

Effects of Direct Instruction on Reading Comprehension for Individuals with Autism or Developmental Disabilities

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Abstract: This study investigated the effects of a Direct Instruction (DI) reading comprehension program on the reading comprehension skills of students with autism spectrum disorder or developmental delay. Although the effectiveness of DI programs has been well documented in disability and instructional literature, effectiveness of DI for individuals with autism and developmental delay is sparse. This study examined the effects of Corrective Reading Comprehension: B1, a reading comprehension program, on students' acquisition of specific reading comprehension skills (parts of speech, combining sentences with and, identifying contradictions, and identifying relevant/irrelevant information). A single subject multiple-probe across behaviors design was employed to investigate whether a functional relation existed between DI and reading comprehension for this sample. A functional relation between the DI and reading comprehension was demonstrated for each participant across all behavioral conditions. Additional data were collected in the area of reading comprehension using standardized and curriculum-based measures.

Reading is a complex metacognitive process that contains numerous components that must be mastered in order to succeed. Of these components, the ultimate goal is for individuals to be able to derive meaning from the text, otherwise known as reading comprehension. According to the ERIC Clearinghouse on Disabilities and Gifted Education (1996), reading is the most critical skill taught in school because it provides students will access to all other learning. Although learning to read is critical to academic success and the ability to function in society, learning to read is not a natural process, and those who struggle to read, whether it be decoding or comprehension, require systematic and explicit instruction (National Reading Panel, 2000).

Approaches to teaching children to read is perhaps the most studied intervention for school-aged children, which is evidenced by the National Reading Panel's (NRP, 2000) report that over 100,000 studies on reading have

been published since 1966. In 2000, the NRP concluded its task of evaluating existing research to identify the best methods of teaching children to read. The panel found a combination of strategies of explicit and systematic instruction in phonemic awareness, guided oral reading, teaching vocabulary words, and reading comprehension were among the most effective components of reading instruction.

The reading instruction program, Direct Instruction System for Teaching Arithmetic and Reading (DISTAR), developed by Engelmann and Becker in the late 1960s, is a reading program that contains strategies for effectively teaching reading and has extensive research evidence for efficacy (Carnine, 2000). Results from Project Follow Through, the largest educational experiment conducted in U.S. history, indicated the Direct Instruction (DI) methods developed by Siegfried Engelmann (which is now known as *Reading Mastery and Corrective Reading*) produced the highest gains in reading achievement when compared to other methods (Kennedy, 1978). Furthermore, Engelmann's methods were found to be effective for diverse groups of students.

Decades of research demonstrate the effec-

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tiveness of DI, which includes its effectiveness as an intervention for students from low socio-economic backgrounds (Torgesen et al., 2001), students at-risk for academic failure (Carlson & Francis, 2002; Foorman, Francis, Fletcher, & Schatschneider, 1998; Frederick, Keel, & Neel, 2002; Grossen, 2004; Shippen, Houchins, Steventon, & Sartor, 2005), students with learning disabilities (Swanson, 1998; Torgesen et al.), students with limited English proficiency (Carlson & Francis, 2002), and students with cognitive deficits (Bradford, Shippen, Alberto, Houchins, & Flores, 2006; Flores, Shippen, Alberto & Crowe, 2004; Gersten & Maggs, 1982).

Although ample evidence exists for the efficacy and effectiveness of this specific direct instruction model, two subgroups that lack validation for this model are individuals with autism and developmental delay. Since studies have shown that students with autism often demonstrate higher reading decoding ability and weaknesses in reading comprehension (Chiang & Lin, 2007; Huemer & Mann, 2010; Minshew, Goldstein, Taylor, & Siegal, 1994; Nation, Clarke, Wright, & Williams, 2006; Tager-Flusberg, Paul, & Lord, 2005), there is a need for increased investigation into effective interventions to address the needs of students who can decode, but whose lack of comprehension skills will interfere with their academic progress. Given that research regarding the effectiveness of reading interventions for students with autism is emerging, a brief review of the studies is warranted.

A research study conducted by Zayac (2009) indicated that pre-k students with autism were able to learn letter-sound correspondences, blending, segmenting, and word reading through the implementation of *Reading Mastery Plus*. Furthermore, research has demonstrated that *Corrective Reading* programs were effective in teaching students with autism comprehension skills (Flores & Ganz, 2007, 2009; Ganz & Flores, 2009). However, each of these studies utilized single-subject designs, were implemented with young children, and utilized less complex cognitive comprehension skills. In addition, these studies did not utilize entire lessons of the DI programs, only strands of skills. Only one group design evaluating the effectiveness of the direct instruction reading comprehension program has

been published to date (Flores et al., 2013). The lead author of this study is the same as three of the previously mentioned studies, is limited to younger children, did not utilize an entire program, and is focused on less cognitively complex reading comprehension skills.

Given the rise in incidence of individuals with autism as well as the significance of literacy in today's society, the importance of improving reading comprehension for students with autism and/or intellectual disability cannot be understated. Due to federal legislation, accountability in education is at an all-time high; therefore, interventions aimed at improvements in reading for these individuals is vital. In determining which interventions are effective for individuals with autism and developmental delay, replications and extensions of previous research is necessary to document what is considered evidenced-based interventions.

DI has been shown to be effective in teaching diverse groups of students; however, no studies have examined the effects of complex comprehension skills for students with autism and developmental delay or for students who can decode but have deficits in comprehension. Therefore, the purpose of this study is to examine the effects of DI on specific comprehension skills that have not been previously examined (parts of speech, combining sentences with and, identifying contradictions, and identifying relevant/irrelevant information). In addition, the researchers examined whether students were able to generalize reading comprehension skills to other comprehension tasks often required within the academic setting.

Method

Setting

This study was conducted in a public middle school general education classroom, within a small rural school district in the southeastern United States. Two students, Jon and Mia, received one-on-one instruction during the time scheduled for their elective courses. The third participant, Tim, received instruction in an after school tutoring program. This researcher provided instruction to all three participants for approximately six weeks.

TABLE 1**Participant Demographic Information**

<i>Student</i>	<i>Age</i>	<i>Ethnicity</i>	<i>Grade Level</i>	<i>Disability</i>	<i>Years of Services</i>	<i>I.Q.*</i>
Jon	10	White	5	Autism	6	82
Mia	14	African American	8	ID**	8	62
Tim	16	White	10	Autism	10	64

* As measured by the KBIT-2.

** Intellectual Disability.

Participants

Three participants were included in the study. Participants were selected based on a previous diagnosis of autism or developmental delay and a need for targeted instruction in the area of reading comprehension. All three students exhibited weaknesses in the area of reading comprehension as indicated by a reading comprehension goal in his/her IEP and reading comprehension achievement standard scores below 85 on reading comprehension portions of the Woodcock Reading Mastery Test – III (WRMT-III; Woodcock, 2011).

The first participant, Jon, was a 10-year-old boy in the fifth grade who had a diagnosis of autism. He was diagnosed by a developmental pediatrician at the age of 3; however, no specific testing information regarding this diagnosis was included in the doctor's report. In order to determine eligibility under IDEA, a school psychologist conducted another, separate comprehensive evaluation and also diagnosed Jon as having autism. The diagnosis was partially based upon scores obtained on the Childhood Autism Rating Scale (CARS) which yielded an overall autism index score of 89 indicating very likely probability of autism. IQ testing administered by this researcher yielded similar results to prior testing.

The second participant, Mia, was a 14-year-old girl in the eighth grade who exhibited significant delays in adaptive behavior, motor, and cognition and had received services for developmental delay since 3 years of age. Prior to receiving special education services from the public school, she received early intervention services through a state funded early intervention program. Motor deficits resulted in difficulty walking and she wore braces on

her legs for support. This also had an impact on her handwriting. Although her handwriting was very neat, motor deficits required a longer amount of time for Mia to complete assignments.

The third participant, Tim, was a 16-year-old boy in the 10th grade who was receiving special education services due to a diagnosis of autism. Tim had received speech services due to language delay as well as special education services for emotional and behavioral disorder since preschool. He was also diagnosed as having "ADHD mixed R/O PDD" (Rule-out Pervasive Developmental Disorder). In 2008, Tim began receiving services for autism rather than emotional and behavioral disorder after being diagnosed as having high functioning autism by a licensed psychologist. He scored in the mild to moderate autistic range on the CARS and was diagnosed as having high functioning autism with ADHD combined type. Detailed information regarding academic and demographic characteristics are provided in Tables 1 and 2.

TABLE 2**Standard Scores for IQ and Reading**

<i>Student</i>	<i>IQ*</i>	<i>Basic Skills</i>	<i>Reading Comp</i>	<i>Total Reading</i>
Jon	82	90	73	82
Mia	62	55	55	55
Tim	64	78	55	67

* WRMT_III.

Materials

Materials used for this study included the reading comprehension program, *Corrective Reading Comprehension: B1* (Engelmann, Osborne, & Hanner, 2008). This consisted of a teacher's guide, scripted teacher presentation book, and student workbook. The program is divided into separate strands of skills with several components in each strand. Each lesson contains instruction regarding multiple strands. Strands of skills include (a) reasoning skills, (b) information skills, (c) vocabulary skills, (d) sentence skills, (e) basic comprehension skills, and (f) writing skills.

In addition to the reading program, probes for each dependent variable were created by the researcher. The first author created probes based on and modeled after strands of skills taught within the *Corrective Reading Comprehension: B1* program. Reliability of these probes was established by calculating Cronbach's alpha. Reliability tests were administered to 25 eighth grade students for each skill observed. These tests yielded a Cronbach's alpha coefficient of $r = 0.93$ for verbs, $r = 0.92$ for nouns, $r = 0.86$ for adjectives, and $r = 0.97$ for articles. For the second analysis of across strands, Cronbach coefficient alpha yielded $r = 0.91$ for contradictions, $r = 0.93$ for relevant/irrelevant, $r = 0.86$ for same.

A content validity analysis was conducted by three master teachers in the field of reading. The master teachers rated each area (verbs, nouns, adjectives, articles, same, relevant, and contradictions) as relevant, somewhat relevant, or irrelevant. Items were assigned a Likert scale from 1 to 3 with 1 being irrelevant, 2 being somewhat relevant, and 3 being relevant. The mean score for parts of speech and same were 2.3, indicating these skills were most likely relevant to reading comprehension. For relevant and contradiction skills, a mean of 3 was obtained indicating that these skills were relevant to reading comprehension. Finally, the KBIT-2 was used to assess intellectual functioning and curriculum-based measures of reading comprehension were obtained using the maze subtests of AIMSWeb.com. The maze subtest is a multiple-choice cloze task that students complete while reading silently. The first sentence of a 150–400 word passage is complete. Thereafter, every

seventh word is replaced with three words inside parenthesis that students are to choose from. The WRMT-III was used to assess current levels of reading comprehension as well as to measure comprehension growth.

Procedure

Prior to instruction, the students completed the placement test found within the DI comprehension program to determine where instruction should begin. All three students tested into the *Comprehension: B1* level. Next, baseline data were collected until the student demonstrated stability which the researchers defined as no more than 10% variance from the mean rate of responding for a minimum of three probes. Once baseline was established, instruction began with Lesson 1 in the *Corrective Reading Comprehension: B1* program. Instruction for two of the participants, Jon and Mia, consisted of two instructional sessions per day, lasting approximately 30 minutes per session, and occurred 5 days per week for approximately six weeks. The third participant, Tim, received instruction after school. Instructional sessions for each participant were carried out in a one-on-one format by the first author. The researcher provided instruction by following the script provided in the program manual and students completed all 60 lessons found within the B1 level.

Lessons were implemented as instructed in the teacher's guide (Engelmann et al., 2008), which included (a) following the script, (b) using correction procedures for incorrect responses, and modeling correct responses. Since instruction was delivered in a one-to-one format choral responding and explicit signal to cue student responses was not necessary. Probes were delivered prior to the delivery of instruction each day. Once students achieved mastery (90% or better on three consecutive probes) of the identified skill, instruction began for the second identified deficit skill. Introduction of skills were dictated by the order in which they appeared in the reading program. When a participant reached mastery prior to the introduction of the next skill, instruction continued as sequenced in the presentation book. When a participant failed to reach mastery before the introduction of the next skill, the participant reviewed the

previous skills as recommended in the teacher's guide, and the next lesson containing the new skill to be introduced was not delivered until student demonstrated mastery of the previous skill. This was the case for Mia (verbs) and Tim (verbs, nouns, and adjectives; and contradictions).

Once the study was completed, the WRMT-III was administered to the students in order to describe progress in reading comprehension. Maze subtests of AIMSWeb curriculum-based assessments were also administered to determine if students were able to generalize reading comprehension skills to classroom tasks. Additionally, a maintenance probe was given one month after the intervention was over.

Treatment Integrity and Inter-Observer Agreement

Treatment fidelity was measured using a checklist of instructional procedures (Marchand-Martella, Lignugaris-Kraft, Pettigrew, & Leishman, 1995). Approximately 20% of instructional sessions were checked through direct observation or videotape. The checklist was completed by a teacher with a master's degree in special education with 10 years of teaching experience as well as experience using DI programs. Treatment fidelity observations were carried out with 100% accuracy for 100% of the observed sessions. Treatment fidelity measures were taken periodically throughout the study. Inter-observer agreement was calculated for each treatment fidelity session. Agreement of 100% was obtained and was calculated by dividing the total number of agreements by the total agreements and disagreements and multiplying by 100.

Research Design

A multiple-probe across behaviors design was used. According to Horner and Baer (1978), the application of multiple-probe design is appropriate when measurement during extended baselines (a) may prove reactive, (b) is impractical, (c) and/or a strong a priori assumption of stability can be made. Each student was observed under two separate, independent experimental analyses. In other words, each student participated in two multiple-probe across behaviors studies

occurring simultaneously as he/she progressed through the reading program. The first experimental analysis involved examination of behaviors of skills within the parts of speech tract within the program's sentence skills strand. The second experimental analysis involved examination of behaviors across strands of skills.

Results

Figures 1–3 present the percentages of correct responses for the parts of speech probes (verbs, nouns, adjectives, and articles) for Jon, Mia, and Tim. Figures 4–6 present the percentages of correct responses for the across strands of reading comprehension probes (same, contradictions, and relevant). The *x*-axis represents the reading comprehension probes and the *y*-axis represents the percentage correct.

Jon

Baseline. For the parts of speech strand, Jon's average performance for each of the skills was 0% on each of three consecutive probes. For the across strands skills, Jon's average performance for each of the skills was 0% on each of three consecutive probes.

Parts of speech strand. For the within strand analysis, Jon reached criterion for identification of verbs after three sessions. The level of performance was 93% with a range of nine to ten. For the second behavior of nouns and verbs, Jon reached criterion after five sessions and his level of performance was 86% with a range of 60 to 100%. For the third behavior of adjectives, nouns, and verbs, Jon reached criterion after four sessions with a level of performance of 88% with a range of 70 to 100%. Finally, the last behavior which required the student to identify articles, adjectives, nouns, and verbs, Jon reached criterion after three data points. Tim's level of performance was 100%. See Figure 1 for Jon's performance on the parts of speech strand.

Across strands. For the second analysis of skills across strands, Jon reached criterion for same after three sessions with an average performance was 97%. Jon reached criterion for the second behavior (contradictions) after three sessions. The level of performance was

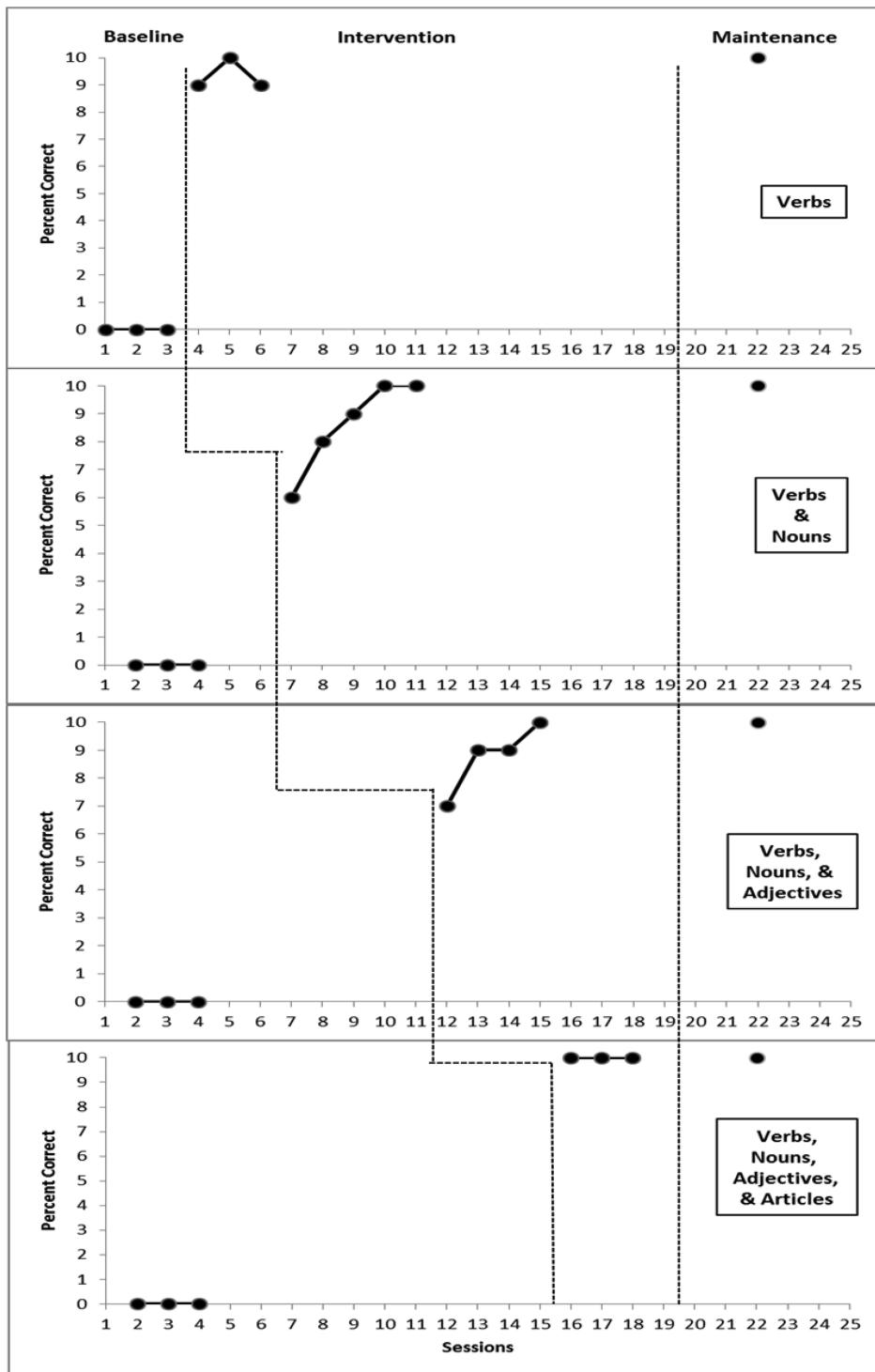


Figure 1. Jon's performance on parts of speech strand.

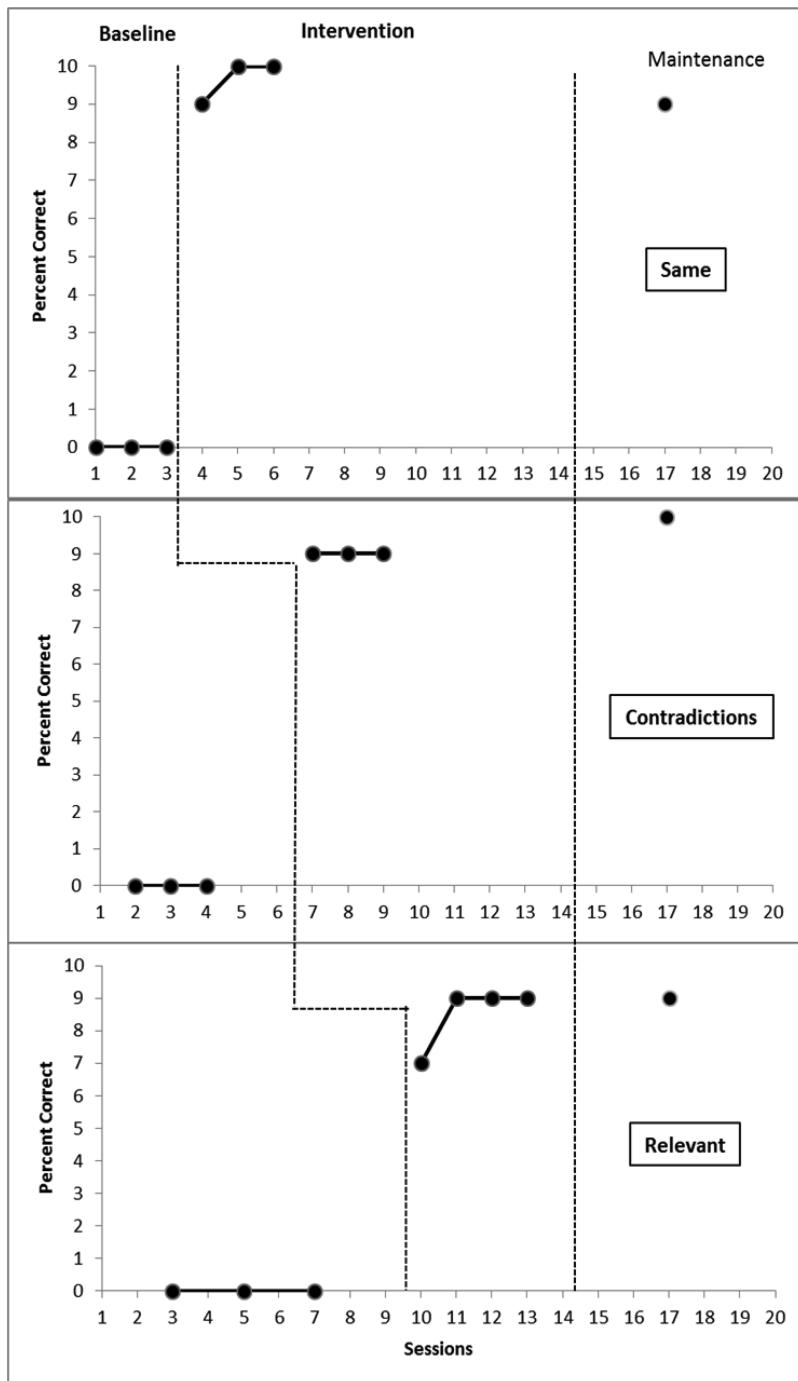


Figure 2. Jon's performance on across skills strand.

90%. For the third behavior, Jon reached criterion after four sessions and average level of

performance was 85%. See Figure 2 for Jon's performance on across strands skills.

TABLE 3**Standard Scores and Grade Equivalents for Jon's Pre/Posttest**

WRMT-III Subtest	Pretest Scores	Posttest Scores	Net Change
Word comp	84 (2.9)	86 (4.0)	+2 (+1.1)
Passage comp	65 (1.7)	94 (4.3)	+29 (+2.6)
Reading comp	73(2.2)	90 (4.2)	+17 (+2.0)
Total reading	82(2.8)	85 (3.6)	+3 (+0.8)

WRMT-III. Jon completed the WRMT-III before and after instruction to determine of gains demonstrated with the use of DI generalized to standardized measures of reading achievement. Jon made a gain in all areas with an increase of almost two standard deviations in the area of passage comprehension and one standard deviation in the area of reading comprehension. See Table 3 for pre- and post-test measures.

Mia

Baseline. For the parts of speech strand, Mia's average performance for verbs was 15% for four consecutive probes. Mia's average performance for each of the remaining skills was 0% on each of the three consecutive probes. For the across strands skills, Mia's average performance for each of the skills was 0% on each of the three consecutive probes.

Parts of speech strand. For the parts of speech analysis, Mia reached criterion for identification of verbs after 12 probes (90% or better after three consecutive probes), and her average performance was 70%. For the second behavior in the parts of speech analysis, Mia reached criterion after seven probes, and her average performance was 73%. Mia reached criterion for the third behavior after eight probes and her average performance was 78%. Mia reached criterion for the last behavior after three probes and her average performance was 100%. Results of Mia's performance on the parts of speech strand are shown in Figure 3.

Across strands. For the analysis of across strands, Mia reached criterion for the first behavior (same), after nine probes and her

average performance was 78%. For the second behavior (contradictions), the average performance was 82%. For the third behavior (relevant), the average performance was 74%. See Figure 4 for Mia's performance on across strands skills.

WRMT-III. Prior to instruction, Mia was administered the WRMT-III to assess her current level of reading achievement. All scores (with the exception of passage comprehension) truncated at 55; therefore, grade equivalents were included. In order to determine if gains demonstrated with the use of DI generalized to standardized measures of reading achievement, a post-test was also administered. Mia made grade equivalent gain in all areas with an exception of passage comprehension. See Table 4 for pre- and post-test measures.

Tim

Baseline. For the parts of speech strand, Tim's average performance for verbs was 57%. For each of the following skills, Tim's performance was 0% on each of the three consecutive probes. For the across strands skills, Jon's average performance for the same skill was 7%. For the skills of contradictions and same two, Tim's performance was 0%. Finally, for the relevant skill, Tim's average performance was 30%.

Parts of speech. For the parts of speech analysis, Tim reached criterion for the first behavior (verbs) after six probes, and his level of performance was 90%. For the second behavior in the parts of speech analysis (nouns), Tim reached criterion after six probes, and his level of performance was 63%. For the third behavior, he reached criterion after 15 probes, and his level of performance was 72%. For the last behavior, Tim reached criterion after three probes and his level of performance was 100%. See Figure 5 for Tim's performance on the parts of speech skills.

Across strands. For the analysis of across strands skills found within the DI comprehension program, Tim reached criterion for the first behavior after four probes with a level of performance of 90%. For the second behavior (contradictions), Tim reached criterion after 13 probes and his average performance was 62%. For the third behavior (same two), Tim

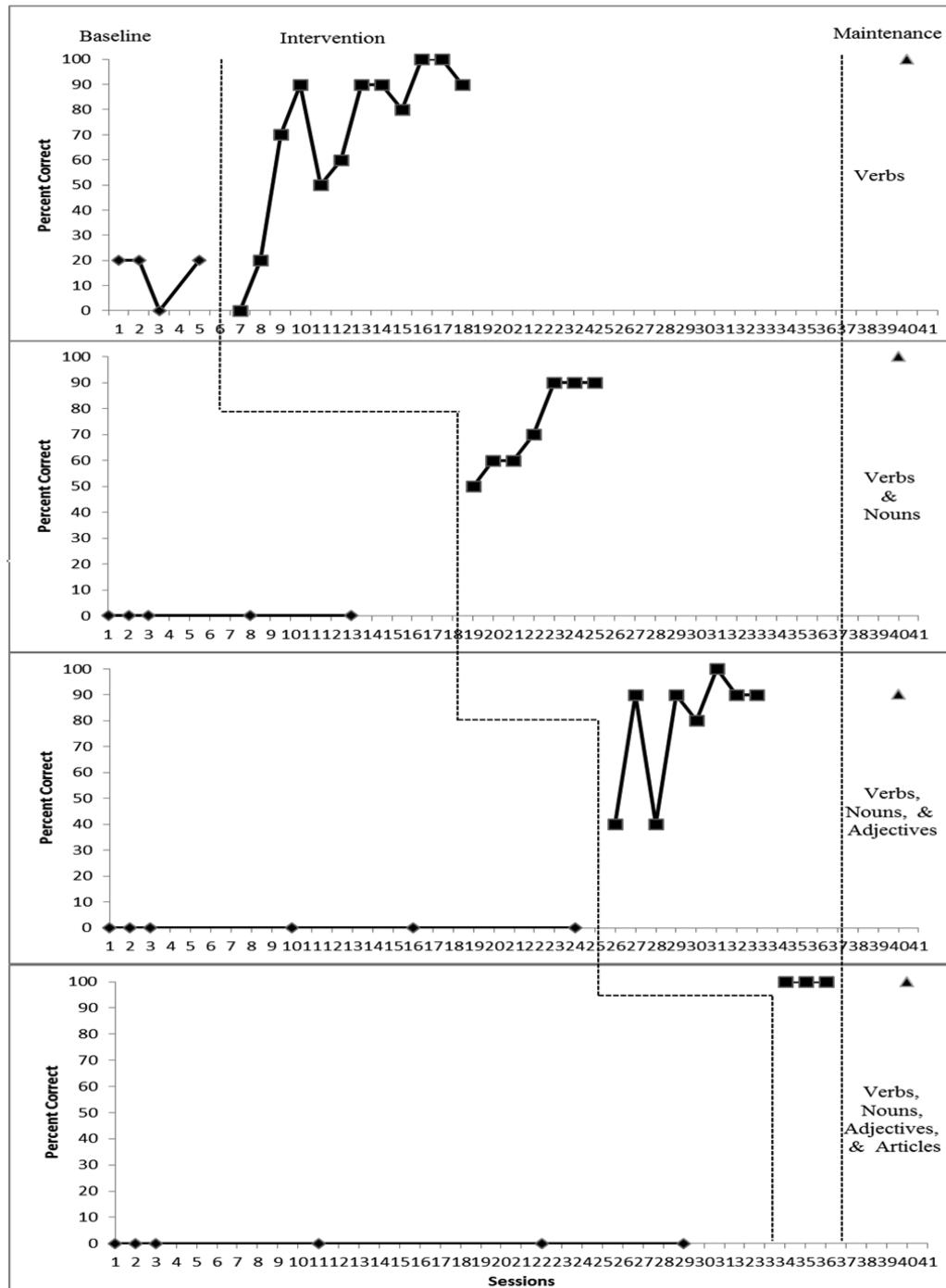


Figure 3. Mia's performance on parts of speech strand.

reached criterion after three sessions with an average of performance of 93%. For the last

behavior (relevant), Tim reached criterion after eight sessions with an average perfor-

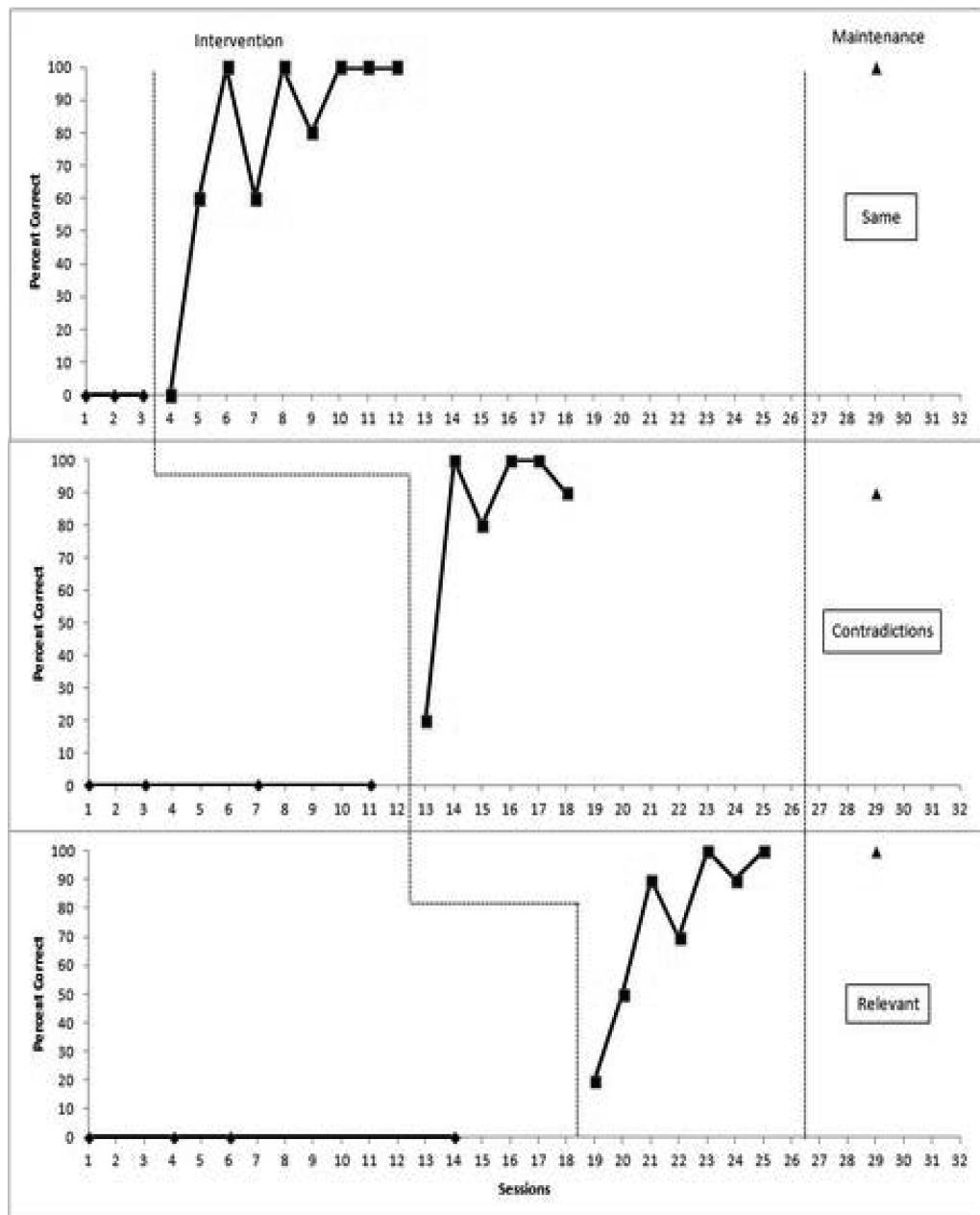


Figure 4. Mia's performance on across strands.

mance of 75%. See Figure 6 for Tim's performance on across strands of skills.

WRMT-III. Prior to instruction, Tim was administered the WRMT-III to assess his current level of reading achievement. In order to determine of gains demonstrated with the use

of Direct Instruction generalized to standardized measures of reading achievement, a post-test was also administered. Tim made a gain in all areas with an increase of one standard deviations in the area of passage comprehension and approximately one-half standard de-

TABLE 4**Standard Scores and Grade equivalents for Mia's Pre/Posttest**

WRMT-III Subtest	Pretest Scores	Posttest Scores	Net Change
Word comp	55 (1.1)	55 (1.7)	0 (+0.6)
Passage comp	57 (1.9)	55 (1.8)	-2 (-0.1)
Reading comp	55 (1.5)	55 (1.7)	0 (+0.2)
Total reading	55 (1.5)	55 (1.7)	0 (+0.2)

vation in reading comprehension and total reading. See Table 5 for pre-posttest measures.

AIMSWeb Data

The researchers collected additional reading comprehension data using the maze subtests of AIMSWeb, a curriculum based measure. All three participants exhibited gains from pre to posttest administrations of these measures. This indicates that students were able to generalize reading comprehension skills to other reading comprehension tasks commonly utilized in classrooms. See Table 6 for individual performance on AIMSWeb subtests.

Tau-U

The researchers calculated a Tau-U statistic to describe the effect size for each analysis. A Tau-U statistic is a relatively new index of analysis for single case research that combines nonoverlap between phases with trend from the intervention phase (Parker, Vannest, Davis, & Sauber, 2011) and is derived from Kendall's Rank Correlation and the Mann-Whitney *U*. A Tau-U effect size statistic was calculated for each outcome variable for each participant. All effect sizes were significant with $p < 0.00$ and effect sizes ranged from 0.92 to 1. See Table 7.

Discussion

The purpose of this study was to investigate the effects of a DI reading comprehension program on the reading comprehension skills of students with autism or developmental de-

lay. A functional relation was demonstrated between the DI program, *Corrective Reading Comprehension: B1* and specific reading comprehension skills. Each student mastered each skill presented and maintained performance once instruction had ended. In addition, all three participants generalized these skills to a norm referenced test of reading achievement and an additional measure of reading comprehension commonly found in general education classrooms.

Initial testing indicated that Jon exhibited a weakness in the area of comprehension; however, results of testing at the conclusion of the study indicated that he had made significant progress in standardized measures of comprehension and comprehension was no longer a weakness. Throughout both analyses of comprehension skills, Jon reached mastery faster than the other participants and made the largest gains in all reading comprehension areas of the WRMT-III. This may have been due to higher intellectual functioning, as his IQ was more than one standard deviation higher than either of the other participants. Jon learned the skills presented very quickly and required no remediation of skills throughout the program. The generalization of reading comprehension skills was evident in gains on AIMSWeb curriculum-based measures.

Mia mastered the skills in the reading comprehension program; however, Mia's gains on standardized measures of reading achievement were not as significant as the other two participants. Both decoding and comprehension skills were significantly weak areas for Mia, and it is plausible that reading decoding set the ceiling for her reading comprehension scores. Perhaps a DI program that focused on both decoding and comprehension would have been more appropriate. Another possible explanation is that standard scores for the WRMT-III truncate at a score of 55, and possibly masking gains in reading comprehension. Regardless, she mastered the reading comprehension skills, and generalized gains (in grade equivalents) to the WRMT-III as well as to AIMSWeb curriculum based measures. Mia also made a 1.5 grade level gain in the area of listening comprehension as measured by the WRMT-III, indicating likely potential to make similar gains in reading comprehension if decoding skills were improved.

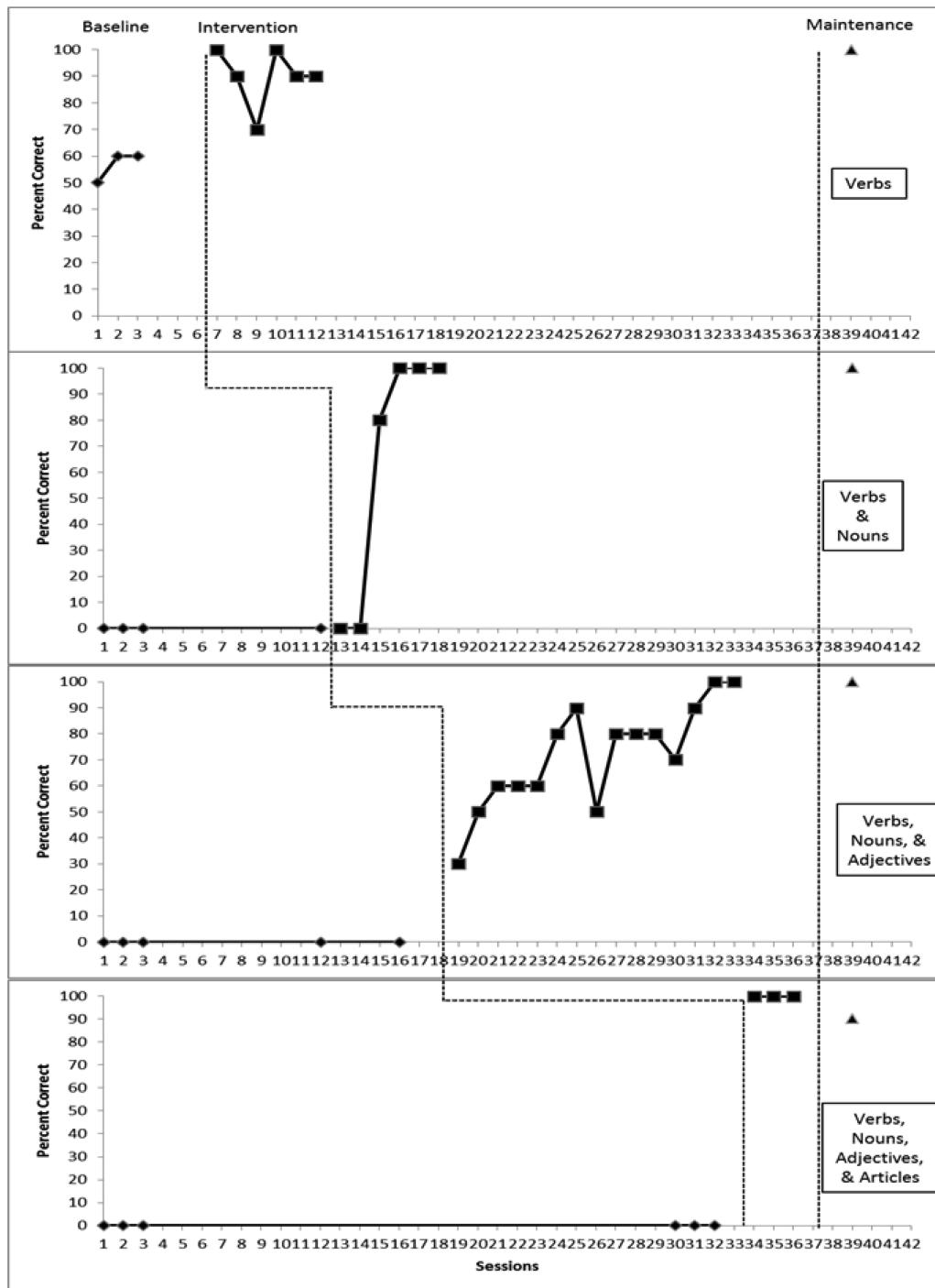


Figure 5. Tim's performance on parts of speech skills.

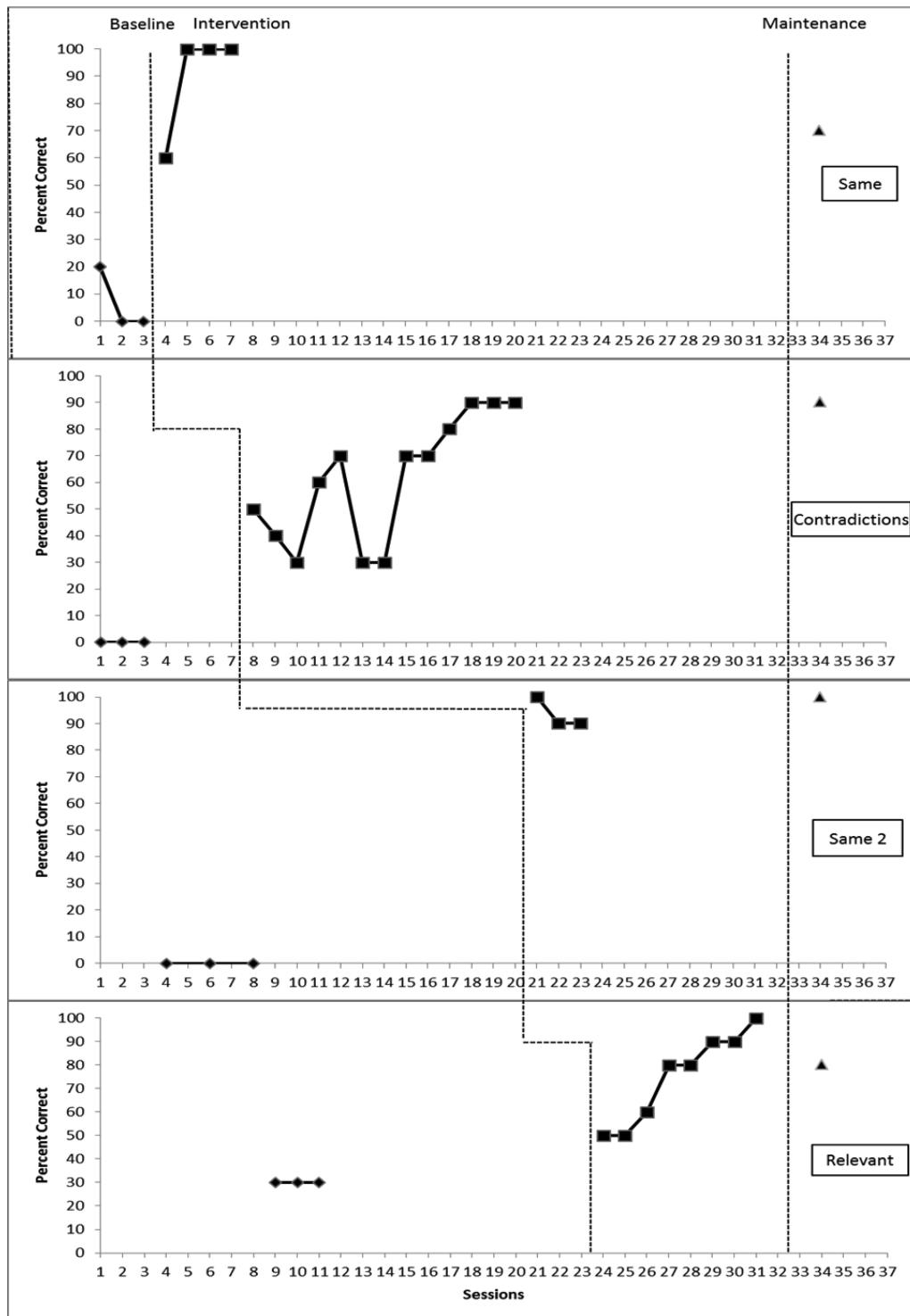


Figure 6. Tim's performance across strands of skills.

TABLE 5
Standard Scores and Grade Equivalents for Tim's Pre/Posttest

<i>WRMT-III Subtest</i>	<i>Pretest Scores</i>	<i>Posttest Scores</i>	<i>Net Change</i>
Word comp	55 (2.1)	55 (2.5)	0 (+0.4)
Passage comp	55 (2.9)	70 (4.8)	+15 (1.9)
Reading comp	55 (2.5)	61 (3.6)	+6 (1.1)
Total reading	67 (4.2)	74 (5.6)	+7 (1.4)

Tim mastered skills quickly; however, those skills which required sustained attention or those which were more cognitively complex took longer to master than the easier ones. It is unclear whether this difficulty was due to attention difficulties or cognitive difficulties or a combination of both; however, Tim worked very quickly, did not check over his work, and skipped around sporadically when completing probes. Tim's lack of attention was possibly exacerbated by his receiving instruction in the afterschool program after school hours. Regardless, Tim was able to make substantial gains in both standardized measures and curriculum based measures of reading comprehension.

Results of this study support previous findings that DI is an effective intervention for students from low socioeconomic backgrounds (Torgesen et al., 2001), students at-risk for academic failure (Carlson & Francis, 2002; Foorman et al., 1998; Frederick et al., 2002; Grossen, 2004; Shippen et al., 2005), students with learning disabilities (Swanson, 1998; Torgesen et al.), as all three participants were from low socioeco-

TABLE 7
Tau-U Statistical Analysis

<i>Student/Strand</i>	<i>Tau-U</i>
Jon POS	ES = 1; $p < 0.00$; $CI_{95} = 0.52 - 1.47$
Jon AS	ES = 1; $p < 0.00$; $CI_{95} = 0.43 - 1.56$
Mia POS	ES = .95; $p < 0.00$; $CI_{95} = 0.59 - 1.3$
Mia AS	ES = .96; $p < 0.00$; $CI_{95} = 0.52 - 1.4$
Tim POS	ES = .92; $p < 0.00$; $CI_{95} = 0.51 - 1.32$
Tim AS	ES = 1; $p < 0.00$; $CI_{95} = 0.56 - 1.44$

nomic backgrounds, had been placed into special education due to poor academic performance and could be considered as having learning disabilities. Furthermore, this study supports previous findings that DI is effective for students with cognitive deficits (Bradford et al., 2006; Flores et al., 2004; Gersten & Maggs, 1982) as two of the participants scored more than two standard deviations below the mean on measures of intellectual functioning.

Limitations and Recommendations

Although the findings from this study indicate a functional relation between the DI reading comprehension program, *Corrective Reading Comprehension: B1* and students' acquisition of reading comprehension skills, some limitations exist. First, each student received one-on-one instruction, which most likely minimized off-task behaviors and attention problems commonly demonstrated by two of the students. Generalization to small group or whole group settings cannot be made. Since students included in this study were labeled as having either autism or intellectual disability, generalizations to other disability categories is limited. Instruction was provided for students ages 10–16, so generalizations to other age groups cannot be made. Furthermore, time spent on instruction was extensive. Due to time constraints, time on task was maximized and students completed a minimum of two lessons per day; therefore, DI instruction which is less intense would probably not yield as significant results shown here. Another limitation is that instruction was deliv-

TABLE 6
Pre/Post-test Performance on AIMSWeb Maze Subtests

<i>Student</i>	<i>Pre-test</i>		<i>Post-test</i>	
	<i>Number Correct</i>	<i>Number Correct</i>	<i>Number Correct</i>	<i>Number Correct</i>
Jon	5 $\frac{2}{3}$		11 $\frac{1}{3}$	
Mia	8 $\frac{2}{3}$		13 $\frac{1}{3}$	
Tim	24 $\frac{2}{3}$		30 $\frac{2}{3}$	

ered by a researcher who was trained in the use of DI and had over 14 years' experience using DI programs. Finally, this study did not compare DI to any other reading programs, so it is unclear if other programs might yield similar results.

There are several recommendations for future research. First, replications of this study are needed in order to confirm whether significant reading comprehension gains are common when implemented with the same type intensity. At some point, researchers and practitioners will reach a point of diminishing returns, where more intense instruction will not result in additional gains. It would be interesting to establish at what intensity this would likely occur. Also, it would be worthwhile to establish whether DI has similar, positive effects on fluency and decoding for students with autism. Future research should also include skills which are even more cognitively complex.

Summary

The importance of the findings presented here cannot be understated. As federal and state laws require increased accountability, the identification and implementation of evidence based practices is imperative. In addition, as the prevalence and incidence of autism continues to rise, there is a need to identify not only teaching methodologies, but also curricula that are most effective for this unique population. Although this study did not compare the DI reading comprehension to other programs, DI has a long documented and established history for effectiveness and efficacy. The results of this study indicate that students with disabilities, specifically those with autism, can make significant academic gains when provided with appropriate instruction. It is disheartening that, given the extensive research regarding the effectiveness of DI, this methodology and curricula is underutilized in educational settings. Regardless, the findings of this study support the efficacy of DI for students with autism and will eventually help establish DI as an evidenced based practice for this population.

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