

12-2015

Research Synthesis: Effective Practices for Improving the Reading Comprehension of Students with Autism Spectrum Disorder

Amy L. Accardo

Rowan University, accardo@rowan.edu

Follow this and additional works at: https://rdw.rowan.edu/education_facpub



Part of the [Special Education and Teaching Commons](#)

Recommended Citation

Accardo, Amy L., "Research Synthesis: Effective Practices for Improving the Reading Comprehension of Students with Autism Spectrum Disorder" (2015). *College of Education Faculty Scholarship*. 6.
https://rdw.rowan.edu/education_facpub/6

This Article is brought to you for free and open access by the College of Education at Rowan Digital Works. It has been accepted for inclusion in College of Education Faculty Scholarship by an authorized administrator of Rowan Digital Works. For more information, please contact jiras@rowan.edu, rdw@rowan.edu.

Research Synthesis: Effective Practices for Improving the Reading Comprehension of Students with Autism Spectrum Disorder

Amy L. Accardo
Rowan University

Abstract: The incidences of autism spectrum disorder (ASD) continue to rise steadily increasing the need for research-based strategies to support this population in the core academic content area of reading comprehension. A research synthesis was conducted with the purpose of (1) reviewing existing research to determine effective practices for teaching reading comprehension to students with ASD, (2) identifying the features of effective practices that appear to influence comprehension outcomes, and (3) assessing the quality of the research related to comprehension strategies and students with ASD. A functional relation was identified between the increased reading comprehension of students with ASD and each of the instructional practices of anaphoric cueing, compare & contrast charts, cooperative learning, explicit/direct instruction, graphic organizers, question generation, read-alouds, reciprocal questioning, story structure and character event maps, and systematic prompts. Research in this area is limited and suggestions for both educators and researchers are provided.

Federal mandates in the form of No Child Left Behind (NCLB, 2002) and the Individuals with Disabilities Education Act (IDEA, 2004) require teachers of learners with disabilities to utilize research-based practices in making educational decisions. These mandates have resulted both in a research dialogue to define the term evidence-based practice (EBP), and in the identification of EBPs to support classroom instruction (Browder & Cooper-Duffy, 2003; Cook, Smith, & Tankersley, 2012; Odom et al., 2005; Spooner, Knight, Browder, & Smith, 2011). In consideration of these mandates, concern exists regarding both the quality of practices implemented in our classrooms, and the best method of disseminating essential research information to our classroom teachers (Odom et al., 2005). The use of EBPs by teachers is especially applicable to students with autism spectrum disorder (ASD) due to (a) the continuously increasing prevalence, (b) the complex characteristics and need for

individualization of practices, (c) an availability of alternative interventions that may not be research-based, and (d) teacher requirement to comply with federal regulation (Mayton et al., 2010). Moreover, as a result of federal mandates requiring schools to utilize scientifically based programs, instructional practices for learners with disabilities, including learners with ASD, are increasingly being held to EBP standards (Mesibov & Shea, 2011).

The Center for Disease Control and Prevention has reported that 1 in 42 boys and 1 in 68 children in the United States are currently identified with ASD (CDC, 2014, p. 1). This marks a 29% increase from the prior 2012 report (CDC, 2012). With an increase in autism rates coinciding with an increase in inclusive placements, many teachers are not equipped to meet the needs of students with ASD in the classroom (Brown, Oram-Cardy, & Johnson, 2013). The underrepresentation of students with

complex disabilities (such as ASD) in studies investigating practices to improve academic skills is of concern (Spooner & Browder, 2015). Research related to comprehension and ASD is of specific concern, as it is well established that individuals with ASD have difficulty with comprehension (Williamson, Carnahan, Birri, & Swoboda, 2014). The identification of EBPs and research-based practices that teachers can implement to support students with ASD is necessary to improve access to core content through reading comprehension.

Comprehension instruction promotes active thinking skills and application of thinking processes (Browder et al., 2009). The use of effective practices to teach comprehension to learners with ASD is crucial as literacy skills are critical for quality of life in areas such as community living, shopping, and following directions (Carnahan, Williamson, & Haydon, 2009), and instruction in comprehension may carry over to socialization skills (Smith & Barnhill, 2001). Research during the past decade provides a consensus that individuals with ASD often exhibit significant difficulties with reading comprehension, despite demonstrating competency and even excelling in the areas of phonics, word recognition, and fluency (Ricketts, 2011; Whalon & Hart, 2011). All learners with ASD are unique, and these differences create an explicit need for teachers to identify individualized approaches to help students achieve their academic goals (Mayton, Wheeler, Menendez, & Zhang, 2010). Meeting the unique needs of each individual learner with ASD through teacher knowledge and preparedness to use multiple research-based practices to teach comprehension is essential.

A search of the literature uncovered several

comprehensive reviews specific to EBPs and autism. Chronologically, Odom and colleagues (2003) conducted a review and analysis of single subject design EBPs for young children with ASD from 1990-2002; Mayton and colleagues published a review of the literature in 2010 applying the Horner et al. 2005 criteria to ten years of research spanning from 2000-2009; and, Mesibov and Shea prepared a comprehensive report in 2011 examining clinical ASD research to strengthen recommendations for effective instruction for educators and parent practitioners. Unfortunately, EBPs specific to reading comprehension and students with ASD were not identified in any of these comprehensive reviews.

Furthermore, Whalon, Al Otaiba, and Delano (2009) reviewed the literature with a focus on quantitative research relevant to the five components of reading instruction as identified by the National Reading Panel (NRP). The NRP Report by the National Institute of Child Health and Human Development (NICHD) established a solid guideline for the instruction of reading, breaking instruction into the five major categories of phonemic awareness, phonics instruction, fluency, vocabulary, and text comprehension (2000). Specific to comprehension, Whalon and colleagues' findings suggest that cooperative learning, anaphoric cueing, and one-to-one direct instruction are promising interventions to facilitate reading comprehension improvement in students with ASD. This research synthesis aims to build on the findings of Whalon and colleagues. In contrast to the broad focus on all five components of reading instruction, this synthesis specifically examines the efficacy of instructional practices designed to improve the main reading need of students with ASD, text comprehension.

Due to the dearth of EBPs specific to comprehension and ASD, a research synthesis was designed to identify effective practices relevant to supporting these learners in the area of reading comprehension. For the purposes of this study, *effective practices* are defined as research-based practices identified through high quality quantitative study, but not yet meeting the strict criteria needed to obtain EBP designation. The purpose of this research synthesis is to explore quantitative studies related to reading comprehension and individuals with ASD in relation to the questions:

1. What are the effective practices for teaching reading comprehension to students with ASD?
2. What features of identified effective practices appear to influence comprehension outcomes?
3. What is the quality of the research related to effective practices and students with ASD?

Method

Review of the existing research began with a computerized search of the ERIC, SAGE, and OMNI databases using the keywords *autism, ASD, reading, comprehension, literacy, reading, and thinking*. Furthermore, while the NRP Report (2000) is now over a decade old, it has remained a significant guideline for the instruction of reading since its publication. As a result, it was used as a keyword search framework. Utilized search terms included the six instructional practices recommended for vocabulary: *keyword method, incidental learning, repeated exposure, pre-teaching of vocabulary, restructuring reading material, and context method*; and the eight instructional practices recommended for comprehension: *comprehension monitoring, cooperative learning, use of graphic organizers, question answering, question generation,*

story structure, summarization, and a multiple strategies approach (International Reading Association, 2002). A search of the literature using the terms *autism*, and each instructional vocabulary practice resulted in no related findings. A search using the comprehension terms, however, did result in findings relevant to learners with ASD and the instructional practices of cooperative learning, graphic organizers, question generation, story structure, and a multiple strategies approach.

Initial findings were expanded via an ancestral hand search of articles from the reference sections of emergent studies. An inclusion criteria and coding guide were established and applied to identify only studies utilizing quantitative methodology with high quality research design.

Inclusion Criteria

For inclusion in the synthesis, studies were required to (a) use a true or quasi-experimental group, or single-case research design, (b) include baseline and intervention data specific to students diagnosed with ASD, and (c) include reading comprehension as a dependent variable. Inclusion criteria limited studies to the specific population of students with ASD, encompassing students with a diagnosis of ASD, PDD, PDD-NOS, Asperger syndrome or a dual diagnosis including ASD. Studies focusing on groups of students including some participants with ASD were excluded unless the study provided separate data points for the population with ASD. In terms of setting, criteria included students with ASD in all grade levels, K-12, and all school settings, including both private and public schools, and both self-contained special education and inclusive classroom settings. Moreover, the dependent variables measured throughout each included study were limited to forms of reading *comprehension*.

Included research explores reading interventions measuring student understanding of text (i.e., passage comprehension, making inferences, and understanding analogies). Studies measuring the effect of interventions on the ability of students with ASD to learn to read (decoding, fluency) with and without a dual focus on comprehension were excluded, unless the studies reported the specific comprehension data points separately.

Coding Procedures

A single-case design coding guide was developed for this research synthesis using the guidelines recommended by Cooper (2010). Specifically, coding began with consideration of Cooper's eight identified primary categories of reporting, independent variable, setting, participants, dependent variable, research design, data outcomes, and coder characteristics. A small sampling of studies were read prior to drafting the guide to identify general themes related to both instruction of students with ASD, and implementation of reading comprehension interventions. Adapting Cooper's recommendations to single-case design and utilizing the organizational framework of Santangelo and Graham (2012) as an exemplar, along with consideration of the quality criteria for single subject design provided by Reichow, Volkmar, and Cicchetti, (2008), and Kratochwill (2013), a guide was developed to code study characteristics and quality indicators. The guide was reviewed by a second researcher and three doctoral students for content and ease of use, resulting in the addition of ceiling and floor effect indicators. As a quality check, two studies were coded by a doctoral student with 100% inter-rater reliability.

Each study was coded for variables in the areas of: setting and participants;

independent variables; and quality indicators, along with the category of results and measures reported on in the findings section. The category of setting and participants included the eight characteristics of location, number of settings, familiarity of setting, number of participants, grade level, diagnosis, reading comprehension level, and other participants. The category of independent variables included the 11 characteristics of instructional strategy, baseline condition, secondary intervention, duration, materials, individualization, pre-teaching, co-occurring strategies, group format, interventionist, and training details. Upon identification, quality indicators were coded as one point, resulting in a quality indicator range of 0-12 points for each study. Quality indicators included: functional relation, coding one point if the design had potential to demonstrate experimental control; baseline stability, coding one point if the study provided evidence of a stable baseline before intervention; and four characteristics related to floor and ceiling effects, with one point coded in each category at both baseline and intervention. The category of interventionist coding was included with each study receiving one point if the interventionist received professional development or was a known expert. Study implementation was coded based on evidence the treatment was administered as intended with integrity (fidelity reporting of $\geq .8$). Furthermore, to assess the quality of research results each study was coded for the three areas of maintenance, generalization, and social validity as reported. Finally, to assure reliability of results, each study was coded for reliability of measures, with one point correlating to reporting of reliability ≥ 0.8 in all measures. A designation of one half point was coded for all studies with partial reliability displaying ≥ 0.8 reliability in some measures, and as in all quality

characteristic, a zero code was used to indicate both a no response to each coding question, and a not reported response to applicable questions.

Results

Thirteen studies met inclusion criteria, with 12 utilizing a single-case design. Six of the studies used a multiple baseline across participants design (Hua et al., 2012; Kamps, Barbetta, Leonard, & Delquadri, 1994; Mims, Hudson, & Browder, 2012; Stringfield, Luscre, & Gast, 2011; Whalon & Hanline, 2008; Williamson et al., 2014), three used an ABAB design (Carnahan & Williamson, 2013; Kamps, Leonard, Potucek, & Garrison-Harrell, 1995a – Experiment 1; Kamps et al., 1995b – Experiment 2), two used a multiple baseline across behaviors design (Flores & Ganz, 2007; Flores & Ganz, 2009), and one used an alternating treatments design (Solis, McCulley & Zein, 2013). The final study utilized a randomized experimental design (Roux, Dion, Barrette, Dupere, & Fuchs, 2014).

In addition to the included research, six additional studies were identified and excluded. Exclusions were due to a lack of baseline criteria, to a group data reporting format in which specific data for students with ASD was not available, and to a format in which data specific to comprehension was not available. An overall lack of research emerged with only 13 studies found meeting inclusion criteria spanning two decades, from 1994-2014. Thirty-three total students participated in the 12 single-case design studies, and 43 total students participated in the recent randomized block design study by Roux and colleagues, encompassing an overall total of 76 participants.

Research Question 1: Effective Practices for Reading Comprehension and ASD

A review of the included studies resulted in the identification of 10 effective practices to teach reading comprehension to students with ASD. Specifically, the 10 effective practices include: anaphoric cueing, a technique in which students are taught to look back to referents in text to identify the meaning of words such as pronouns (Solis et al., 2013), compare and contrast diagrams (Carnahan & Williamson, 2013), cooperative learning (Kamps et al., 1994,1995a), direct/explicit instruction (Flores & Ganz, 2007; Flores & Ganz, 2009; Roux et al., 2014), graphic organizers (Carnahan & Williamson, 2013), question generation (Hua et al., 2012), read-alouds (Mims et al., 2012), reciprocal questioning (Whalon & Hanline, 2013), story structure maps/character event maps (Stringfield et al., 2011; Williamson et al., 2014), and systematic prompts (Mims et al., 2012). A combination of effective practices or a multiple strategy approach in which a primary intervention was supplemented with another effective practice as a secondary intervention also occurred. For example, in addition to Carnahan and Williamson studying the use of compare and contrast Venn diagrams, a form of graphic organizer, Whalon and Hanline used a graphic story map organizer in their study of reciprocal questioning, and Mims and colleagues included graphic organizers in their study of systematic prompts.

A synthesis of the research reveals a functional relation between the explicit use of instructional practices and the comprehension of students with ASD, with 11 of 13 studies resulting in comprehension gains. Two studies were reported to be inconclusive by the original researchers due to minimal outcome gains; however, no instructional practices were shown to be clearly ineffective as those deemed inconclusive were shown to be effective by

alternate included research. Specifically, Kamps and colleagues reported inconclusive findings regarding the use of cooperative learning strategies on comprehension of students with ASD (1995b), yet a functional relation between cooperative learning and reading comprehension was established by Kamps and colleagues in two additional studies (1994, 1995a). Similarly, Hua and colleagues reported inconclusive findings regarding the use of question generation on comprehension of students with ASD (2012), yet a functional relation between question generation and reading comprehension was established by Solis and colleagues (2013) (see Table 1).

Research Question 2: Features of Identified Effective Practices

Each research study was coded for variables and analyzed for patterns in the three areas of: setting and participants; independent variables; and quality indicators. Emerging patterns were explored with the purpose of identifying features of effective practices that appear to influence comprehension outcomes. Findings are reported by area.

Setting and participants. The study by Roux et al. included 43 elementary school students spanning in age from 7 to 10. The remaining studies each included two to four participants. Participants in nine studies were reported as having reading comprehension levels significantly below average (three or more years below grade level). Participants included students diagnosed with ASD, high functioning ASD (HFASD), Asperger syndrome, and pervasive developmental disorder (PDD). Participants spanned from first grade through high school with the majority of studies conducted in a third or fifth grade classrooms. Coding revealed a lack of

research at the high school level with only one study conducted in grades 9 through 12.

No pattern emerged related to the variable of intervention location in terms of public or private school, however in terms of familiarity of setting, only one study was conducted in a non-familiar setting and this study was one of two total studies reported as inconclusive by the original researchers. Approximately 50% of studies conducted included other participants ranging from general education peers to students with other disabilities. The inclusion of other participants did not appear to have a direct effect on intervention.

Independent variables. During independent variable coding, instructional practices were aligned with the terminology of the eight identified research-based interventions recommended by the NRP: “comprehension monitoring,” “cooperative learning,” “use of graphic organizers,” “question answering,” “question generation,” “story structure,” “summarization,” and a “multiple strategies” approach (International Reading Association, 2002, p. 14). Identified effective practices aligned with NRP recommendations include: cooperative learning, graphic organizers, question generation, and story structure. Additional effective practices beyond those recommended by the NRP include the interventions of anaphoric cueing, compare and contrast charts, explicit/direct instruction, read-alouds, reciprocal questioning, and systematic prompting.

Analysis of patterns related to study features included coding variables of co-occurring instructional practices. Visual supports across studies included picture cues and arrays, graphic organizers, story boards,

Table 1. *Effective Practices to Teach Reading Comprehension to Learners with ASD*

a. Practices	b. Author(s)	c. Data points	d. Findings
Anaphoric Cueing	Solis et al. 2013.1	RCA- Rdg Comp Q Mean (M): B- 68.75% I- 92.5%	Effective: 2/2 students increased passage comprehension using anaphoric cueing intervention, a 24% mean increase baseline to intervention. (Alt. Treatment Design/see Question Generation below)
Cooperative Learning	Kamps et al., 1994	RCA- 5 Rdg Comp Qs (5Ws) M: B-46% I1-78% B- 64% I2- 89%	Effective: During classwide peer tutoring with a cooperative role reversal, 3/3 students increased correct responses to wh questions, a 43% increase.
	Kamps et al., 1995a	RCA- 5 Rdg Comp Qs (5Ws) M: B-27% I1-52% B- 25% I2- 58%	Effective: One student increased correct responses to reading comprehension questions while responding to novels with peers, a 31% increase B to I
	Kamps et al., 1995b	RCA- 10-12 Rdg Comp Qs # answered correctly B-1 I1-3 B-1.25 I2-3.5	Inconclusive: 2/2 students using 5 th grade level novels with peers displayed variability in pre/post test scores. As a result, the intervention was modified to basal readers at their level, a minimal 2% -3% increase.
Direct/ Explicit Instruction	Flores & Ganz, 2007	RCA- Reading Comp. Q M: Inferences Facts Analogies B-18 I-91 B-0 I-89% B-27 I- 90%	Effective: 2/2 students showed gains in all 3 reading comprehension skills of analogies, statement inferences and facts on researcher created probes (mean of all 3 categories) , a 75% mean increase B to I.
	Flores & Ganz, 2009	RCA- Reading Comp. Q M: Analogies Inductions Deductions B-25 I-100 B-0 I-88% B-15 I- 87%	Effective: 2/2 students showed gains in all 3 reading comprehension skills of analogies, deductions, and inductions on reading probes (mean of all 3 categories), a 78% mean increase B to I.
	Roux et al., 2014	RCA- Post Test Vocabulary- effect size 1.06 Main Idea- effect size .92	Effective: In a randomized experimental design of 43 students with ASD across 6 elementary schools, explicit instruction along with visual boards resulted in increased intervention group results.
Graphic Organizer (compare/contrast)	Carnahan & Williamson, 2013	RCA- Reading Comp Q M: B-66% I-96%	Effective: 3/3 students increased passage comprehension using a venn diagram to read 3 paragraph passages of science text, a 30% mean increase B to I.
Question Generation	Solis et al. 2013.2	RCA- Reading Comp Q M: B-47.5% I-82.5%	Effective: 2/2 students increased passage comprehension using QG intervention, a 35% mean increase B to I.
	Hua et al., 2012	RCA- 8 Reading Comp. Q M: Facts B-31% I-40% Inferences B-25% I-35%	Inconclusive: 3/3 students increased the number of correctly answered factual and inferential questions; however results were modest with a mean increase of less than one question correct, a 10% increase.
Story Structure Map or Character Event Map	Stringfield et al., 2011	CBA- Qs read orally M: B- 16% Maint.- 93.3%	Effective: During maintenance of story map instruction, 3/3 students scored a mean of 93.3% from a baseline of 16%; a mean increase of 77.3%.
	Williamson et al., 2014	RCA- 10 Reading Comp Q M: B- 51% I.- 90%	Effective: 3/3 students increased comprehension of narrative chapters using a character event map, along with books on tape and teacher modeling of think alouds. A 39% mean increase baseline to intervention.
Systematic Prompts w/ Read-alouds	Mims et al., 2012	RCA- 11 Rdg Comp. Questions (5Ws, First, Next, Last, etc.) M: B- 23% I- 73%	Effective: 4/4 increased comp. using systematic prompt removal with read-alouds, story structure and graphic organizers, 50% increase B to I.
Reciprocal Questioning	Whalon & Hanline, 2008	RCA- Rdg Qs asked/answered M: Unprompted Q's B- 0 I-2.8 Response to Peers B- 0 I-3.5	Effective: 3/3 increased asking unprompted comp. questions, responding to peer questions while reading storybooks with gen. ed. peers; using self-monitoring and graphic story maps, a 31.5% increase B to I.

Note. ^vDenotes use of visual strategies; ^mDenotes use of motivational plan; Effective- functional relation established between intervention & comprehension; Inconclusive- as reported by primary researcher(s); RCA- Researcher created assessment; CBA- Curriculum based assessment; B- Baseline; I- Intervention; 5Ws- who, what, where, when & why questions

picture exchange system (PECS), support for non-verbal participants, word cards, and Velcro storyboards. The use of visual supports emerged as a common pattern of effective intervention. Analysis showed the two studies deemed inconclusive did not use a visual component during intervention. Moreover, motivational strategies were employed as a secondary intervention in multiple studies and included additional visuals in the forms of graphic progress charts and stickers.

The remaining intervention features of format, duration, and materials show variability. Intervention format results include: small group instruction (54%), dyad format (23%), and individual instruction (23%). Duration of intervention ranged from approximately 135 to 2000 minutes. Regarding reading material, approximately 46% of studies used books, 38% used paragraphs or short passages, and 15% used sentences, with only five of 13 interventions reportedly individualizing materials for students. In terms of assessment measures, commonality did emerge from the measures used to assess outcomes. Researcher created

assessments, most commonly in the form of who, what, when, where, why questions were utilized in 92% of studies with only one study using a program curriculum based assessment.

Research Question 3: Quality of Research

Quality indicators were coded as one point each, resulting in a quality indicator range of 0 – 12 points for each study. The mean quality score for all included studies was 7.2 out of a total possible 12 points. Four quality indicators were identified in 80% or more of the included studies: ceiling effects at baseline (92%); floor effects at intervention (92%); reliability of measures (85%); and design allowing for functional relation (85%). Four quality indicators were evident in 50 – 79% of studies: fidelity of treatment (77%), training of interventionist (69%), social validity (62%), and maintenance (54%). Finally, four quality indicators were met by less than 50% of studies indicating a limited collective focus on the quality indicators of: baseline stability prior to intervention (31%); floor effects at baseline (46%); ceiling effects at intervention (23%); and generalization (8%) (see Table 2).

Table 2. Mean Quality Indicator Reporting

Overall Percentage of Studies	Reported Quality Indicator	M
≥ 80% of studies	Floor Effect at Intervention	92%
	Ceiling Effect at Baseline	92%
	Reliability of Measures (reported ≥. 80)	85%
	Functional Relation/ Internal Validity	85%
50% - 80% of studies	Fidelity of Treatment (reported ≥. 80)	77%
	Training of Interventionist	69%
	Social Validity	62%
	Maintenance Data over Time	54%
<50% of studies	Floor Effect at Baseline	46%
	Stable Baseline Before Intervention	31%
	Ceiling Effect at Intervention	23%
	Generalization	8%

Discussion

In a 2009 synthesis, Whalon and colleagues reviewed the research related to reading instruction and students with ASD. Results included the recommendation that comprehension based instructional practices become a priority for children with ASD, who often exhibit decoding skills but struggle with comprehending text (Whalon et al., 2009). Whalon et al. found, “when considering the instructional methods used to increase meaning-focused skills, specifically, direct comprehension instruction, the lack of such interventions targeting individuals with ASD is surprising” (p. 10). This synthesis extended the 2009 review of Whalon and colleagues by limiting the focus of included studies to comprehension, and by including strategies beyond those recommended by the National Reading Panel. Results of this review, however, establish that despite more than 60% of the included studies taking place since 2009, there remains a surprising lack of research focusing on reading comprehension and ASD.

The purpose of this synthesis was to explore quantitative studies related to reading comprehension and individuals with ASD (1) reviewing existing research to identify effective practices to teach reading comprehension of students with ASD, (2) identifying features of effective practices that appear to influence comprehension outcomes, and (3) assessing the quality of the overall research related to comprehension interventions and students with ASD. Instructional practices were found to be effective with a functional relation established between increased reading comprehension of students with ASD and each of the 10 effective practices of anaphoric cueing, cooperative learning, compare and contrast charts, direct/ explicit instruction, graphic organizers, question generation, read-alouds, reciprocal questioning, story structure or character

event maps, and systematic prompts. Overall findings provide strong support for teachers to implement the explicit use of reading comprehension strategies in the classroom for students with ASD.

This research synthesis reveals the need for classroom teacher support and education. While not labeled as such within studies, a multiple strategy approach seemed to be effective with multiple studies combining primary interventions with teaching practices including not only visual graphic organizers, but also behavior plans, and/ or motivational materials. The pairing of explicit instruction with visual representation emerged as the intervention feature most frequently utilized to positively influence comprehension outcomes. The coding of secondary interventions used within each study identified the use of visual supports and graphic organizers as effective in conjunction with a primary strategy. In addition, effective strategies were found to be used repeatedly, e.g. using a consistent who, what, where, when, why graphic organizer for multiple passage readings throughout an entire marking period. A multiple strategy approach to comprehension instruction appears to be highly effective but is potentially more difficult to implement than strategies in isolation. Research studying teacher access to and knowledge of identified effective practices may be warranted, along with ongoing professional development for special education teachers related to the teaching of reading comprehension.

Unfortunately, most classroom teachers lack both the time to search for evidence-based treatments, and the access to information related to research-based practices (Kretlow & Blatz, 2011). In an effort to make EBPs readily available to practitioners, multiple research organizations have established free, on-line information databases including the What Works Clearinghouse

(<http://ies.ed.gov/ncee/wwc/>), the Best Evidence Encyclopedia (<http://www.bestevidence.org/>), and the Promising Practices Network (<http://www.promisingpractices.net/>) (Kretlow & Blatz, 2011). It appears until EBPs related to comprehension and ASD are available, teachers also need avenues to access effective practices to teach comprehension to learners with ASD in their classrooms.

The third purpose of this study was to investigate the quality indicators underlying the existing research. This synthesis shows an overall research emphasis on reliability of measures, and on single-case-design allowing for establishing a functional relation, however, this synthesis revealed a limited number of studies investigating comprehension and ASD. This lack of research identifies a clear need for large group quasi-research or true research design studies in the area of reading comprehension and students with ASD, perhaps through implementation of effective practices across autistic support classrooms in an entire school district, or across all students in a private school for students with ASD. In addition, a focus on research quality in terms of criteria required for EBP designation, such as maintenance of intervention, and generalization of reading comprehension to other tasks, emerges as limited. A hierarchical method to prioritize research-based practices when no, or limited, EBPs exist emerges as a need to meet the mandates of IDEA and to provide teachers with appropriate and effective options for instructing learners with ASD in the area of comprehension.

Study Limitations

Single-case design research results included a limited reporting of student comprehension outcomes using primarily researcher created assessments. Effect sizes were available for only one study, and study

comparisons were limited to descriptive data and data derived from student percentage of increase on assessments with unclear comparability. As a result, the rating of identified instructional practices by effectiveness was not attempted. Findings of this synthesis are limited to the outcomes and quality indicators of each single-case study as reported by original authors.

Future Research Recommendations

Studies with experimental design assessing larger populations of students with ASD are essential to further prove efficacy and prioritize effectiveness of instructional practices identified within this research synthesis. Additional areas of recommended research include: specific study of the effect of using visual supports on reading comprehension in conjunction with a primary intervention; the effect of increased instructional time on reading comprehension; the effect of delivering comprehension strategies through multiple means of instruction including the use of technology; and the use of effective practices in middle and high school classrooms.

Time spent on comprehension intervention implementation varied greatly and, further research is recommended to investigate how much time is actually being spent on instruction of reading comprehension in the classrooms for students with ASD. Specific comprehension instruction guidelines along with time spent on instruction guidelines are recommended to correlate the importance of reading comprehension remediation with other provided services on student IEPs, such as speech therapy and behavioral therapy. Studies assessing the direct effect of increased instructional time on reading comprehension and increased social understanding for students with ASD are recommended as an expansion of comprehension research. Furthermore, a search of the literature revealed no studies

meeting inclusion criteria using technology to teach reading comprehension to students with ASD. Research is recommended specifically integrating the effective practices identified, along with the use of technology.

In conclusion this review of the extant literature indicates reading comprehension instruction for learners with ASD is an established area of need. Multiple effective practices to teach reading comprehension to students with ASD have been identified, yet concern exists that these effective practices may not be readily accessible to teachers because they lack the EBP designation.

Research connecting learning needs of students with ASD, effective practices, teacher training, and teacher perceptions of their own ability to teach reading comprehension to learners with ASD is scarce. Furthermore teachers report a lack of knowledge in accessing empirical research (Burns & Ysseldyke 2009; Mazzotti, Rowe, & Test, 2012). Future research investigating teacher knowledge and perception of the identified effective practices is recommended to guide future research, and to provide appropriate professional development for teachers leading to the use of targeted comprehension interventions in the classroom.

References

- Browder, D. M., & Cooper-Duffy, K. (2003). Evidence-based practices for learners with severe disabilities and the requirement for accountability in “no child left behind.” *The Journal of Special Education*, 37, 157-163.
- Browder, D., Gibbs S., Ahlgrim-Delzell, L., Courtade, G. R., Mraz, M. & Flowers, C. (2009). Literacy for learners with severe disabilities: What should we teach and what do we hope to achieve? *Remedial and Special Education*, 30, 269-282.
- Brown, H. M., Oram-Cardy, J., & Johnson, A. (2013). A meta-analysis of the reading comprehension skills of individuals on the autism spectrum. *The Journal of Autism and Developmental Disorders*, 43, 932-935. doi: 10.1007/s10803-012-1638-1
- Burns, M. K., & Ysseldyke, J. E. (2009). Reported prevalence of evidence-based instructional practices in special education. *The Journal of Special Education*, 43, 3-11. doi:10.1177/0022466908315563
- *Carnahan, C. R., & Williamson, P. S. (2013). Does compare-contrast text structure help students with autism spectrum disorder comprehend science text? *Exceptional Children*, 79, 347-363.
- Carnahan, C. R., Williamson, P. S., & Haydon, T. (2009). Matching literacy profiles with instruction for learners on the spectrum: Making reading instruction meaningful. *Beyond Behavior*, 19, 10-16.
- Centers for Disease Control and Prevention. (2014, March 28). Prevalence of autism spectrum disorder among children age 8 years – Autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *CDC Online Newsroom Press Release*, Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6302a1.htm?s_cid=ss6302a1_w
- Centers for Disease Control and Prevention. (2012, March 29). CDC estimates 1 in 88 children in united states has been identified as having an autism spectrum disorder. *CDC Online Newsroom Press Release*, Retrieved from http://www.cdc.gov/media/releases/2012/p0329_autism_disorder.html

- Cook, B. G., Smith, G. J., & Tankersley, M. (2012). Evidence-based practices in education. In K. R. Harris, S. Graham, & T. Urdan (Eds.), *APA educational psychology handbook* (Vol. 1, pp. 495-528). Washington, DC: American Psychological Association.
- Cooper, H. (2010). *Research synthesis and meta-analysis: A step-by-step approach* (4th ed.). Los Angeles, CA: Sage Publications.
- *Flores, M. M., & Ganz, J. B. (2007). Effectiveness of direct instruction for teaching statement inference, use of facts, and analogies to students with developmental disabilities and reading delays. *Focus on Autism and Other Developmental Disabilities, 22*, 244-251.
- *Flores, M. M., & Ganz, J. B. (2009). Effects of direct instruction on the reading comprehension of student with autism and disabilities. *Education and Training in Developmental Disabilities, 44*, 39-53.
- Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-179.
- *Hua, Y., Hendrickson, J. M., Therrien, W. J., Woods-Groves, S., Ries, P. S., & Shaw, J. J. (2012). Effects of combined reading and question generation on reading fluency and comprehension of three young adults with autism and intellectual disability. *Focus on Autism and Other Developmental Disabilities, 27*, 135-146. doi: 10.1177/1088357612448421
- Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).
- International Reading Association. (2002). *Summary of the (U.S.) National Reading Panel report: Teaching children to read*. Newark, DE: U.S. Division of Research and Policy. Retrieved from http://www.reading.org/Libraries/reports-and-standards/nrp_summary.pdf?sfvrsn=0
- *Kamps, D. M., Barbetta, P. M., Leonard, B. R., & Delquadri, J. (1994). Classwide peer tutoring: An integration strategy to improve reading skills and promote peer interactions among students with autism and general education peers. *Journal of Applied Behavior Analysis, 27*, 49-61.
- *Kamps, D. M., Leonard, B., Potucek, J., & Garrison-Harrell, L. (1995a, b). Cooperative learning groups in reading: An integration strategy for students with autism and general classroom peers. *Behavioral Disorders, 21*, 89-109.
- Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindsopf, D. M., & Shadish, W. R. (2013). Single-case intervention research design standards. *Remedial and Special Education, 34*, 26-38. Doi:10.1177/0741932512452794
- Kretlow, A. G., & Blatz, S. L. (2011). The ABCs of evidence-based practice for teachers. *Teaching Exceptional Children, 43*(5), 8-19.
- Mayton, M. R., Wheeler, J. J., Menendez, A. L., & Zhang, J. (2010). An analysis of evidence-based practices in the education and treatment of learners with autism spectrum disorders. *Education and Training in Autism and Developmental Disabilities, 45*, 539-551.
- Mazzotti, V. L., Rowe, D. R., & Test, D. W. (2012). Navigating the evidence-based practice maze: Resources for teachers of secondary learners with disabilities. *Intervention in School and Clinic, 48*, 159-166. doi: 10.1177/1053451212454004
- Mesibov, G. B., & Shea, V. (2011). Evidence-based practices and autism. *Autism 15*, 114-133. doi:10.1177/136236130934-8070
- *Mims, P. J., Hudson, M. E., & Browder, D. M. (2012). Using read-alouds of grade-level biographies and systematic prompting to promote comprehension for students with moderate and severe developmental disabilities. *Focus on Autism and Other Developmental Disabilities, 27*, 67-80. doi: 10.1177/1088357612446859

- National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. (NIH Publication No. 00-4769). Washington, DC: U.S. Government Printing Office.
- No Child Left Behind Act of 2001, Pub. L. No. 107-110, 115 Stat. 1452 (2002).
- Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. R. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children, 71*, 137-148.
- Odom, S. L., Brown, W. H., Frey, T., Karasu, N., Smith-Canter, L. L., & Strain P. S. (2003). Evidence-based practices for young children with autism: Contributions for single-subject design research. *Focus on Autism and Other Developmental Disabilities, 18*, 166-175.
- Reichow, B., Volkmar, F. R., Cicchetti, D. V. (2008). Development of the evaluative method for evaluating and determining evidence-based practices in autism. *Journal of Autism and Developmental Disorders 31*, 1311-1399. doi:10.1007/s10803-007-0517-7
- Ricketts, J. (2011). Research review: reading comprehension in developmental disorders of language and communication. *The Journal of Child Psychology and Psychiatry, 52*(11), 1111-1123. doi: 10.1111/j.1469-7610.2011.02438.x
- *Roux, C., Dion, E., Barrette, A., Dupere, V., & Fuchs, D. (2014). Efficacy of an intervention to enhance reading comprehension of students with high-functioning autism spectrum disorder. *Remedial and Special Education, 1-12*. doi: 10.1177/0741932514533998
- Santangelo, T., & Graham, S. (February, 2012). *Spelling Instruction for elementary-aged students: A meta-analytic review*. Presentation given at the annual Pacific Coast Research Conference, Coronado, CA.
- Smith, S. W., & Barnhill, G. P. (2001). Current topics in review: What's new in AS research: A synthesis of research conducted by the Asperger syndrome project. *Intervention in School and Clinic, 36*, 300-305.
- *Solis, M., McCulley, L., & Zein, F. E. (2013). *An alternating treatments comparison of reading comprehension interventions for students with autism spectrum disorders*. Presentation given at The Meadows Center. Texas
- Spooner, F., & Browder, D. M. (2015). Raising the bar: Significant advances and future needs for promoting learning for students with severe disabilities. *Remedial and Special Education, 36*, 28-32. doi:10.1177/074193251455022
- Spooner, F., Knight, V. F., Browder, D. M., & Smith, B. R. (2011). Evidence-based practice for teaching academics to learners with severe developmental disabilities. *Remedial and Special Education, 33*, 374-387. doi:10.1177/0741932511421634
- *Stringfield, S. G., Luscre, D. & Gast, D. L. (2011). Effects of a story map on accelerated reader postreading test scores in students with high-functioning autism. *Focus on Autism and Other Developmental Disabilities, 26*, 218-229. doi:10.1177/1088357611423543
- Whalon K. J., Al Otaiba S., & Delano, M. E. (2009). Evidence-based reading instruction for individuals with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 24*, 3-16. doi:10.1177/1088357608328515
- *Whalon K. J., & Hanline, M. F. (2008). Effects of reciprocal questioning on the question generation and responding of children with autism spectrum disorder. *Education and Training in Developmental Disabilities, 43*, 367-387.
- Whalon K. J., & Hart, J. E. (2011). Children with autism spectrum disorder and literacy instruction: An exploratory study of elementary inclusive settings. *Remedial and Special Education, 32*, 243-255. doi:10.1177/0741932510362174

*Williamson, P., Carnahan, C. R., Birri, N. & Swoboda, C. (2014). Improving comprehension of narrative using character event maps for high school students with autism spectrum disorder. *The Journal of Special Education*, advance online publication, 1-11.
doi:10.1177/0022466914521301

*References marked with an asterisk indicate studies included in the research synthesis.

Correspondence concerning this article should be addressed to Amy L. Accardo, Rowan University, Interdisciplinary & Inclusive Education Department, James Hall #3050, 201 Mullica Hill Road, Glassboro, NJ 08028, Email: Accardo@rowan.edu