FURTHER EVALUATION OF DIRECT INSTRUCTION TO TEACH LANGUAGE SKILLS TO AN INDIVIDUAL WITH AUTISM SPECTRUM DISORDER

by

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(Under the Direction of Kevin Ayers)

Abstract

One of the diagnostic features of Autism Spectrum Disorder (ASD) is delay or difficulty with language development and reciprocal communication (American Psychiatric Association, 2013). Thus, developing interventions to target these difficulties is of high social significance for behavior analysts working with children with ASD. One intervention that may be effective in teaching children with ASD relevant skills is Direct Instruction (DI). The current study further replicates language skill development using the DI curriculum, *Language for Learning,* with a 10-year-old boy diagnosed with ASD using an a priori, nonconcurrent multiple baseline across skills design. The study also evaluates the generalization of newly learned skills outside of the curriculum designed probes with a pre- and post-intervention assessment using *Assessment of Basic Language and Learning Skills Revised*. Results and implications are further discussed in relation to the appropriateness of behavior analysts using DI as an effective teaching strategy for clients with ASD.

Keywords: Direct Instruction, Language Development, Language for Learning

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B.S., Ohio State University, 2021

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2022

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December 2022

TABLE OF CONTENTS

CHAPTER 1

Introduction

Delays in language development and expressive speech are a hallmark in identification and diagnosis of Autism Spectrum Disorder (ASD); such that, the majority of commonly used ASD screening questionnaires contain questions specifically relating to social communication (Thabtah & Peebles, 2019). Development of communication skills can benefit the individual by allowing access to more meaningful social interactions and effective expressions of wants and needs. In order to improve quality of life, teaching these skills should be of high priority to educators. Several methods of instruction for teaching language skills to individuals with ASD have been evaluated. Such methods include discrete trial training of component skills, milieu language training, script fading, and augmentative and alternative communication or incorporation of sign language (Duffy & Healy, 2011; Goldstein, 2002). While these instruction methods offer the seeming promise of effectiveness, improper implementation of instruction has the potential to drastically affect treatment outcomes. A project ImPACT study evaluating treatment fidelity and spontaneous vocalizations in children found that parent fidelity and child vocalizations had a positive correlation (Ingersoll & Wainer, 2013). Another study done by Strain and Bovey found that students with ASD whose teacher implemented protocols of the Learning Experiences and Alternative Program for Preschoolers and Their Parents (LEAP) program with fidelity saw greater improvements in various skills, including receptive and expressive language, than peers whose teacher implemented LEAP protocols with lower fidelity (Strain & Bovey, 2011). The concern with previously mentioned popular language interventions

is the need for substantial training to ensure treatment fidelity and increase the opportunity for student gains.

While about 66% of individuals with ASD are referred to a speech-language pathologist to receive services, quality language instruction can and should be delivered at school to bolster the success of the student (Gillon et al., 2017). For this reason, a quality tier one teaching method that can be implemented by teachers is of value to the special education community. Direct Instruction (DI) is a method of teaching that utilizes scripted lessons and specified error correction procedures within a framework of scaffolded programs to match each student's learning pace. A study conducted by Carnine (1981) evaluated the effects of teaching components associated with Direct Instruction– rapid pacing, frequent praise, clear and precise signals, and consistent and immediate corrections. This study found that even implementation of Direct Instruction components with low fidelity led to 80% correct responding on average. High fidelity implementation led to 95% correct responding on average. Studies evaluating DI implementation in schools see high treatment fidelity in teachers who participated in trainings that lasted just one day or less (Benner et al., 2010; Shippen et al., 2005;). The quick training time and high implementation fidelity make DI a great teaching solution to use in schools.

Several studies have evaluated the effectiveness of DI in teaching skills to individuals with ASD with results that suggest it to be an effective method to foster student growth (Frampton et al., 2020; Cadette et al., 2016; Flores et al., 2007; Frampton et al., 2021). The DI curriculum *Language for Learning* (LFL) (Engelmann & Osborn, 1999) targets a plethora of language-based skills including object identification, verb tense, pronoun usage, and labeling actions, among others. A host of studies evaluated this specific curriculum's effects on language development in individuals with ASD (Ganz & Flores, 2009; Shillingsburg et al., 2015) but the

findings are generally sporadic and few evaluate skill development based on criteria set forth by LFL as well as a secondary measure. For example, a study conducted by Wolfe et al. (2018) evaluating generalization of skills learned via LFL found that although the target skill was generalizable to implementer and stimuli, the script surrounding task presentation had to remain rigid to obtain correct responding with a participant. On the other hand, a study conducted by Flores et al. (2016) saw generalization of skills across learning activities in all participants. Scahill et al. (2022) found LFL to be an effective intervention in teaching language skills according only to a secondary measure– Clinical Evaluation of Language Fundamentals. This may not represent a true evaluation of LFL because without reported data on the LFL assessments one cannot determine mastery of skills as designated by the curriculum. Flores et al. (2016), Ganz & Flores (2009), and Schillingsburg et al. (2015) found LFL to be an effective intervention in teaching language skills according only to LFL. This type of analysis could be an even more incomplete evaluation of LFL because without any evidence-based measure to compare skill development to, gains made via the curriculum and measured by the assessments within the curriculum may not hold adequate external validity.

The potential value of an instruction method like LFL deserves further evaluation with the ASD population. The idiosyncratic nature of ASD itself means that no single blanket intervention will be effective for every individual or even for individuals with similar topographies of behavior. The system by which LFL presents discriminative stimuli and corrects student errors relies on repetitive presentation of similarly worded directions and a developed echoic repertoire of the student. Evaluations of LFL within the population of ASD seems promising but it is important now to present findings with subsets of this population before it is broadly applied to support or special education classroom usage. Previous studies have offered

partial evaluations of LFL thus, it is necessary to evaluate LFL both as it stands, utilizing accompanying assessments, and against an evidence-based tool in order to make conclusions about its effectiveness. The current study evaluates the effects of language instruction using *Language for Learning* on receptive language, vocal imitation, labeling, intraverbals, spontaneous vocalizations, and syntax and grammar for a child with autism in a clinic setting.

CHAPTER 2

Method

Participants

The participant, Trent, was seeking assistance with his language skills from a local university. Researchers determined participant eligibility based on an ASD diagnosis, decent mand and tact repertoires, and difficulties with autoclitics, correct grammar and syntax, etc. Trent is a 10 year old male receiving services in a clinic setting. He is in the 2nd percentile of language development as assessed by an SLP prior to his participation in the study. He previously received language instruction in his special education classroom and individualized instruction via his SLP with little progress. Parents gave consent prior to his participation in the study.

Setting

This study was conducted in a clinic in the southeast United States. All sessions took place in a clinic classroom with a researcher delivering instruction and an observer. Trent received instruction at a 6ft x 3ft table in the back of the clinic classroom. Researchers conducted all sessions in a 1-to-1 format with the researcher seated next to the participant and an observer positioned at a secondary table across the room.

Materials

Materials were consistent for all sessions. Researchers used the *Language for Learning* (LFL) presentation books A and B, LFL workbook A, and LFL picture book during instruction. Researchers used the scoring sheets in the back of the LFL Teacher Guide to collect data on all

placement tests and assessments. Researchers also used the LFL teacher guide to review how to implement instruction. For pre- and post-intervention assessment of skills, researchers used the *Assessment of Basic Language and Learning Skills Revised* (ABLLS-R).

Response Definitions and Measurement

Measurement System

A researcher naive to the purpose of this study administered specific ABLLS-R sections for Trent pre- and post- *Language for Learning* (LFL) instruction via parent interview. Researchers used the scores to evaluate the generalization of LFL instruction then administered the LFL placement test during the first session with the participant. Performance on the placement test determined Trent's starting place of instruction. Then researchers administered the program assessment corresponding to the participant's starting lesson (i.e., assessment 4 for participant placement at lessons 31-40) for baseline data. Researchers probed participant progress using the corresponding program assessment again at the completion of each lesson.

Reliability and Fidelity

Interobserver agreement (IOA): A trained second observer collected data using the same *Language for Learning* placement test data sheet and program assessment data sheet. Researchers calculated agreement by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100.

For Trent, a second observer collected IOA data on 100% of placement tests, 80% of baseline program assessment probes, and 53% of intervention program assessment probes. Researcher and observer agreement was 100%, 99%, and 99%, respectively.

Procedural fidelity (ProFi): All researchers and observers were trained in the program procedures using the *Language for Learning* Teacher Guide. A trained second observer collected

ProFi data using a secondary data collection sheet that assessed researcher behaviors. Researchers calculated ProFi data by dividing the number of steps implemented correctly by the number of total steps and multiplying by 100.

For Trent, a second observer collected ProFi data on 100% of placement tests, 55% of baseline program assessment probes, 47% of intervention program assessment probes and 56% of instruction lessons. Researcher fidelity was 100% for all categories.

Experimental Design

Researchers used an a priori non-concurrent multiple baseline across skills design to evaluate the effectiveness of instruction across skills for the participant. To control for threats to internal validity within the design, baseline lengths were arbitrarily determined to be three, five, and seven data points. This decision was made because increasing the length of time in baseline as time in intervention increased allowed for researchers to determine that exposure to baseline or familiarity with the script alone was not enough to increase child performance across tiers. A pre-/post- measure was also used to evaluate the generalization of the program instruction. For Trent's first condition, researchers used the corresponding program assessment to probe participant progress on lessons 31-40 (found via placement test), in chronological order, at the completion of each lesson. For Trent's second condition, researchers used the corresponding program assessment to probe participant progress on lessons 41-50, in chronological order, at the completion of each lesson. For Trent's third condition, researchers used the corresponding program assessment to probe participant progress on lessons 51-60, in chronological order, at the completion of each lesson.

Procedures

General Procedures

In each condition, the independent variable was the delivery of language instruction using *Language for Learning*. Researchers used the *Language for Learning* Teacher Guide and associated curriculum materials to provide instruction, including all prompting and error correction procedures as outlined in the Teacher Guide.

ABLLS-R

A researcher naive to the purpose of this study administered sections C, E, and G-J of *Assessment of Basic Language and Learning Skills Revised* (ABLLS-R) for the participant via parent interview. Researchers chose to administer these sections of ABLLS-R because they coincide with the skills taught directly in the *Language for Learning* curriculum. A naive researcher first administered the ABLLS-R sections prior to the delivery of any *Language for Learning* instruction. They administered the ABLLS-R sections again at the completion of the participant's third condition, again via parent interview.

Placement Test

Researchers administered the *Language for Learning* placement test according to protocol detailed in the Teacher Guide during the participant's first session. Researchers collected data on the placement test data sheets provided in the curriculum. The participant's performance on the placement test determined their starting place for instruction. During the placement test, researchers and observers provided no prompting and repeated the task direction once following no response before marking an item as incorrect.

Probes

Researchers administered the corresponding program assessment three times before instruction began in condition one, five times before instruction began on condition two, and seven times before instruction began on condition three to collect data on the participant's baseline level of responding. Following the baseline probes, researchers used the corresponding program assessment to probe the participant's progress at the completion of each lesson. When instruction on the final lesson on the set concluded, researchers administered the final program assessment probe. For this probe, following the mastery criteria outlined in the *Language for Learning* Teacher Guide, researchers implemented a 90% correct criteria before beginning instruction on the next set of lessons (condition two). If the participant's performance on the final condition probe was below 90%, researchers reviewed the lessons outlined in the curriculum and re-probed at the completion of this review. This process continued until all review lessons had been completed. If the participant had still not reached mastery criteria at this point, data collection began on the next lesson set.

Following successful competition of all lessons and program probes in condition one, researchers used the next corresponding program assessment to begin baseline probes in condition two. Researchers began delivering instruction on the next lesson set following baseline data collection and used the corresponding program assessment to probe participant progress at the completion of each lesson.

With the 90% correct criteria still in place, upon successful competition of all lessons and program assessment probes in condition two, researchers began collecting baseline data on condition three by probing each participant using the next corresponding program assessment.

With the 90% correct criteria still in place, upon successful completion of all lessons and program assessment probes in condition three, the participant was finished with instruction.

During all probes, researchers and observers provided no prompting unless specified by curriculum, repeated the task direction every 15 seconds until the participant responded, and provided general verbal praise statements (i.e. “good trying”, “nice working hard”, ect.) on a VR5 schedule throughout each probe.

Lesson Instruction

Researchers delivered instruction on a total of 30 lessons for the participant. Researchers used the protocols detailed in the *Language for Learning* Teacher Guide including all prompting and error correction procedures. Instructional sessions occurred four days a week for the participant with each session lasting one hour. During sessions, researchers taught each lesson and followed the completion of each lesson with a program assessment probe as described above. Researchers taught all lessons in chronological order utilizing the curriculum materials as well as various secondary materials needed for instruction (specific common objects for part of a whole, specific items for preposition instruction, etc.).

CHAPTER 3

Results

Figure 1 presents correct responses on program assessment probes for Trent. The y-axis shows correct responding as a percentage of assessment items correct and the x-axis shows each assessment probe administered by researchers following the completion of each lesson. For assessments 4 and 6, Trent did not meet mastery criteria following the conclusion of the lesson set so he participated in review lessons. Researchers probed the program assessment again following each review lesson. The *Language for Learning* curriculum set a mastery criteria of 90% correct responding following completion of instruction using the corresponding assessment. Although Trent met mastery criteria in one of three conditions he responded to treatment in an upward trend in all three lesson sets with high PND (100% in condition 1, 70% in condition 2, and 100% in condition 3).

During baseline of condition one, Trent's highest scoring probe was 26%. The data path in baseline was low and stable. Trent's highest scoring probe during intervention increased to 81%. The data path in intervention (including review) was variable but increasing primarily after probe 11. In this condition Trent did not reach mastery criteria following review lessons.

During baseline of condition two, Trent's highest scoring probe was 70%. The data path in baseline was relatively high and stable. Trent's highest scoring probe during intervention increased to 93%. The data trend in intervention was steadily increasing across probes. In this condition, Trent reached mastery criteria at probe 15 and review lessons were not necessary.

During baseline of condition three, Trent's highest scoring probe was 56%. The data path in baseline was relatively high and stable. Trent's highest scoring probe during intervention increased to 74%. The data path in intervention (including review) was steadily increasing from probes 8-12 then became variable for the rest of instruction. In this condition Trent did not reach mastery criteria following review lessons.

Table 1 shows Trent's scores on *Assessment of Basic Language and Learning Skills Revised* (ABLLS-R). Scores on the post-intervention assessment decreased by 1% for receptive language and 3% for vocal imitation. Scores on the post-intervention assessment remained the same for spontaneous vocalizations. Scores on the post-intervention assessment increased by 14% for labeling, 30% for intraverbal, and 114% for syntax and grammar. For all administered sections, Trent's total ABLLS-R score increased 8% following instruction.

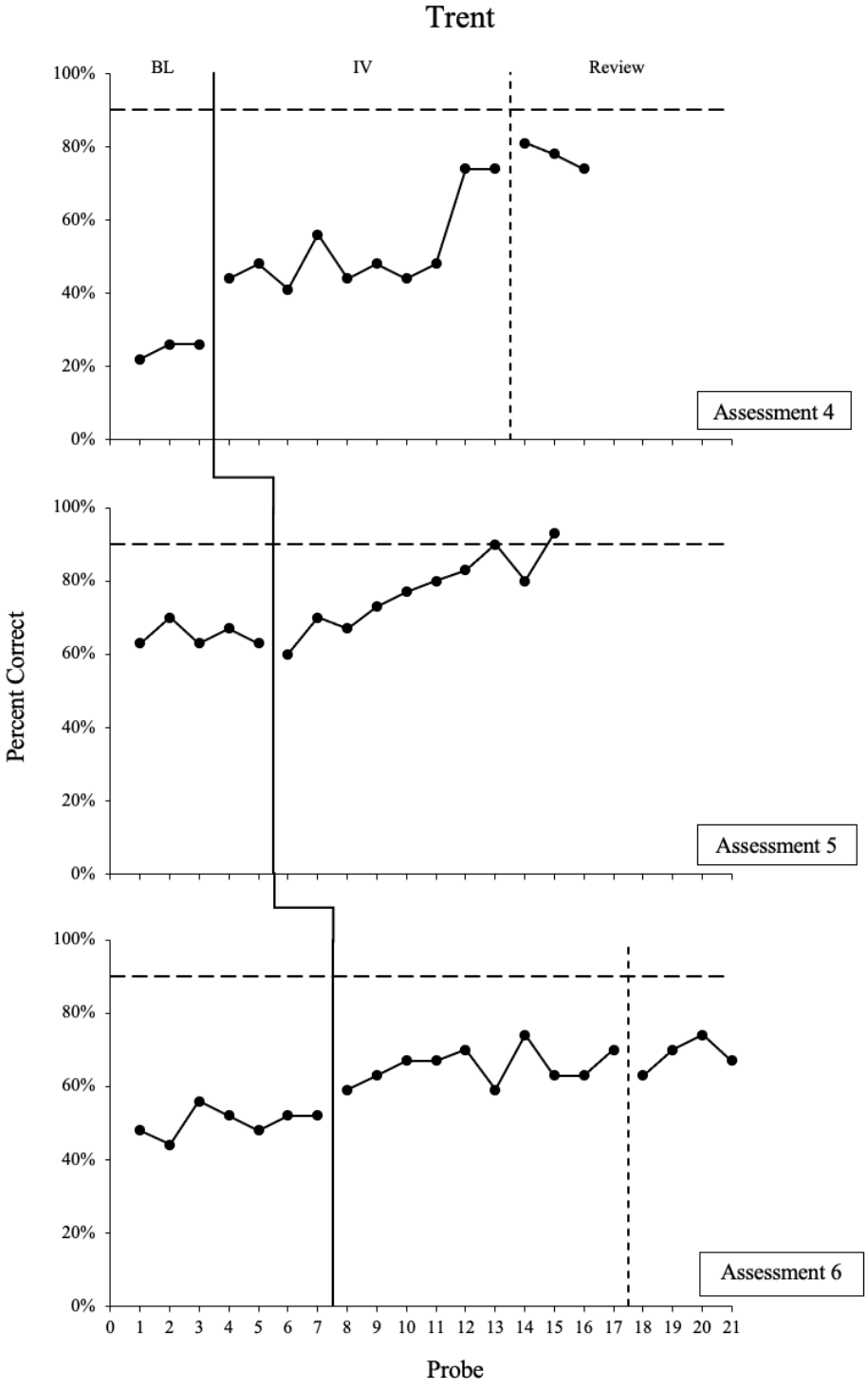

Figure 1: Percentage of correct responses to Language for Learning assessment probes

Table 1: Pre and post intervention ABLLS-R scores for Trent

Section	Pre-intervention	Post-intervention	Section Total
Receptive Language	163	161	184
Vocal Imitation	51	49	56
Labeling	87	99	154
Intraverbal	70	91	180
Spontaneous Vocalizations	25	25	28
Syntax and Grammar	7	15	44
Total	405	440	648

CHAPTER 4

Discussion

The purpose of this study was to further evaluate the current Direct Instruction (DI) research with individuals with ASD. Researchers evaluated the effectiveness of *Language for Learning* (LFL) to teach language skills to an elementary aged child with autism and assessed the generalization of these skills with *Assessment of Basic Language and Learning Skills-Revised* (ABLLS-R). While PND was high and data from assessment probes showed an increase in percent correct responding over time, mastery criteria was not met for two of the three conditions. In addition, post-intervention ABLLS-R scores increased by only 8% overall. Researchers conducted a post-hoc error analysis of questions missed on probes. Those results are displayed in table 2. The table is organized to display concepts introduced in LFL in chronological order from left to right.

Researchers collected the best score on any probe for each section of assessments 4, 5, and 6. Of all sections, Trent scored less than 100% in actions (pronouns), actions (labeling) classification, tense, and concept application. One hypothesis for continuous low scores in these domains is that model prompts can create a stimulus control issue. LFL uses a "model, lead, test" error correction procedure for all child errors. When correcting pronoun errors, for example, the implementer delivers the S^D, "What am *I* doing?" For a child error, the implementer then corrects the error by delivering the vocal model prompt "*You* are …." in reference to themselves. Prompt dependence on the vocal model prompt and a learning history of reinforcement for repeating the vocal model seemed to create faulty stimulus control when teaching subject pronouns such that

Trent often repeated the pronoun used in the S^D. The same hypothesis can be extended to concept application questions because at the beginning of instruction on this skill, the implementer stated a rule that would apply to the next set of questions. The child must then apply that rule to answer questions about an accompanying picture. For example, the implementer states the rule, "The black dog *will* sleep" then, the implementer delivers the S^D, "What do you know about the white dog?" while directing the child's attention to a picture of a black dog, a white dog, and a gray dog. For child errors, the implementer corrects the error by delivering the vocal model prompt "It *won't* sleep". Again, prompt dependence and reinforcement history seemed to create faulty stimulus control such that Trent often would not discriminate subjects to which the rule didn't apply.

In all of the domains that Trent reached 100% correct responding, the vocal model delivered during error correction very clearly mimicked the S^D (e.g. S^D: "Say the whole thing about what an umbrella has" *while pointing to a picture of an umbrella handle*. Error correction: "An umbrella has a handle") so in echoing the model the child still utilized the correct verbiage to relate to the original S^D.

Limitations

The scaffolded nature of the curriculum means that skills are targeted and represented across lessons and revisited across lesson sets, so the possibility exists that previous exposure to and increasing familiarity with the script influenced high baselines in conditions two and three. However, even with a higher level of baseline responding, Trent was unable to meet mastery criteria in any baseline sessions meaning that instruction during previous tiers was not enough intervention to reach mastery criteria in other tiers. Based on the education history of the participant and the reports from parents of halted progress despite several previous instruction

changes researchers were able to evaluate these data amid this potential history threat. Increased baseline lengths in conditions two and three allowed for detection of potential history threats as well as maturation across conditions.

Implications for Future Research

The current study identifies a potential population with whom the error correction procedures of DI may not be applicable. Individuals with strong echoic repertoires may rely more heavily on a script to answer questions presented in this manner. Vocal model prompting can introduce stimulus control issues for individuals who have a developed echoic repertoire and have a strong reinforcement history with repetition of a vocal model. More research should be conducted using DI to teach vocal language skills to individuals with ASD with strong echoic repertoires to evaluate this hypothesis and obtain data on errors made by individuals with a similarly developed repertoire. These data could also be compared to vocal language instruction that isn't so reliant on vocal model prompting and the development of skills in both conditions.

Table 2: Conservative estimate error analysis of frequently missed probe items.

	Information	Actions (Pronouns)	Actions (Labeling)	Part/Whole	Prepositions	Opposites	Classification	Plurals	Tense	Concept Application
Assessment 4	100%	*71%*	–	100%	100%	100%	–	–	–	–
Assessment 5	100%	–	*71%*	100%	100%	100%	–	–	–	–
Assessment 6	100%	–		–	–	–	*60%*	100%	*83%*	*66%*

CHAPTER 5

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