writing steps in an academic task and a TA, gaining learner attention, and using the prompt hierarchy	1 hour 30 min	TA	Ten	Three	One
Reinforcement	Define R +, difference between R + and a bribe, types of reinforcement, correct/incorrect use of reinforcement	1 hour	TA form	Twelve	Two	One

Note. SLP=System of Least Prompts, TA=Task Analysis, R^+=Positive Reinforcement

Table 3

Module Analytics

Paraprofessional	Module 1				Module 2				Module 3				Time
	Views	SC	ATT	Quiz	Views	SC	ATT	Quiz	Views	SC	ATT	Quiz	5: 57
KP	1	100%	1	60%	1	83.5%	1	70%	1	100%	1	40%	
			2	70%			2	100%			2	80%	
			3	100%							3	100%	
MY	3	67%	1	70%	1	50%	1	90%	1	100%	1		5:06
			2	70%			2	100%			2		
			3	100%									
TO	2	100%	1	80%	1	0%	1	90%	1	75%	1	100%	4:34
				100%			2	100%					

Notes: Views=Number of times reviewed module, self-check average score=SC, ATT=Attempt to quiz mastery, Quiz=scores at each attempt

Table 4

Cohen's Kappa Reliability

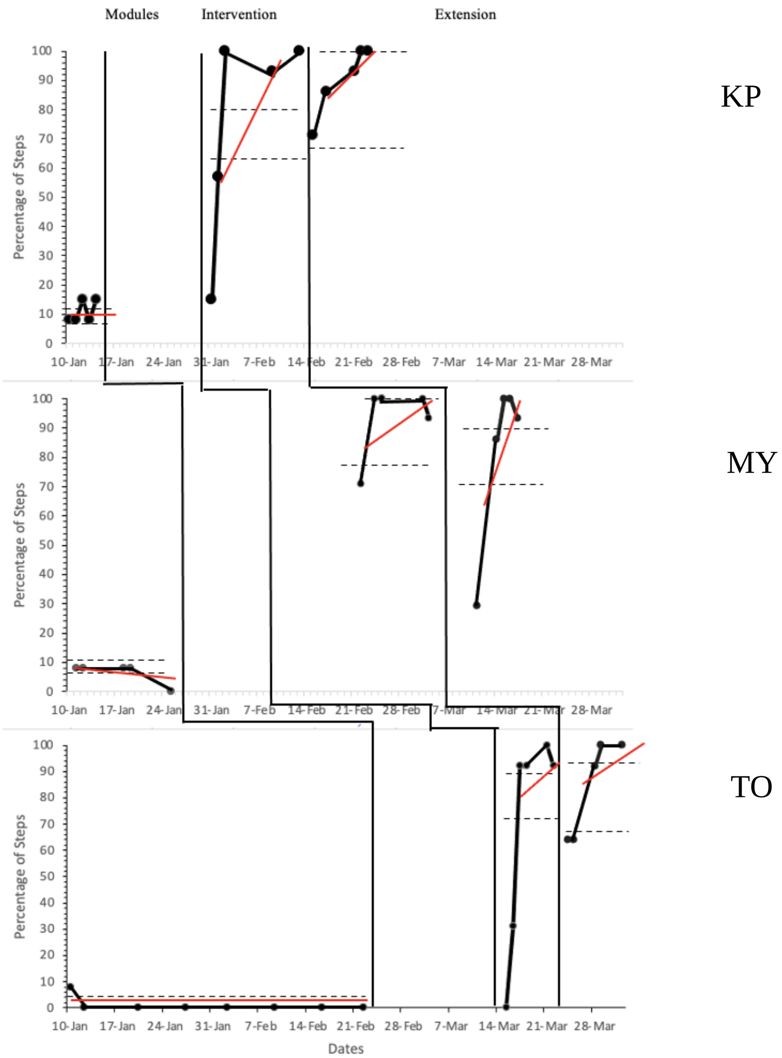
Baseline	1.00
Intervention	1.00
Extension	1.00

Appendix B

Figures

Figure 1

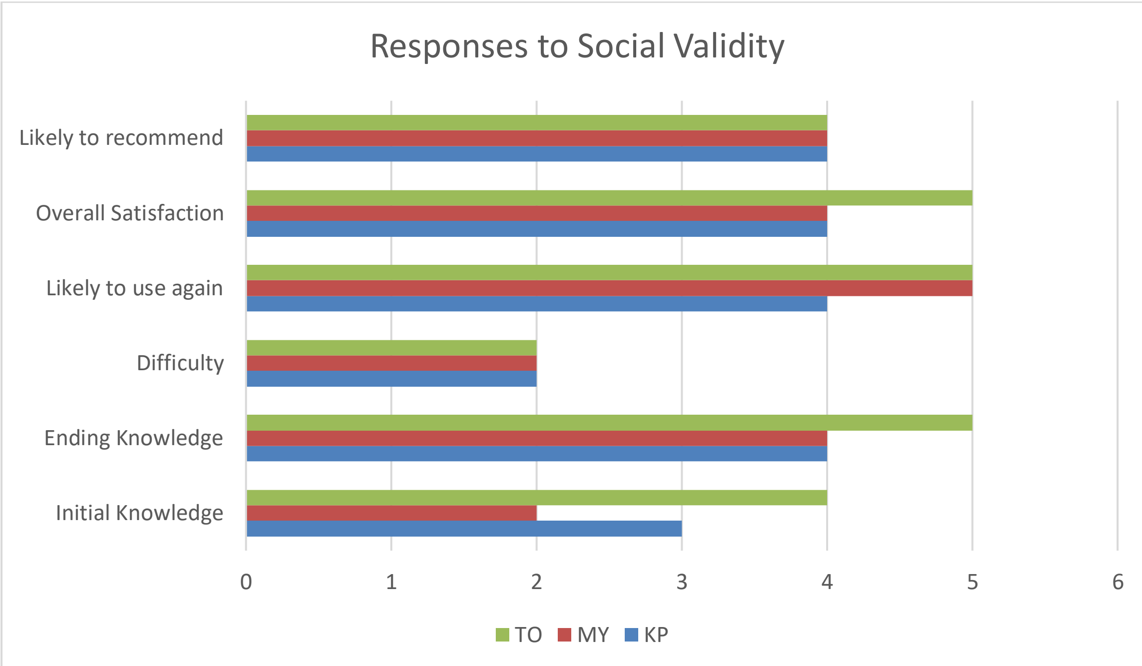
Percentage of Steps Accurately Implemented



Note: Figure 1 illustrates the percentage of steps implemented with accuracy as demonstrated on the Implementation Fidelity Checklist

Figure 2

Measures of Social Validity



Note: Paraprofessional responses to Likert items on social validity questionnaire

Appendix C

Review of Relevant Literature

Four areas of research are relevant to the present study: paraprofessional training, including legislative mandates and roles in the classroom, access to and best practices in training, distance learning, video modeling, including feedback and types of feedback, and system of least prompts (SLP).

Paraprofessional Training

The use of paraprofessionals to deliver instructional and behavioral interventions has grown steadily, as mandates for full inclusion were put in place via federal legislation. During the 1969–1970 school year, the US Bureau of Labor Statistics reported 57,000 paraprofessionals working in the schools. In 2001, the number of paraprofessionals working with students with disabilities in United States schools was roughly estimated to be 300,000 (Giangreco et al., 2001). By 2019, 882,071 paraprofessionals served students with disabilities, making up roughly 13% of the school employee population (Teacher assistants: Occupational Outlook Handbook, 2022). As the number of paraprofessionals serving students in schools has increased, researchers have attempted to delineate the roles of paraprofessionals, what they do and what they should do, while also measuring their efficacy in their roles. Put briefly, the use of paraprofessional support does not always equal positive outcomes for students (Giangreco et al., 2005).

Legislative Mandates

The demarcation of necessary skills and hours regarding the training of paraprofessionals was first addressed legislatively by Public Law No. 94-142 (Education for All Handicapped Children Act of 1975). During these initial debates, legislators made assumptions about the ability of children with severe intellectual or behavioral disorders to be educated in schools. The role of a paraprofessional was that of a supportive adult to monitor the child with severe disabilities rather than educate them because this student population would not be able to learn regardless of instruction (Giangreco et al., 2001). The passage of the Individuals with Disabilities Education Act (IDEA) 1994 and reauthorized in 2004, set forth basic guidelines regarding the education and training of paraprofessionals in 20 U.S.C. 1412(a)(14). The law states, "State educational agency has established and maintains qualifications to ensure that personnel necessary to carry out this part are appropriately and adequately prepared and trained, including that those personnel have the content knowledge and skills to serve children with disabilities." (Individuals with Disabilities Education Act, 2004).

The nature and quality of this training varied between local and state authorities. The No Child Left Behind Act (NCLB) of 2001 attempted to provide parameters for paraprofessional use in the classroom. Paraprofessionals were only to act under the direct supervision of a special education teacher, where the teacher created the lesson plans and supplementary instructional materials (Patterson, 2006). NCLB specifically states, "Because paraprofessionals provide instructional support, they should not be providing planned direct instruction, or introducing students to new skills, concepts, or academic content" (NCLB, 2004). In a qualitative study regarding paraprofessionals perception of their abilities and roles, Carter et al. (2009) found paraprofessionals reported providing direct one-on-one or small group instruction to the students they support (Carter et al., 2009).

The reauthorization of Every Child Succeeds Act (ESSA) in 2015 attempted to define what a paraprofessional is and delineate the roles and responsibilities they must undertake. Specifically, "the paraprofessional's primary job is to support the instruction provided by the teacher, providing assistance to the teacher, assisting with classroom management, and other duties as assigned" (ESSA, 2016). ESSA authorized the specific use of paraprofessionals to work with students with severe disabilities in Title 1 schools. Unfortunately, no specifics exist in these pieces of legislation regarding what constitutes appropriate roles for paraeducators or standards that suggest a paraprofessional is "well-trained."

Roles in the Classroom

Two distinct educational environments exist in which paraprofessionals most commonly work: general education settings and special education settings. The assignment to either setting is generally based on supports listed in a child's IEP or by the teacher supervising the paraprofessional (Fisher & Pleasants, 2012; Giangrecro, 2010). Fisher and Pleasants (2012) found that 78% of paraprofessional respondents reported directly to a special education teacher during the workday. They reported that approximately 20% of the paraprofessionals surveyed worked one-on-one with a student for the entire day in either the general or special education setting. This contrasts with the legislative dictate that paraprofessionals must work under the direct supervision of a special education teacher and must not provide instruction they create.

In another study regarding the roles of paraprofessionals in the classroom, Mason et al. (2021) found a lack of clarity for teachers and paraprofessionals on the responsibilities and duties paraprofessionals were expected to perform, the role of a paraeducator and the lack of respect and inequality felt by paraprofessionals given their responsibilities (Mason et al., 2021). Paraprofessionals noted that teachers looked at them as second-class citizens rather than collaborative partners. Teachers responded that their efficacy in working with paraprofessionals is due to a lack of training during teacher training in multiple studies (Lane, 2021; Lerman et al., 2020; Massafra et al., 2020).

During the time in the classroom, paraprofessionals not only provide direct instruction to the students they serve but also implement behavioral plans (Carter et al., 2009; Mason et al., 2021), design and deliver instruction (Reddy et al., 2020) and perform other duties, such as data collection and social interventions (Massafra et al., 2020). Paraprofessionals provide these services to children from early childhood and preschool (Hughes & Valle-Riestra, 2008) to K–12 settings (Giangreco, 2010; Giangreco et al., 2005; Suter & Giangreco, 2009). Of great concern in the extant literature base is the quality of the educational services provided by paraprofessionals due to skill deficits and poor training outcomes.

Access to Training

Several issues exist in the current practice of training paraprofessionals, including the assumption special education teachers can and will train paraprofessionals to deliver specific instruction. Special education teacher delivery of training is affected by teachers' lack of self-efficacy as trainers (Brock & Carter, 2016; Walker & Smith, 2015). Even when teachers can identify competencies necessary to demonstrate within their training, the paraprofessionals they train do not perceive the teachers as mastering these competencies (Wallace et al., 2001). One reason is the lack of specific training for pre-service teachers in paraprofessional training and development (Collier-Meek et al., 2018). Teachers can provide excellent training to their paraeducators, which became a focus of paraprofessional training interventions (Scheeler et al., 2018; McCoy & McNaughton, 2019). Brock and Anderson (2020) found a shift from researcher-delivered training to teacher-implemented training. For example, in an experimental study where the classroom teacher was the primary investigator the teacher trained a paraprofessional and a peer tutor to use simultaneous prompting (SP) during instruction of a student with ID (Britton et al., 2017). In this study, the 71-year-old paraprofessional had some experience in constant time delay (CTD), SLP, and recording instructional data. The peer tutor had no experience with prompting procedures or data collection. The study demonstrated that both participants could implement SLP with high levels of fidelity when teaching a student with ID academic content (Britton et al., 2017).

Another issue in the training of paraprofessionals is the training format. In a descriptive study, Patterson (2006) found that 13% of respondents reported they had no training prior to working with a student. Many paraprofessionals report the only training they received as on-the-job (Cappizzi & Defonte, 2012), or through large group trainings (Carter et al, 2009). To systemize the criterion of a quality special educator, the Council for Exceptional Children developed common core guidelines for paraprofessionals. The skills necessary for quality paraprofessional services include (a) Learner Development and Individual Learning Differences, (b) Learning Environments, (c) Curricular Content Knowledge, (d) Instructional Planning and Strategies, (e) Professional Learning and Ethical Practice, and (f) Collaboration (CEC, 2015). Skill development in paraprofessionals is an ongoing process, whereby a one-time training opportunity will not provide enough practice to develop these skills (Massafra et al., 2020).

Best Practices in Training

The literature agrees on best practices in training. First, paraprofessionals must be given well-defined roles (Brock & Anderson, 2020) with a clear definition of their roles and responsibilities (Giangreco, 2010). Second, paraprofessional training packages should occur within a live setting and provide multiple opportunities for feedback and practice (Giangreco, 2005; Yates et al., 2020). This includes the use of standardized observation forms that give specific feedback to the paraprofessional within a close time frame to the end of their session with the student (Collier-Meek et al., 2018; Walker et al., 2020). Strategies that deliver immediate feedback to paraprofessionals during live implementation sessions hold promise in this area (Rosenberg et al., 2020; Scheeler et al., 2018). Finally, paraprofessionals need accessible training in terms of time and money. In rural school districts, paraprofessional training often involves the use of school counselors (Darch et al., 2017) or provides limited access to trainings because of geographical isolation (Bugaj, 2002; Chopra et al., 2013). School districts in these areas should increase the funding available for paraprofessionals (Douglas et al., 2019); and distance learning can alleviate the costs of providing professional trainers on a consistent basis (Brock & Carter, 2013; McCulloch & Noonan, 2013; Robinson, 2011).

Distance Learning

Zigerell (1984) defined distance learning as “A form of instruction characterized by the physical separation of teacher from student, except for the occasional face-to-face meeting allowed for by some projects” (p. 10). Distance learning began with correspondence courses in the 1800s (Caruth & Caruth, 2013; Pregowska et al., 2021). This distance model assumes that training can take place via written materials (Caruth & Caruth, 2013) in mixed-model settings that include mail, texts, and videos with content available on radio and television stations (e.g., UK’s Open University), and including the use of modern technologies such as virtual reality and video streaming platforms (Pregowska et al., 2021). As the availability and quality of online platforms have increased, distance education has become seen as a remedy to the challenges of higher education and adult education. Namely, it has helped overcome challenges related to access through lower prices and materials delivered over large geographical distances (Walker & Rehfedlt, 2012).

The development of online platforms led to an explosion of programs offered through universities. Distance education evolved from correspondence courses into online degree programs offered at approximately 25% of US Institutions (e.g., Penn State's World Campus) in 1999. As of the Fall 2019 semester, 7,313,623 students were enrolled in distance education courses at degree-granting postsecondary institutions (NCES Fast Facts, 2019). These courses allowed universities to expand the breadth and depth of the students they enroll, while collecting much-needed revenue for the development of programs and research (Caruth & Caruth, 2013). However, many adults do not have access to formal coursework due to financial constraints (Gravani, 2019; Simpson, 2013). Instead of providing adult learners with university coursework, many businesses buy or develop training courses specific to the nature of the business's needs.

The difference between learning, which is the acquisition of knowledge over time, and training, which is the acquisition of knowledge and skills to perform a job (Masadah, 2012), has led to a difference in the development of online modules provided in the military (Fortuna, 2017) to train specific subgroups of employees in business (Singh et al. 2021; Stonkute et al., 2018), provide medical training to nurses (Amiri et al., 2021), train teachers in specific methodology, (Al-Balushi & Al-Abdali, 2015; Cooke & DeBettencourt, 2001), and train therapists and paraprofessionals to implement evidence-based practices (Vismara et al., 2009). Successful online training includes specific mechanisms, such as a focus on the difference between adult and child learners, the use of interactive features, coaching and feedback, and active participation activities (Dunst & Trivette, 2009). These results are further supported by findings from Brock & Carter (2013, 2015), Walker et al. (2019), and Douglas et al. (2019).

Video Modeling

Video modeling is the use of a pre-filmed video segment to teach skills to a student that involves learner imitation and correct implementation of a variety of skills (Vladescu et al., 2012). Videos can be delivered via DVD players (Kanfush & Jaffe, 2019), via computer software

(Mechling et al., 2012; Walser et al., 2012), or as videos embedded into instructional modules (Mason et al., 2017). Videotaping target behaviors or component skills increases student capacity to memorize or imitate new behaviors (McCoy & Hermansen, 2007). Video modeling is an evidence-based practice with learners from grades K–8 (Franzone & Collet-Kingenberg, 2008) with positive outcomes for learners with autism.

One form of modeling included self-modeling (Creer & Miklitch, 1970; Hitchcock et al., 2003), where the student serves as his or her own model. The use of the self as model has theoretical underpinnings in the work of Bandura (1969), wherein a key component of learning is the ability to imitate components of a task through observation (Bandura, 1963; McCoy & Hermanson, 2007). A second form of video modeling is video modeling with other as model (VMO), where another model (typically the teacher or therapist) performs the task the student watches in the video.

VMs can differ through perspectives. For instance, a third-person perspective of a video model involves recording the scene from a distance, where the model is present and the viewer is watching the implementation of the skill (Spencer et al., 2015). By contrast, a first-person perspective only shows the hands of the model completing the task and is also filmed from the model's shoulder (Ayers & Langone, 2007; McCoy & Hermansen, 2007). Research in the use of video modeling has shown that while the gender of the video model is important (Hoogerheide, Loyens, et al., 2015), having a model that reflects a student's age is not necessarily the most impactful (Hoogerheide et al., 2016).

As a tool for staff training, video modeling has effectively trained staff to implement stimulus preference assessments (Lipschultz et al., 2015), to train teachers in a variety of behavior analytic skills and procedures (e.g., functional communication training, differential reinforcement, a picture activity schedule, and escape extinction) they then generalized in the classroom (DiGennaro-Reed et al., 2010) and to train instructors to implement discrete trial training (Pollard et al., 2014). The skills acquired during video model training were maintained and generalized by staff once interventions ended (Collins et al., 2009). Hillman et al. (2020) demonstrated that adults with autism spectrum disorder could be trained on how to implement DTT using video modeling and that the participants' procedural fidelity generalized across participants and targets.

Feedback

Performance feedback involves someone (e.g., colleague, coach) observing a teacher and providing specific feedback about the instruction to increase a teacher's use of a selected practice (Govender & Archer, 2021; Collins et al., 2018). Early research on performance feedback delivered to preservice teachers had four critical components identified as ideal. Cornelis and Nagro (2014) determined quality feedback needs to happen immediately during or directly after instruction (Scheeler et al., 2004; Suhrheinrich & Chan, 2017). Feedback needs to provide specific and constructive details to help the teacher trainee understand deficits in performance (Hattie & Timperley, 2007) and be given with the express purpose of moving the trainee toward a goal (Cornelis & Nagro, 2014).

Types of Feedback

Feedback can be delivered in a variety of formats, including written observation forms or email (Casey & McWilliam, 2011; Rhodes & Carter, 2021), checklists and protocols developed by researchers (Bolton & Mayer, 2008; Brock & Carter, 2015), and self-management checklists (McCulloch & Noonan, 2013). Other forms of feedback include live sessions with the experimenter in the same area as the paraprofessional (Brock & Carter, 2015) and distance feedback delivered through a variety of technological mediums, including bug in ear (Scheeler et al., 2018) and video conferencing software (Fischer et al., 2019).

Feedback can be delivered immediately (i.e., within the moment an action occurs by the trainee) and is powerful because it “creates opportunities for practitioners to change their behavior in the moment and avoid repeating errors throughout entire teaching sessions” (Schaefer & Ottley, 2018, p. 1). Immediate feedback can be delivered to paraprofessionals in a “live” setting by either a teacher or researcher and can be delivered live during an intervention session (Brock & Anderson, 2020). For example, Ledford et al. (2018) found that delivering feedback through direct coaching sessions during implementation sessions improved paraprofessional implementation of evidence-based practices. Coaches provided reinforcing social praise or corrective feedback at a rate of approximately once a minute and then used verbal prompting to prevent errors in the future. Coaches delivering feedback faded themselves by increasing their distance from a position sitting immediately next to the paraprofessional to standing outside of the instructional area (Ledford et al., 2018).

Another form of immediate feedback is delivered through bug-in-ear technology (BIE). BIE delivered immediate feedback has the advantage of providing similar quality of feedback in the moment that a trainee is implementing a strategy while decreasing the costs associated with the time of research and his or her travel to the school site (Artman-Meeker et al., 2017, Rosenberg & Huntington, 2021). For example, Scheeler et al. (2018) increased the delivery of behavior contingent praise by training a teacher to provide corrective and immediate feedback (within 1–3 seconds) of the paraprofessional’s implementation of specific praise to a student during and instructional session (Scheeler et al., 2018). BIE has been successful in coaching teachers and school personnel in rural communities where the increased distance between schools and experimenters adds unsuitable costs in time and money (Horn, 2021; Horn et al., 2020). Some evidence suggests that BIE, as a type of real-time performance feedback, should be considered an evidence-based practice for changing interventionist behaviors during instruction (Sinclair et al., 2020).

Advancements in the quality and availability of technology led to the use of telehealth live video platforms to deliver immediate feedback. Known as distance bug in ear (DBIE), researchers and behavior analysts can provide BIE feedback via video livestreaming programs (Rosenberg & Huntington, 2021). DBIE was successful in increasing the fidelity of implementation of incidental teaching (Rosenberg et al., 2020), functional communication training (Artman-Meeker et al., 2017), and contingent-specific praise (Scheeler et al., 2018). Using DBIE for students based on diagnostic criteria (i.e., autism, intellectual disability) and instructional practice (i.e., systematic teaching) needs to be further explored.

Delayed feedback is the delivery of constructive feedback after the instructional session is completed (Suhrheinrich & Chan, 2017). While immediate feedback has the benefit of reducing practitioner errors because of the correction during feedback (Scheeler et al., 2018), delayed feedback has also improved the performance of trainees (Fyfe et al., 2021; Metcalfe et al., 2009). Using video conferencing software to deliver feedback has the advantage of reduced costs while still delivering feedback that meets quality standards (Brock et al., 2021). Delayed video feedback has been used to train paraprofessionals to implement pyramidal training (Wei & Machalicek, 2021) and systematic instruction (Brock et al., 2021). The research comparing delayed video feedback to other forms is encouraging. For example, Zhu et al. (2021) compared the use of email feedback to video conferencing delivered directly to the teacher and assessed the difference in the implementation of discrete trial training (DTT) and incidental teaching (IT).

Their results suggested that teacher implementation of DTT and IT were higher than those when only email feedback was delivered. They reported that teachers rated the delayed video feedback as more acceptable and effective (Zhu et al., 2021).

There is a difference between the experimental effects of feedback on teacher participants as opposed to paraprofessional participants. In a study examining the effects of immediate video feedback on training teachers and paraprofessionals to implement Classroom Pivotal Response Training (CPRT), Suhrheinrich and Chan, (2017) noted that while feedback helped the teacher and paraprofessional participants, it was more impactful with paraprofessionals. They hypothesized this was due to teachers' prior knowledge and experience, which was significantly greater than the paraprofessionals in their study.

System of Least Prompts

Students with ID often require intensive, one-on-one support to experience success in the classroom (Hundert, 2009). The system of least prompts (SLP) is an evidenced-based instructional method used to encourage independent responding by a student in response to a stimulus (Doyle et al., 1988; Shepley et al., 2019). Doyle et al. (1988) defined a system of least prompt instruction as having four essential components: the presentation of a stimulus (i.e., task direction), an opportunity to respond to the stimulus, the use of a prompt hierarchy beginning with the least intrusive prompt (e.g., gestural), and either the delivery of reinforcement for a correct response or presentation of the stimulus with the next prompt type. While SLP may not be as efficient as other teaching strategies, such as constant time delay (CTD), for some learners it is more effective (Chazin & Ledford, 2021).

System of least prompts (SLP) is a form of response prompting procedure, whereby the instructor uses prompts to transfer stimulus control from him or herself to the task at hand

(Shepley et al., 2019; Wolery et al., 1990). An interventionist who uses SLP predetermines the levels of prompts to be used during a teaching session and orders them from least intrusive to most intrusive (Shepley et al., 2019). The instructor delivers a task cue with the least restrictive prompt first; if the student responds correctly, the instructor will then present the next task cue in a chained task (Wolery et al., 1990). If a student responds to a stimulus incorrectly, then the instructor moves to the next restrictive prompt level (e.g., a visual prompt). Students will continue to be prompted in a more intrusive way until the instructor uses a terminal or highly restrictive prompt. At this point, the prompt ensures the student contacts reinforcement (NCES, 2018). In a systematic review of the literature, Shepley et al. (2019) examined over 50 studies and found a functional relation to the use of SLP to teach a variety of chained tasks to students 13 years and older as part of an established behavior training package (i.e., prompting, prompt fading) in the National Standards Project report (2015). When deciding on an effective implementation of SLP, interventionists need to make critical decisions regarding how many prompts students need to complete the task successfully. While Doyle et al. (1988) state the need for only two prompt levels, these parameters have changed to include all six prompt levels (i.e., gestural, visual, verbal, model, partial physical, and full physical) to meet the needs of students (West & Billingsley, 2005) As West and Billingsley (2005) noted, true independence happens when a student can respond to natural cues in the environment with no prompting. An example of this in the classroom is the teacher giving a verbal direction to “begin writing” and the student immediately doing so.

SLP has been used successfully to teach children with autism (Wong et al., 2015), ID (Brock & Carter, 2013: Dieruf et al., 2020) and with learning disabilities (Satsangi et al., 2021). Skills taught using SLP include vocational skills (Van Laarhoven et al., 2018; Yakubova et al., 2019), activities of daily living (Ayers et al., 2013; Probst & Walker, 2017), and academic skills (Bouck & Long, 2020; Dieruf et al., 2019). However, the extant research base regarding teaching paraprofessionals how to implement SLP is limited when examining the effectiveness of distance learning on paraprofessional accuracy of teaching with SLP (Brock & Anderson, 2020; Walker et al., 2020).

SLP and Academic Tasks

SLP has been effective as a means of teaching students with ID academic tasks, such as writing sentences (Pennington et al., 2018), comparing characters in a reading assignment (Dieruf et al., 2020), demonstrating comprehension of social studies texts in inclusive settings (Wood et al., 2015) and solving mathematics problems, including algebraic equations (Jimenez et al., 2008; Spooner et al., 2019). These projects demonstrate promise regarding the use of SLP in special and general education classrooms. Pennington et al. (2018) used sentence frames and SLP to teach students to write sentences. The incorporated sentence frames, such as "I want ________" and then prompted the student to write or type the label to an object identified as a potential reinforcer on a preference assessment. They only used two prompt levels on their hierarchy: a model and then physical prompts. The student participants demonstrated an immediate increase in the percentage of sentences written correctly within the intervention condition.

In a study designed to evaluate the effectiveness of SLP and the use of a graphic organizer to teach reading comprehension to students with intellectual disabilities, Dieruf et al. (2020) found the intervention as proposed was effective for one student; it needed modification for the other two students. A graphic organizer (Venn diagram) was used as a visual prompt in the SLP-prompting hierarchy and as a visual aid during instruction. All student participants were able to effectively compare two characters in the target story, to generalize the skills to a second story. Instructors used an SLP hierarchy of verbal, visual, model, and physical prompts.

Perhaps the largest body of research examining the use of SLP to teach academic tasks is in mathematics instruction. Spooner et al. (2019) conducted a systematic review of the literature to determine what EBP is currently used in teaching students with ID in math. The authors found systematic prompting was used in most high and adequate quality single-case design studies (19 of 22, 86%) and included 62 participants with moderate and severe disabilities across nine research teams in eight geographic areas (Spooner et al., 2019). The authors found that the use of SLP was particularly effective when teaching longer-chained academic tasks, such as word problems or algebraic equations.

Jimenez, et al. (2008) used manipulatives such as a number chart and equation frames (similar to those used by Pennington et al., 2018) to teach students to solve one-step equations. The mathematics task was broken down into a task analysis with nine steps; instructors only used verbal and model prompts. Participants demonstrated an increased ability to solve equations in this manner. Of concern is the lack of generalization of these studies, especially those which gave students problem frames. It is not known if these outcomes would generalize to novel problems found in a mathematics textbook or standardized test (Jimenez et al., 2008).

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Appendix D

Data Collection Materials

Procedural Fidelity Checklist for Feedback

Step	Score	Comments
Did the experimenter review all steps in the implementation checklist used by the paraprofessional and experimenter? If not, how many were reviewed?	**+** (all) **-** (missing) How many were used? (Minimum 1, maximum 20 PER STEP) _______	
Did the experimenter provide reinforcement accurate implementation to the paraprofessional?	**+ -**	
Did the experimenter provide corrective feedback for steps inaccurately implemented?	**+ -**	
Did the experimenter refer to a specific module or video model when providing corrective feedback?	**+ -**	
Did the experimenter ask the participant if he or she had any questions about the session?	**+ -**	
Did the experimenter answer participant questions?	**+ -**	
Did the experimenter review expectations for the next session with the paraprofessional?	**+ -**	

Implementation Checklist for a System of Least Prompts

Target	Step
Gain Attention	Presenting an initial cue (look" while pointing to materials). OR presenting the target stimulus (hand the student a worksheet)
Present the Task Cue Independent	""Let's look at the problem"
Waits 3-5 sec	
Learner Response	If correct, reinforce If error or no response, use next restrictive prompt C E / NR
Para Response	R+ P
If P, then present next level Gestural	"Let's look at the problem"
Waits 3-5 sec	
Learner Response	If correct, reinforce If error or no response, use next restrictive prompt C E / NR
Para Response	R+ P
If P, then present next level Verbal	"Let's look at the problem"
Waits 3-5 sec	
Learner Response	If correct, reinforce If error or no response, use next restrictive prompt C E / NR
Para Response	R+ P
Waits 3-5 sec	
If P, then present last level Model	"Let's look at the problem"
Learner Response	If incorrect, guide student until he or she is correct
Para Response	Reinforce even with prompting

Accuracy	Deliver one prompt at a time Y / N
	Waits 3-5 seconds before next prompt Y / N
Present the Task Cue Independent	"Write the first number of the problem on your paper"
Waits 3-5 sec	
Learner Response	If correct, reinforce If error or no response, use next restrictive prompt C E / NR
Para Response	R+ P
If P, then present next level Gestural	"Write the first number of the problem on your paper
Waits 3-5 sec	
Learner Response	If correct, reinforce If error or no response, use next restrictive prompt C E / NR
Para Response	R+ P
If P, then present next level Verbal	"Write the first number of the problem on your paper"
Waits 3-5 sec	
Learner Response	If correct, reinforce If error or no response, use next restrictive prompt C E / NR
Para Response	R+ P
Waits 3-5 sec	
If P, then present last level Model	"Write the first number of the problem on your paper"
Learner Response	If incorrect, guide student until he or she is correct
Para Response	Reinforce even with prompting
Accuracy	Deliver one prompt at a time Y / N
	Waits 3-5 seconds before next prompt Y / N

Task Analysis Data Sheet Intervention

	Step						
1	Bring pencil and paper to desk	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
2	Look at problem	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
3	Write first number on paper	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
4	Write second number on paper aligned with first number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
5	Draw a line under bottom number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
6	Write a plus sign to the left of bottom number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
7	Add top and bottom number in the one's column	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
8	Write answer under problem	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
9	Add to 2nd column (regroup) only if necessary	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
1 0	Write number in 2nd column under problem	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**

Note: IND= Independent, G= Gestural, V= Verbal, Model=Modelli

Task Analysis Data Sheet Extension

Note: IND= Independent, G= Gestural, V= Verbal, Model=Modelling

	Step						
1	Write first number on paper	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
2	Write second number on paper aligned with the decimal point in the first number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
3	Write third number on paper aligned with the decimal point in the first and second number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
4	Write a plus sign to the left of bottom number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
5	Draw a line under the bottom number	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
6	Add zeros to empty places to make sure all numbers are the same 7.1= 7.100	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
7	Add top and bottom number in the one's column	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
8	Write answer under problem	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
9	Add to 2nd column (regroup) only if necessary	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
10	Write number in 2nd column under problem	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
11	Add all numbers in 3rd column	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
12	Write sum of numbers in 3rd column under problem	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**
13	Write decimal point in correct spot in answer	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**	**IND G V Model**

Implementation Checklist

Checklist for Implementation: Do I have:

Data Sheets	Y N
Pens/Pencils	Y N
Materials used to teach academic task	Y N
At least 2 reinforcers (at least 1 each from two different categories) Example: edibles and praise	Y N

Student Social Validity Questionnaire

Thank you for helping your teacher and classroom aide with this project. We hope you had some fun. Please answer the following questions as honestly as you can. You will not be graded on this, and your paraprofessional will not see what you write.

1. Did you like learning math this way?
2. What was the best part of the way you were taught?
3. What would you change about the way you were taught?
4. Is there anything you would like to tell the research team?

Paraprofessional Social Validity Questionnaire

1. How would you rate your beginning knowledge of a systems of least prompts (before intervention)?

2. How would you rate your ending knowledge of a system of least prompts (post intervention)?

3. Please rate the difficulty level of the intervention

4. How satisfied were you with the following?
    a. Observation
    b. Online modules
    c. Video recording
    d. Instructions
    e. Feedback
    f. Activities

5. How likely will you be to use a system of least prompts in future instructional sessions?

6. Which sections did you find most relevant?
    a. Pre-intervention
    b. Module 1
    c. Module 2
    d. Module 3
    e. Intervention sessions
    f. Extension sessions
    g. Feedback

7. How satisfied were you with the overall project?

8. How likely are you to recommend this intervention to another paraprofessional?

9. Any comments regarding the modules of the intervention?

10. Any comments regarding the quality of the videos embedded in the modules?

11. Any comments regarding the efficacy of the intervention?

12. Any comments to the study team to improve further projects?

Appendix E

Training Materials

Sample Script for Video Modeling

Video 1: Video model of an independent prompt
Actors: 1 as instructor, 1 as student
Materials: Task analysis, pen/pencil, math worksheet

Script:

Instructor says "Let's work on our math problem" as attention getter.

S_d: *Instructor says*, "Look at the math problem."

Student actor looks at the math problem.

Instructor provides social praise "I love you're ready to work!"

Video 2: Video model of a visual prompt
Actors: 1 as instructor, 1 as student
Materials: Task analysis, pen/pencil, math worksheet, copy of step 3- writing the first number on the paper in columns

Script:

S_d: *Instructor says*, "Write the first number of the problem on your paper."

Instructor waits 3–5 seconds.

*Instructor delivers visual prompt: "*Write the first number of the problem on your paper, like it did here." Instructor shows visual prompt and keeps in sight of student.

Student actor writes the first number on their paper.

Instructor provides social praise "Good job."

Video 3: Video model of a verbal prompt
Actors: 1 as instructor, 1 as student
Materials: Task analysis, pen/pencil, math worksheet, token board and marker

Script: S_d: *Instructor says, "Draw a line under the numbers of the problem."*

Instructor waits 3-5 seconds. Instructor delivers verbal prompt "Look at the numbers of the problem. Draw a line under them."

Module Sample Content: Module 1 Prompts and Prompt Systems

Hello, and welcome to our intervention—learning to implement a system of least prompts with our students. I'm excited and grateful that you're here, ready to learn and expand what we know about best teaching practices for students with intellectual disabilities. This course covers a series of three modules. Module one defines prompts and prompt hierarchies. Module two illustrates how to implement SLP using a task analysis, and Module three concludes instructional content by illustrating how to deliver the task direction, how to respond to learner errors, non-responses or correct responses (i.e., rules for reinforcement of learning responding), delivering reinforcement based on student responding, and completion of a TA form by underlining the correct type of prompt needed for the learner to access reinforcement.

Each module will deliver content to you through text, graphics, and video models of the content. At the end of each module, you will be prompted to take a quiz on Google docs. You must achieve a 90% or higher on this quiz before moving on to the next module. Once all modules are complete, I will start taking video of you performing a system of least prompts. Don't worry, I'm sure you'll do fine! Let's begin with Module 1.

Defining Prompting and Prompting Systems

Welcome to Module 1, defining prompting and prompting systems. Before we can learn to use a system of least prompts with students performing an academic task, we need to define a few concepts.

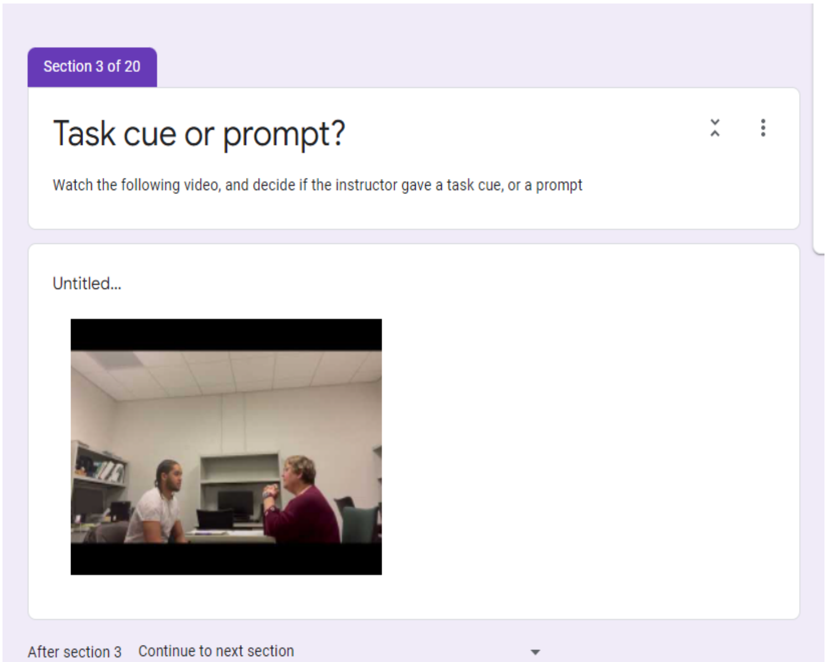
1. What is a task cue? A task cue is a direction you give to a student.

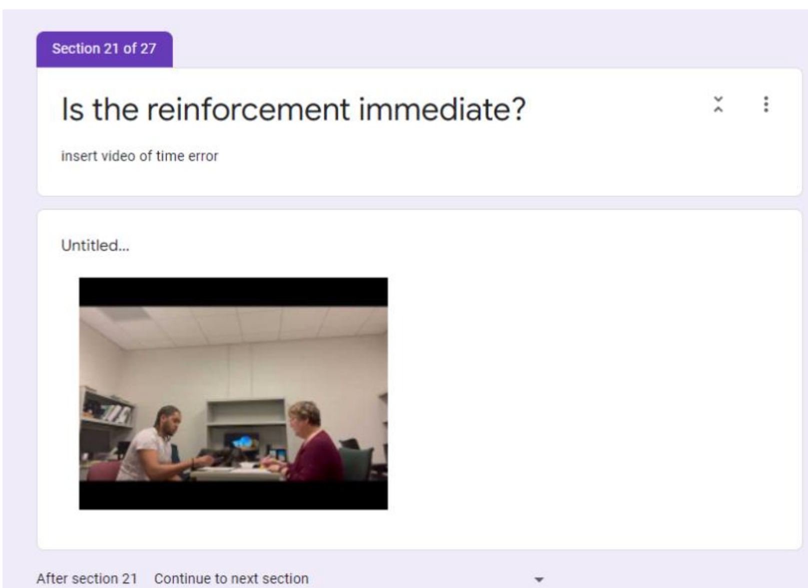
2. What is a prompt? A prompt is any added stimulus given to a student to ensure they answer or perform a skill correctly.

The following chart gives you five examples of a task cue vs. a prompt:

Task Cue	Prompt
Point to the problem	AFTER the cue, you point to the problem and say "point to the problem"
Look at the screen	After the cue, you say "Watch me, "look at the screen"
Draw a line	AFTER the cue, you say "do this" while drawing a line and say the task cue again "Draw a line"
Write your answer	AFTER the cue, you take the student's hand and say "write your answer" while helping him/her write the answer
Listen to the teacher	AFTER the cue, say "Listen to the teacher" and touch your ears

Sample Training Videos





Sample Self-Check and End of Module Quiz Questions

Self- Check Items

Module 1: On the lines below, write your definition of a task cue and a prompt. It will be reviewed for accuracy.

Module 2: How many prompt levels MIGHT you use for each step in the task analysis?

a. 1
b. 2
c. 3
d. 5

Module 3: For our skill check, choose the type of reinforcer described in the scenario:

Bryce is in Ms. Peter's classroom. All students can earn wood chips to use in the classroom store if they finish all of their homework. Bryce finished his homework and got 3 wood chips.

a. Token
b. Social
c. Tangible
d. Edible

End of Module Quiz Items

Module 1: When using ___________ for fading prompts, the teacher begins with a level of prompting that virtually assures that the student will produce the appropriate response.

a. Least to most
b. time delay
c. graduated guidance
d. most to least

Module 2: A task analysis is:

a. a list of the tasks you want the learner to complete
b. an analysis of whether a task is worth teaching

c. a detailed list of the steps necessary to finish a task
d. a list of items a paraprofessional is responsible for

Module 3: My son loves M&M s . After he helped me shovel snow, I bought him some M&Ms. What type of reinforcer did I give him?

a. Tangible
b. edible
c. c. Social
d. d. natural

VITA

Michele Marie Brown

EDUCATION

Ph.D. in Special Education, 2022
The Pennsylvania State University

M.Ed. in Special Education, 2016
The Pennsylvania State University

M.A. in English Literature, 1993
University of Wales, Bangor, UK

B.A. in Economics/English Literature, 1991
Rutgers University

PROFESSIONAL CERTIFIACTIONS

Board Certified Behavior Analyst, 2017

Pennsylvania Teacher License, 1995–Current

Licensed Behavior Specialist, PA Medical Board, 2021

PROFESSIONAL EXPERIENCES

2017-2022 Teaching Assistant, Research Assistant, Guest Lecturer, and Course Instructor, The Pennsylvania State University, University Park, PA

2021-2022 Adjunct Instructor, College of Education, Juniata College, Huntington, PA

PUBLICATIONS

Brown, M. M., & Kubina, R. M. (2022). Increasing confident thoughts in an adolescent with autism. *Behavior Analysis in Practice*. April 12, 2022.

Brown, M.M., Wolfe, P.S., & Jung, S. (2022). Effectiveness of online training of paraprofessionals in delivering instruction with a system of least prompts. *Behavior Analysis in Practice, under review.*

Brown, M. M., Wolfe, P. S., & Riden, B. (2020). The efficacy of self-monitoring to increase on-task behaviors in students with autism. *American Journal on Intellectual and Developmental Disabilities. Under Review*