

Reading Interventions for Elementary English Language Learners With Learning Disabilities: A Review

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This paper provides a review of the literature on reading interventions for English language learners (ELLs) with learning disabilities (LD) in the elementary grade levels (K-5). The goal of this review was to identify and evaluate reading interventions that have been used in the special education literature for ELLs with LD in the early grade levels. A systematic search of the literature from 1975 to 2016 yielded nine studies that met our inclusion criteria. Reading interventions that emerged from our review included: (a) computer-based constant time delay, (b) graphic organizers, (c) peer-tutoring, (d) repeated reading with a vocabulary component, and (e) two reading programs (Project PLUS & Read Well). Overall, the results of the studies showed promising effects on improving the reading outcomes for ELLs with LD in the elementary classroom.

Keywords: English language learners, learning disabilities, reading, interventions, elementary school

Today, in the United States, a growing and ever-increasing number of English language learners (ELLs) are enrolled in our nation's schools. According to a 2013-2014 report, ELLs comprise 10.10% of the student population in the public schools (Snyder, de Brey, & Dillow, 2016), an increase of more than 50% from 1999 (Meyer, Madden, & McGrath, 2004), with 76.5% of these students speaking Spanish/Castilian as their first and home language (Snyder et al., 2016). With this steady increase in the number of ELLs in our classrooms, it is imperative that we identify effective instructional approaches to meet their academic needs.

ELLs, either due to a deficient language knowledge or poor learning skills (Goldenberg, 2011), often experience academic difficulties in the classroom, especially in the area of reading (Klingner, Artiles, & Barletta, 2006; Swanson, Orosco, Lussier, Gerber, & Guzman-Orth, 2011). This is not surprising given that many classroom academic tasks require skilled reading. ELLs' reading abilities depend on many factors including their literacy and language skills in their native language, reading proficiency levels in their non-native lan-

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guage, their disabilities, past literacy educational experiences in their non-native language, their text comprehension, background knowledge, and teacher abilities (August & Shanahan, 2006; Eskey, 2005; Grassi & Baker, 2010; Samson & Lesaux, 2009; Saracho & Spodek, 2007).

As might be expected, ELLs with reading challenges fall further behind their classmates in reading than in other subject areas, and they perform poorly in academic language vocabulary, and in the ability to make inferences and analyze text in English (Gersten & Baker, 2000). The achievement differences in comprehension scores between ELL and non-ELL tend to emerge by kindergarten, widen through fourth grade, and persist well into high school (Hansen & Collins, 2015; Hemphill, Vanneman, & Rahman, 2011; Kieffer, 2010). By the upper elementary grades, their limited vocabulary often leads to comprehension challenges (Hansen & Collins, 2015).

According to data from *The Nation's Report Card*, only 8% of ELLs read at or above a *Proficient* level in the fourth grade (National Center for Education Statistics, 2015). As a result of poor academic achievement, ELLs are often referred to special education (Solari, Petscher, & Folsom, 2014). In the state of Texas, for example, estimates indicate that nearly 14.31% of ELLs are classified with a disability (Eppolito, Lasser, & Klingner, 2013). Some research suggests that ELLs tend to be underrepresented in special education in the early elementary years, while overrepresented by grades three (Artiles, Rueda, Salazar, & Higuera, 2002) or five (Samson & Lesaux, 2009), which could delay them in receiving needed special education services. When referred to special education, ELLs are most commonly identified with a learning disability (LD; Peña, Bedore, & Gillam, 2011) and struggle in the area of reading instruction (García & Tyler, 2010; Snow, Burns, & Griffin, 1998).

Even though ELLs with LD are often challenged by reading, there remains limited research related to literacy instruction and ELLs with disabilities (Klingner et al., 2006). However, it is important that both general and special education teachers provide effective, research-based reading interventions to support ELLs with LD in the classroom. The purpose of this paper is therefore to review the current body of reading intervention research for ELLs with LD in the elementary grade levels.

METHOD

Criteria for Inclusion

To be included in this review, a study satisfied the following eight conditions: (a) published in English between 1975 and 2016, (b) published in a peer-reviewed journal, (c) included participant(s) identified as an English language learner with a learning disability, (d) included students enrolled in grades K-5 in schools in the United States, (e) administered a reading intervention or

program as the study's primary strategy, (f) the dependent measures included reading outcome measures, (g) research methodologies included single-subject, quasi-experimental, or experimental group designs, and (h) sufficient data were provided for each reading outcome to compute effect sizes for single-subject designs (i.e., extractable graphical time series data or tabular time series data) and group design studies (e.g., means, standard deviations, t or F values).

Studies that included ELLs and students with LD in the sample, but that did not explicitly indicate whether these students were identified as ELL and LD (Wanzek & Roberts, 2012) were excluded. Also excluded were studies that did not include the necessary data to compute effect sizes (Davenport, Arnold, & Lassmann, 2004).

Literature Search Procedures

First, an electronic search of the research literature was performed through ERIC (EBSCOhost), PsycINFO (ProQuest), and Linguistics and Language Behavior Abstracts (ProQuest) from 1975 to 2016. This search employed the following key descriptors and its combinations: *English language learners*, *English learners*, *English as a second language*, *English (second language)*, *language minority students*, *limited English proficiency*, *learning disabilities*, *reading*, *interventions*, *school based interventions*, *strategies*, *elementary*, and *elementary school students*. Second, a search was conducted in "Library Quick Search" by Summon (ProQuest), a search engine within the UTSA library system, to locate studies using the following descriptors: *English language learners*, *learning disabilities*, *reading*, *interventions*, and *elementary*. Third, a search of Google Scholar was performed to locate additional studies that met the criteria for inclusion. Fourth, a search of studies in OnlineFirst (for 2016) and an electronic hand search of the table of contents of the current issues was conducted of the following journals: *Exceptional Children*, *Exceptionality*, *International Journal for Research in Learning Disabilities*, *Journal of International Special Needs Education*, *Journal of Learning Disabilities*, *Learning Disabilities Research & Practice*, *Learning Disabilities: A Contemporary Journal*, *Learning Disabilities: A Multidisciplinary Journal*, *Learning Disability Quarterly*, *Reading & Writing Quarterly: Overcoming Learning Difficulties*, *Remedial and Special Education*, *The Elementary School Journal*, and *The Journal of Special Education*. Finally, a "snow ball" search was performed using the abstracts, literature review sections, and references of the studies to identify other potential studies that satisfied the inclusion criteria. This systematic search procedure yielded seven reading intervention journal articles that met the criteria for inclusion in this review.

Data Extraction

The first author conducted search procedures and developed a coding protocol and worksheet to summarize the nine studies in terms of total number of participants, number of ELLs with LD or related disorder, primary language (L1), grade level(s), age, intelligence quotient (IQ) score, pre-intervention reading scores, pre-intervention English proficiency scores, research design, instructional conditions, instructional setting and format, interventionist, number of instructional sessions, dosage (i.e., length and frequency of sessions), duration of the study, treatment fidelity, inter-observer agreement (IOA), reading dependent measures, and effect sizes. An independent coder was trained in the coding protocol and computation of effect sizes by the first author. Prior to coding of the studies, the first author and the trained coder independently evaluated each potential study to determine its eligibility according to the inclusion criteria. Discrepancies were discussed and resolved. Then, the first author and the trained coder independently and in duplicate read, coded, and calculated effect sizes for 100% of the studies that met the inclusion criteria.

Effect Size Calculation

Effect sizes (*ES*) for single-subject design studies were calculated using the percentage of non-overlapping data points (PND) metric. PND is calculated as the percent of the data points in the treatment phase that surpasses the highest data point during the baseline phase. PNDs were computed for each dependent measure for which graphic data was available. For single-subject studies that included several participants identified as ELL and LD, the average PND across those participants was reported. PNDs were not computed when ceiling or floor levels were detected in the baseline (Rogers & Graham, 2008). Interpretation of the effectiveness of a treatment used the following criteria (Rogers & Graham, 2008): (a) a large effect when above 90% of PND, (b) a moderate effect from 70.1% to 90% of PND, (c) a small effect from 50.1% to 70% of PND, and (d) ineffective from 50% or less of PND.

For group design studies, effect sizes were calculated for each dependent measure when sufficient data were available to determine the magnitude of the effect of the reading intervention. Hedge's *g* was used to estimate the effect size of those studies that solely reported posttest means and standard deviations as the difference between the posttest means of the treatment and control group divided by the pooled standard deviation. Effect sizes for pre-posttest treatment-control comparison group design studies were calculated as the difference of the mean gain of the treatment group and the mean gain of the control group divided by the posttest pooled standard deviation when unadjusted group means and standard deviations were provided (What Works Clearinghouse, 2014). For a one-group repeated measures design longitudinal study, effect sizes were calculated as the difference between the post-treatment and pre-treatment mean

scores divided by the pooled standard deviation. To correct for upward small sample bias, effect sizes were adjusted by the Hedge's correction factor (Hedges & Olkin, 1985). Effect sizes reported in the studies were used when no sufficient data were available. Inverse-variance weighted mean aggregate effect sizes were calculated for each dependent variable in the longitudinal one-group repeated measures design study reporting outcomes per dependent measure and grade (Lipsey & Wilson, 2001). Interpretation of effect sizes followed the guidelines recommended by Cohen (1988) as: (a) small – greater than or equal to 0.2 and below 0.5, (b) medium – greater than or equal to 0.5 and below 0.8, and (c) large – 0.8 and above.

Inter-Coder Reliability

To assess inter-coder reliability, coding of the nine studies and their effect sizes by the first author and the trained coder were compared to identify discrepancies. Inter-coder reliability was computed using a point-by-point agreement ratio by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The inter-coder agreement mean was 96.30%. Disagreements were discussed and agreed upon by consensus.

RESULTS

Nine studies met the criteria for inclusion. Selected studies were published in the following journals: *Exceptional Children*, *International Journal of Disability, Development and Education*, *Journal of International Special Needs Education*, *Journal of Special Education Technology*, *Learning Disability Quarterly*, *Remedial and Special Education*, and *The Journal of Special Education*.

Tables 1 and 2 show the participants' demographic information and the studies characteristics and findings, respectively.

Demographic Information and Characteristics of the Studies

Participants. A total of 585 students participated across the nine studies. Of these, 517 students were identified as ELLs, including 165 ELLs classified as having LD, one with LD and a speech and language impairment (SLI), one with LD and attention deficit disorder (ADD), one with SLI, and two with developmental disabilities (DD). Eight of the nine studies included solely English language learners. Of these, four studies included only ELLs with LD.

ELL status was determined by the school district in four of the nine studies (Haager & Windmueller, 2001; Landa & Barbetta, in press; Sáenz, Fuchs, & Fuchs, 2005; Tam, Heward, & Heng, 2006). In four of the studies (Bos & Anders, 1992, Studies #1, #2, & #3; Chai, Ayres, & Vail, 2016), ELL determination was based on the primary language spoken at home. One study did not report the criteria to establish ELL status (Santoro, Jitendra, Starosta, & Sacks, 2006). English proficiency information for the ELLs was included in four of the studies (Bos & Anders, 1992, Study #3; Landa & Barbetta, in press;

Sáenz et al., 2005; Tam et al., 2006), with English proficiency levels ranging from beginner to advanced.

One study classified students with LD based on federal determination criteria (Tam et al., 2006), another on federal and state criteria (Sáenz et al., 2005), five on school district determination criteria (Bos & Anders, 1992, Studies #1, #2, & #3; Haager & Windmueller, 2001; Landa & Barbetta, in press), and two studies did not specify the eligibility criteria for LD (Chai et al., 2016; Santoro et al., 2006).

Students' ages were reported in four studies and ranged from 6.6 to 11.1 years old (Chai et al., 2016; Landa & Barbetta, in press; Santoro et al., 2006; Tam et al., 2006). Three of the remaining studies reported the mean age of the participants (Bos & Anders, 1992, Studies #1 & #2; Sáenz et al., 2005). Two studies did not indicate the age of the sample population (Bos & Anders, 1992, Study #3; Haager & Windmueller, 2001). Across all studies, participants were enrolled in grades one thru six, with the majority of the studies including participants from two or more grade levels.

Three studies included the participants' mean full scale intelligence quotient scores (Bos & Anders, 1992, Studies #1, #2, & #3) and one study reported the participant's IQ information with scores ranging from 86 to 98 (Santoro et al., 2006). The other five studies did not report IQ information.

In eight of the studies (Bos & Anders, 1992, Studies #1, #2, & #3; Chai et al., 2016; Landa & Barbetta, in press; Sáenz et al., 2005; Santoro et al., 2006; Tam et al., 2006), the authors reported the pre-intervention reading achievement levels of the students. Initial participants' reading levels were obtained using a variety of standardized reading assessments (e.g., TERA-3, WJPB, etc.), informal reading assessments (e.g., ARI), and state standard competency tests. In four studies (Chai et al., 2016; Landa & Barbetta, in press; Santoro et al., 2006; Tam et al., 2006), the researchers assessed the participants' reading level prior to the start of the study. Across the eight aforementioned studies, the initial reading achievement levels of the participants with LD were below grade level.

Setting and format. Four of the studies were conducted in a pull-out setting and implemented reading instruction in a one-on-one format (Chai et al., 2016; Landa & Barbetta, in press; Santoro et al., 2006; Tam et al., 2006). The remaining five studies were conducted in an in-class format. Three studies were conducted in a bilingual social studies classroom (Bos & Anders, 1992, Studies #1, #2, & #3), one in a bilingual transitional classroom (Sáenz et al., 2005), and one in an inclusive classroom (Haager & Windmueller, 2001). Of these studies, two studies delivered reading instruction in a group format (Bos & Anders, 1992, Studies #1 & #2), one delivered instruction in both large and small groups (Bos & Anders, 1992, Study #3), one used large and small groups

or a one-on-one format (Haager & Windmueller, 2001), and one employed a dyads format (Sáenz et al., 2005).

Research design. Of the five studies that employed group designs, four used a treatment-control comparison design (Bos & Anders, 1992, Studies #1, #2, & #3; Sáenz et al., 2005), while the other, a one-year longitudinal study (Haager & Windmueller, 2001), utilized a one-group repeated measures design. The remaining four studies employed single-subject research designs, of which, one study employed a multiple baseline across participants design (Tam et al., 2006), two implemented a multiple probe across participants design (Landa & Barbetta, in press; Santoro et al., 2006), and one used a multiple probe design across behaviors replicated across participants (Chai et al., 2016).

Instructional conditions. A series of reading interventions or programs were used across the included studies to target different aspects of reading such as alphabetic knowledge, phonological awareness, reading fluency, and reading comprehension skills. Reading interventions included: (a) *computer-based constant time delay* (Chai et al., 2016), (b) *graphic organizers* (Bos & Anders, 1992, Studies #1, #2, & #3), (c) *peer-tutoring* (Sáenz et al., 2005), (d) *repeated reading with a vocabulary component* (Landa & Barbetta, in press; Tam et al., 2006), (e) a supplemental reading program called *Project PLUS* (Haager & Windmueller, 2001), and (f) a curriculum reading program known as *Read Well* (Santoro et al., 2006).

Dependent measures. Across the nine studies in this review, dependent measures employed were heterogeneous, including standardized, curriculum-based, and researcher-developed measures. Standardized measures were employed in three studies (Haager & Windmueller, 2001; Sáenz et al., 2005; Santoro et al., 2006) to evaluate alphabetic knowledge, phonological awareness, and reading fluency. One study (Chai et al., 2016) employed a researcher-developed measure to assess phonological awareness. Oral reading fluency was evaluated thru the number of correct words per minute and errors per minute on read passages in two studies (Landa & Barbetta, in press; Tam et al., 2006). In those studies that assessed reading comprehension, researcher-developed measures were employed in four studies (Bos & Anders, 1992, Studies #1, #2, & #3; Tam et al., 2006), standardized comprehension measures in two studies (Sáenz et al., 2005; Santoro et al., 2006), and one study utilized a curriculum-based comprehension measure (Landa & Barbetta, in press). Standardized measures were also used to assess the participants' growth on reading comprehension from pre-intervention to post-intervention in one study (Santoro et al., 2006)

Dosage and duration. Of those reporting, reading instruction was administered daily (Haager & Windmueller, 2001; Landa & Barbetta, in press; Tam et al., 2006), 3 times per week (Sáenz et al., 2005; Santoro et al., 2006), or 4 to 5 times per week (Chai et al., 2016). Reported intervention session lengths

ranged from 4 to 60 minutes, with a third of the reporting studies holding sessions in the range from 30 to 35 minutes and another third in the range of 50 to 60 minutes. Of those reporting, duration of the studies ranged from 5 weeks to a school year.

Interventionists. The reading interventions were implemented by researchers in four studies (Bos & Anders, 1992, Study #1; Chai et al., 2016; Landa & Barbetta, in press; Tam et al., 2006), by teachers in three studies (Bos & Anders, 1992, Studies #2 & #3; Sáenz et al., 2005), by teachers and support staff in one study (Haager & Windmueller, 2001), and by a team consisting of a teacher and two graduate students in another study (Santoro et al., 2006). Interventionists in four of the studies were trained prior to the implementation of the study. In one study (Bos & Anders, 1992, Study #1), researchers were trained to deliver intervention procedures. In a second study (Bos & Anders, 1992, Study #2), teachers participated in a 5-week development program. In a third study (Sáenz et al., 2005), teachers were trained in the intervention procedures in a day workshop. In a fourth study (Santoro et al., 2006), teachers and graduate assistants received training in a 2-hour session. In two studies, the interventionists received training and support for the entire duration of the study. In one of these studies (Bos & Anders, 1992, Study #3), teachers received on-going staff development, while in the other study (Haager & Windmueller, 2001), teachers participated in professional development workshops weekly during the school year.

Maintenance and generalization. Seven studies included maintenance measures (Bos & Anders, 1992, Studies #1, #2, & #3; Chai et al., 2016; Landa & Barbetta, in press; Santoro et al., 2006; Tam et al., 2006). Maintenance measures were either assessed repeatedly in a period that ranged from two to six weeks (Chai et al., 2016; Landa & Barbetta, in press; Santoro et al., 2006; Tam et al., 2006) or by a follow-up test (Bos & Anders, 1992, Studies #1, #2, & #3). Three studies reported generalization measures (Chai et al., 2016; Landa & Barbetta, in press; Tam et al., 2006), one of these (Chai et al., 2016), administered generalization assessments before and after intervention, while two other studies (Landa & Barbetta, in press; Tam et al., 2006) probed the students' generalization skills during all the conditions of the study. Two studies did not report either maintenance or generalization measures (Haager & Windmueller, 2001; Sáenz et al., 2005).

Fidelity of treatment. In five of the nine studies, independent trained observers collected treatment fidelity data on the implementation of the reading interventions. In three studies, treatment fidelity was assessed by direct observation (Sáenz et al., 2005; Santoro et al., 2006; Tam et al., 2006), one study from video recordings of the study sessions (Chai et al., 2016), and another from audio recordings of the sessions (Landa & Barbetta, in press). Of those reporting,

treatment fidelity sessions were conducted for 4.4% to 60% of the sessions, with percent of treatment fidelity ranging from 90% to 100%.

Inter-observer agreement. Similarly, five studies reported the percent of inter-observer agreement. In three of the five studies, IOA data was compiled by listening to audio-tape recordings of the sessions (Landa & Barbetta, in press; Santoro et al., 2006; Tam et al., 2006), and one study collected IOA data through video recording (Chai et al., 2016). Of those reporting, the percent of IOA sessions ranged from 20% to 60%, with IOA in the range from 92.30% to 99.20%.

Summary of the Reading Intervention Studies

Computer-based constant time delay. Chai et al. (2016) employed a computer-based constant time delay intervention to enhance the phonological abilities of students using a researcher-developed app for an iPad to learn target phonemes. Results indicated that the reading intervention was moderately effective to improve the phonological skills to learn target phonemes for the ELL student with LD during intervention ($PND_1 = 79.79\%$), and highly effective during maintenance phases ($PND_M = 100\%$). Moreover, from pre-intervention to post-intervention, the student increased his ability to identify object names that started with the taught target phonemes in a paper presentation.

Graphic organizers. Three studies were conducted by Bos and Anders (1992) to evaluate the effectiveness of three interactive learning approaches using graphic organizers: (a) semantic mapping (SM), (b) semantic feature analysis (SFA), and (c) semantic/syntactic feature analysis (SSFA) to teach vocabulary and improve the reading comprehension skills of ELLs with LD attending bilingual upper elementary classrooms. In the first and second studies (Bos & Anders, 1992, Studies #1 & #2), the effectiveness of the three graphic organizer strategies (SM, SFA, & SSFA) to improve students reading comprehension skills were compared to a definition instruction model. Effect sizes on reading comprehension in both studies were large ($ES = 0.81 - 1.46$) for all three experimental conditions compared to the control condition. Moreover, Study #1 reported a large effect size on reading comprehension for the three treatment conditions relative to the control condition one month after the completion of the intervention ($ES = 0.86$). In the third study by Bos and Anders (1992, Study #3), from pre-intervention to post-intervention both strategies were equally effective to enhance the reading comprehension of ELLs with LD ($ES = 0.03$). Furthermore, students in the SM and SFA groups performed better than average performing students who did not receive the intervention on comprehension measures at posttest ($ES = 0.46$ & 0.30 , respectively). At a one-month follow-up, the SM strategy group did better than both the SFA group from pretest to follow-up ($ES = 0.35$) and the comparison group at posttest ($ES = 0.62$).

Table 1. Studies Demographic Information

Citation	Participants	L1	Grade	Age	IQ	Reading Achievement English Proficiency
Bos & Anders (1992) Study #1	N = 42 n = 42 ELL & LD	Spanish (n = 42)	NR	M = 11.36	M = 96.90 ^a	Reading Achievement M = 75.98, NR
Bos & Anders (1992) Study #2	N = 47 n = 47 ELL & LD	Spanish (n = 47)	NR	M = 11.47	M = 94 ^a	Reading Achievement M = 75.42, NR
Bos & Anders (1992) Study #3	N = 26 n = 26 ELL & LD	Spanish (n = 26)	M = 5.45	NR	M = 92.63 ^a	WJRB Reading Achievement M = 3.1, English LAS M = 3.59
Chai, Ayres, & Vail (2016)	N = 3 n = 1 ELL, SLI & LD n = 1 ELL & SLI n = 1 ELL & DD	Spanish (n = 3)	1 & 2	6.6 - 7.2	NR	TERA-3: 64 - 74, NR
Haager & Windmueller (2001)	N = 335 n = 267 ELL n = 22 ELL & LD n = 9 LD	Spanish (n = 267)	1 & 2	NR	NR	NR, NR
Landa & Barbetta (in press)	N = 4 n = 4 ELL & LD	Spanish (n = 4)	3, 4, & 5	10 - 11	NR	ARI Instructional Reading Level 1-2, ESOL Levels III-IV
Sáenz, Fuchs, & Fuchs (2005)	N = 119 n = 99 ELL n = 20 ELL & LD	Spanish (n = 119)	3 - 6	M = 10.40	NR	Reading Grade Level M = 3.44, Woodcock Munoz Language Survey M = 3.11
Santoro, Jitendra, Starosta, & Sacks (2006)	N = 4 n = 3 ELL n = 1 ELL & LD	NR	2	7.0 - 8.11	WISC-III: 86 - 98	Terra Nova Test of Cognitive Skills: Reading Percentile: 23-30%, NR
Tam, Heward, & Heng (2006)	N = 5 n = 1 ELL & LD n = 1 ELL & LD & ADD n = 1 ELL & DD n = 2 ELL	Amharic (n = 2) Khmer (n = 1) Spanish (n = 2)	3 - 5	9.4 - 11.1	NR	Brigance Diagnostic Inventory of Basic Skills – WR, ORF, & RC: Primer-1 st Grade Level, English-Second Language: Level: 2

Note. DD = Developmental Disabilities, ELL = English Language Learner, IQ = Intelligence Quotient, L1 = Primary Language, LD = Learning Disabilities, ORF = Oral Reading Fluency, RC = Reading Comprehension, SLI = Speech and Language Impairment, WR = Word Recognition, NR = Not Reported, ARI = Analytical Reading Inventory (Woods & Moe, 2006), ESOL = English for Speakers of Other Languages (Miami, FL.: Dade County Board of Public Instruction), LAS = Language Assessment Scales (De Avila & Duncan, 1990), TERA-3 = Test of Early Reading Ability 3rd ed. (Reid, Hresko, & Hammill, 2001), WJPB = Woodcock Johnson Psycho-educational Battery (Woodcock & Johnson, 1977), WISC-III = Wechsler Intelligence Scale for Children-III (Wechsler, 1991).

a. Performance IQ - IQ test no reported.

Table 2. Studies Characteristics and Findings

Citation	Research Design Instructional Conditions	Setting Format Interventionist(s)	Session(s) Dosage Duration	TF (%s, %tf)	IOA (%s, %ioa)	Reading Dependent Measures	Results
Bos & Anders (1992) Study #1	Quasi-experimental pretest-posttest treat- ment control design C: Definition instruc- tion T ₁ : Semantic mapping T ₂ : Semantic feature analysis T ₃ : Semantic/syntactic feature analysis	In-class, Group, Researchers	T ₁ , T ₂ , T ₃ 3 practice & 3 inter- vention sessions, 50 min	NR	NR	a. Score on research- er-developed comprehension multiple-choice test	For students with ELL & LD: a. T ₁ , T ₂ , T ₃ vs. C (posttest): ES = 0.81 ^{a,b} T ₁ , T ₂ , T ₃ vs. C (follow-up): ES = 0.86 ^{a,b}
Bos & Anders (1992) Study #2	Quasi-experimental pretest-posttest treat- ment control design C: Definition instruc- tion T ₁ : Semantic mapping T ₂ : Semantic feature analysis T ₃ : Semantic/syntactic feature analysis	In-class, Group, SPED teachers	T ₁ , T ₂ , T ₃ 3 practice & 3 inter- vention sessions, 50 min	NR	NR	a. Score on research- er-developed comprehension multiple-choice test	For students with ELL & LD: a. T ₁ , T ₂ , T ₃ vs. C (posttest): ES = 1.46 ^{a,b}

Table 2. Studies Characteristics and Findings (continued)

Citation	Research Design Instructional Conditions	Setting Format Interventionist(s)	Session(s) Dosage Duration	TF (%s, %tf)	IOA (%s, %ioa)	Reading Dependent Measures	Results
Bos & Anders (1992) Study #3	Quasi-experimental pretest-posttest treat- ment control design C: Normative com- parison group T ₁ : Semantic mapping T ₂ : Semantic feature analysis	In-class, Large & small groups, SPED teachers	NR, NR, 5 weeks	NR	NR	a. Score on research- er-developed comprehension multiple-choice test	For students with ELL & LD: a. T ₁ vs. C (posttest): $ES = 0.46^b$ T ₂ vs. C (posttest): $ES = 0.30^a$ T ₁ vs. T ₂ (pre-test/posttest): $ES = 0.03^a$ T ₁ vs. C (follow-up): $ES = 0.62^a$ T ₂ vs. C (follow-up): $ES = 0.06^c$ T ₁ vs. T ₂ (pre-test/follow-up): $ES = 0.35^c$
Chai, Ayres, & Vail (2016)	Multiple probe design across behaviors replicated across participants B: Identify an object on a computer screen that starts with a target pho- neme T: Computer-based constant time delay	Pull-out, 1:1, Researcher	T: 6 - 17, 4 min, 4 - 5 times x week	20%, 92.7%	20%, 99.2%	a. Percentage of unprompted cor- rect identification of pictures with identical initial phonemes	For the student with ELL & LD: a. $PND_1 = 79.79\%$ $PND_M = 100.00\%$

Table 2. Studies Characteristics and Findings (continued)

Citation	Research Design Instructional Conditions	Setting Format Interventionist(s)	Session(s) Dosage Duration	TF (%, %of)	IOA (%, %ioa)	Reading Dependent Measures	Results
Haager & Windmueler (2001)	One-group repeated measures design T: <i>Project PLUS</i> - supplemental reading instruction for ELLs at-risk for LD	In-class, Large & small group or 1:1, Teacher & support personnel	1 hour*, daily, 1 school year	NR	NR	a. DIBELS Letter Naming Fluency b. DIBELS Phoneme Segmentation Fluency c. DIBELS Nonsense Word Fluency d. DIBELS Oral Reading Fluency	For all students: a. $ES = 1.25^a$ b. $ES = 0.99^a$ c. $ES = 0.88^a$ d. $ES = 1.19^a$
Landa & Barbetta (in press)	Multiple probe design across participants B: Vocabulary instruction & one reading with error procedures T: Vocabulary instruction, 1 st reading with error correction + 2 RR	Pull-out, 1:1, Researcher	T: 7 - 38, 10 - 20 min, daily, 12 weeks	25%, 99.78%	25%, 94.87 - 98.97%	a. Correct words per minute b. Errors per minute c. Correct responses to literal comprehension questions provided by basal readings	For students with ELL & LD: a. $PND_1 = 86.65\%$ $PND_M = 66.67\%$ $PND_G = 62.50\%$ $PND_{G-M} = 75.00\%$ b. $PND_1 = 21.78\%$ $PND_M = 41.67\%$ $PND_G = 47.50\%$ $PND_{G-M} = 50.00\%$ c. $PND_1 = 48.18\%$ $PND_M = 66.67\%$ $PND_G = 50.00\%$ $PND_{G-M} = 0.00\%^2$

Table 2. Studies Characteristics and Findings (continued)

Citation	Research Design Instructional Conditions	Setting Format Interventionist(s)	Session(s) Dosage Duration	TF (%, %atf)	IOA (%, %ioa)	Reading Dependent Measures	Results
Sáenz, Fuchs, & Fuchs (2005)	Experimental treatment-control comparison design C: Typical reading instruction T: Peer-assisted learning strategies (PALS)	In-class, Dyads, Teachers	T: 45 ^{std} , 35 min, 3 times a week, 15 weeks	4.4% ^{std} , 90 - 96%	25%, 96 - 99%	a. CRAB number of words read cor- rectly b. CRAB maze choices correct c. CRAB number of comprehension question answered correctly	For students with ELL & LD: a. T vs. C: $ES = 0.36^{a,d}$ b. T vs. C: $ES = 0.47^{a,d}$ c. T vs. C: $ES = 0.91^{a,d}$
Santoro, Jitendra, Starosta, & Sacks (2006)	Multiple probe design across participants B: Typical classroom reading instruction T: <i>Read Well</i> program	Pull-out, 1:1, SPED teacher & Graduate stu- dents	T: NR, 30 min session, 21 week- s ^{std}	60%, 94%	60%, 92.3 - 94.6%	a. DIBELS Letter Naming Fluency b. Letter Sound Flu- ency c. DIBELS Phonemic Segmentation Fluency d. DIBELS Nonsense Word Fluency e. Correct words per minute (ORF)	For the student with ELL & LD: a. $PND_1 = 0.00\%$ $PND_M = 0.00\%$ b. $PND_1 = 100.00\%$ $PND_M = 100.00\%$ c. $PND_1 = 80.00\%$ $PND_M = 100.00\%$ d. $PND_1 = 100.00\%$ $PND_M = 100.00\%$ e. $PND_1 = 63.64\%$ $PND_M = 100.00\%$
						Pretest/Posttest WRMT-R Word Identification WRMT-R Word Attack WRMT-R Passage Comprehension	

Table 2. Studies Characteristics and Findings (continued)

Citation	Research Design/ Instructional Condi- tions	Setting Format Interventionist(s)	Session(s) Dosage Duration	TF (%s, %atf)	IOA (%s, %ioa)	Reading Dependent Measures	Results
Tam, Heward, & Heng (2006)	Multiple baseline across participants B0: 3-RR B1: Story telling + 3-RR T ₁ : Vocabulary instruction + untimed reading with error correc- tion+ 3 RR T ₂ : Vocabulary instruction + untimed reading with error correc- tion + 3RR - to fluency criterion	Pull-out, 1:1, Researcher	T ₁ : 12 -21, T ₂ : 7 -22, 35 min, daily	20%, 100%	22%, 94.8 - 98.5%	a. Correct words per minute b. Errors per minute c. Correct responses to researcher- developed compre- hension questions	a. T ₁ PND ₁ = 30.98% T ₂ PND ₁ = 45.78% PND _M = 43.65% b. T ₁ PND ₁ = 68.63% T ₂ PND ₁ = 98.48% PND _M = 61.90% c. T ₁ PND ₁ = 33.44% T ₂ PND ₁ = 68.75% PND _M = 57.14% Generalization c. T ₁ PND _G = 45.00% T ₂ PND _G = 68.75% PND _{GM} = 50.00%

Note. cfd = Computed from Data, %ioa = % of Inter-Observer Agreement (min - max), %as = % of Sessions (min - max), %atf = % of Treatment Fidelity (min - max), B = Baseline, C = Control, IOA = Inter-observer Agreement, PND_G = % of PND Generalization during Intervention versus Generalization during Baseline, PND_{G-M} = % of PND Generalization during Maintenance versus Generalization during Baseline, PND_M = % of PND Intervention versus Baseline, PND_M = % of PND Maintenance versus Baseline, RR = Repeated Reading, T = Treatment, TF = Treatment Fidelity, CRAB = The Comprehensive Reading Assessment Battery (Fuchs, Fuchs, & Hamlett, 1989), DIBELS = Dynamic Indicators of Basic Early Literacy Skills, 6th ed. (Good & Kaminski, 2002), WRMT-R = Woodcock Reading Mastery Test-Revised (Woodcock, 1987).
a. Statistical findings not reported.
b. Reported in the study.
c. Students with LD also received 1 hour of supplemental reading instruction.
d. Based on Sáenz (2002).

Peer-tutoring. One study (Sáenz et al., 2005) was found that implemented peer-tutoring with ELLs that included ELLs with LD in its sample population. In this study, Sáenz et al. (2005) compared the effects of peer-tutoring (Peer-Assisted Learning Strategies – PALS) versus regular reading instruction in 12 ELL classrooms, which included at least two students with LD per class. Peer-tutoring instruction consisted of partner reading with story retell and paragraph shrinking during the first 4 weeks of the intervention, prediction relay was then introduced in the fifth week, and implemented with the other two peer-tutoring components in the remaining 11 weeks of the study. Findings showed that ELLs in the PALS condition, including those with LD, significantly outperformed their peers in the control condition on measures of reading fluency and comprehension. Specifically, for ELLs with LD, even though no statistical findings were reported for this group of students, results suggest that ELLs with LD in the PALS group outperformed their peers in the regular instruction group on reading fluency ($ES = 0.36$ & 0.47) and comprehension ($ES = 0.91$).

Repeated reading with a vocabulary component. Two studies assessed the effects of a repeated reading intervention with a vocabulary component to increase students reading fluency and comprehension skills. During baseline in the first study, Landa and Barbetta (in press), the researcher began the sessions with one-to-three minutes of vocabulary instruction depending on the participants' need. Then, the participants read a novel passage aloud once with whole-word error correction (Barbetta, Heward, & Bradley, 1993) followed by reading fluency and literal comprehension assessments. During repeated reading, sessions began with the identical limited vocabulary instruction and an initial reading with error correction, followed by two additional readings. Immediately following approximately 25% of the sessions throughout the study, generalization probes were administered to test generalization to untaught passages that were similar to those being used in the experimental sessions. Maintenance probes were taken on passages two, four, and six weeks after the study concluded. Results indicated that on average the repeated reading intervention was moderately effective on improving students' reading fluency from baseline to intervention ($PND_I = 86.65\%$). On reading comprehension, even though the PND metric ($PND_I = 48.18\%$) suggests the strategy was not effective, with a ceiling effect observed for two of the participants, the mean number of correct answers to literal comprehension questions increased across all participants from baseline to intervention, with those students scoring lower at baseline showing the largest improvement in comprehension during intervention. In the 6-week maintenance period, reading fluency levels ($PND_M = 66.67\%$) were similar or higher than those achieved during intervention for two of the students and above baseline levels for the other two students. Moreover, reading comprehension levels were at or above those in the intervention phase for all the students ($PND_M = 66.67\%$). On gen-

eralization passages, from baseline to intervention, out of the four participants, three increased their mean reading fluency performance ($PND = 62.50\%$) and two improved their average reading comprehension scores ($PND = 50\%$). During maintenance, except for one of the participants, reading fluency average performance continued to improve relative to intervention ($PND_{G-M} = 75\%$). Nonetheless, reading comprehension levels on generalization passages for all but one of the students fell at or below their baseline levels ($PND_{G-M} = 0\%$).

In a second study, Tam et al. (2006) implemented a repeated reading intervention with vocabulary instruction. Four repeated reading conditions were employed in the study, which included two successive baseline conditions followed by two intervention conditions. In the first baseline condition, students read a novel passage three times and then answered comprehension questions. The second baseline condition was identical to the first except that before implementing the repeated reading intervention, students were read a story and asked comprehension questions. The first repeated reading condition used similar procedures to those in the first baseline, but included a vocabulary instruction component and an initial reading of a novel passage with error correction procedures prior to the three repeated readings of the passage. The same procedures were implemented in the second repeated reading condition, except that students moved to a new passage after achieving a predetermined fluency criterion. For ELLs with LD, results indicated that the repeated reading to a fluency criterion intervention was more effective than three repeated readings of the same passage ($PND_1 = 45.78\%$ & 30.98% , respectively). Gains in reading fluency acquired during the last intervention phase were sustained during maintenance ($PND_M = 43.65\%$). On reading comprehension, repeated reading of a passage to a fluency criterion was more effective than reading a passage three times ($PND_1 = 68.75\%$ & 33.44% , respectively). Similarly, on generalization to novel passages during the intervention phases, repeated reading of a passage to a fluency criterion was also more effective to enhance reading comprehension than reading a passage three times ($PND_G = 68.75\%$ & 45.00% , respectively). During the maintenance phase, average reading comprehension for taught passages continued to increase for one of the ELLs with LD while decreased for the other student but remained above baseline levels ($PND_M = 57.14\%$). A similar pattern was observed for reading comprehension of generalization passages during maintenance ($PND_{G-M} = 50.00\%$).

Reading programs. Two studies employed a reading program as the primary reading intervention. In the first study, Haager and Windmueller (2001) implemented a supplemental reading program called *Project PLUS* during an entire school year in a low achieving urban school to improve alphabetic, phonological awareness, decoding, and reading fluency abilities of first and sec-

ond graders with LD or at-risk, which included a large number of ELLs. Results revealed that all participants, including those identified as ELLs with LD, showed substantial growth on alphabetic, phonological awareness, and decoding skills ($ES = 1.25, 0.99$ & 0.88 ; respectively); however, slower growth was noted on reading fluency ($ES = 1.19$). The authors suggested that the lack of English language knowledge for the ELLs might have hindered their progress on reading fluency, which would possibly explain the overall slower growth rate observed on reading fluency.

The reading intervention in Santoro et al. (2006) consisted of the curriculum reading program known as *Read Well* to teach phonological awareness, decoding skills, vocabulary, reading fluency, and comprehension to three ELLs, one of which was diagnosed with LD. Results indicated that during intervention the program was moderately effective for the student with ELL and LD on phonological awareness ($PND_1 = 80\%$), highly effective on decoding ($PND_1 = 100\%$), and slightly effective on reading fluency ($PND_1 = 63.64\%$). However, disparate findings were noted on alphabetic measures; the reading program was highly effective to increase the student's skills to sound letters ($PND_1 = 100\%$), and ineffective to improve the student's ability to identify letters ($PND_1 = 0\%$). During maintenance, the student's performance continued to improve relative to intervention on alphabetic measures ($PND_M = 0\%$ & 100%), phonological awareness ($PND_M = 100\%$), decoding ($PND_M = 100\%$), and reading fluency ($PND_M = 100\%$). Moreover, the ELL student with LD exhibited an increase on norm-referenced pre-posttest decoding and reading comprehension outcomes, with higher increases observed on word attack and passage comprehension measures.

DISCUSSION

Reading difficulties are common for ELLs with LD in the elementary grade levels in school. Although extensive research exists related to effective, research-based reading interventions for elementary students with LD (Chard, Vaughn, & Tyler, 2002; Kim, Bryant, Bryant, & Park, 2016; Stevens, Walker, & Vaughn, 2016), our knowledge and understanding of reading interventions for ELLs with LD at the elementary level is quite limited. Findings from this review highlight some promising reading interventions to improve the reading performance of ELLs with LD, but clearly show the need for further research in this area of study. In general, the results of this review revealed a series of reading interventions (i.e., computer-based constant time delay, graphic organizers, peer-tutoring, repeated reading with a vocabulary component) and programs (*Project PLUS* & *Read Well*) that showed potential to positive effects to improve the reading outcomes for elementary-age ELLs with LD. Key findings from the studies are presented below; however, due to the small number of studies found

in peer-reviewed journals, and the limited number of students identified as ELLs with LD in these studies, our findings should be taken with caution.

First, there is a paucity of published research studies that focus on reading interventions for ELLs identified with LD at the elementary school level. Only nine reading intervention studies were found that included ELLs with LD enrolled in an elementary school (K-5) from 1975 to 2016. Moreover, all of the studies, except two (Chai et al., 2016; Landa & Barbetta, in press), were published more than ten years ago. Additionally, of the four studies in this review that focused exclusively on ELLs with LD, three were conducted in the early 1990s (Bos & Anders, 1992, Studies #1, #2, & #3), which clearly shows a gap in the literature and the critical need for research on reading interventions for ELLs with LD in the early grade levels.

Second, the first language of the ELLs in the studies reviewed was limited. Most of the participants' first language was Spanish with limited participants speaking other languages (e.g., Amharic & Khmer). While 71% of ELLs' first language is Spanish, there are many other first languages spoken by ELLs (Migration Policy Institute, 2015). There are at least five states where a first language is something other than Spanish, Montana, Maine, Alaska, Hawaii, and Vermont, and there are many other languages spoken in the states where Spanish is predominant (Migration Policy Institute, 2015). Additional research is needed to investigate the effects of reading interventions for ELLs who speak a different first language.

Third, except for Bos and Anders studies (1992), the majority of the studies implemented reading interventions proven effective for native English speakers, but did not describe specific adaptations needed to meet the needs of ELLs with LD, such as linguistic responsive instruction, or how to modify the reading intervention or its materials in a more culturally responsive framework (Gay, 2002), which might be more effective for ELLs with lower levels of English language proficiency. Moreover, in these studies, instruction was delivered exclusively in English without instructional support in the participants' primary language during the implementation of the interventions. Thus, further research is needed to investigate the effectiveness of research-based reading interventions that have been adapted to meet the English proficiency levels of ELLs with LD. In addition, despite research demonstrating strong evidence that teaching ELLs to read in their first language or using a bilingual approach promotes better levels of reading achievement in English (Francis, Lesaux, & August, 2006; Rolstad, Mahoney, & Glass, 2005; Slavin & Cheung, 2005), the majority of the studies focused on monolingual English reading instruction. Therefore, future research is needed to explore the effects of reading interventions for ELLs with LD using bilingual instruction or delivered in the students' primary language.

Fourth, a limited number of reading interventions were implemented to assess their effects on reading outcomes for ELLs with LD in the elementary grades. These interventions included: computer-based constant time delay, graphic organizers, peer-tutoring, repeated reading with a vocabulary component, and two reading programs (*Project PLUS* & *Read Well*). All of the reading interventions, except for computer-based constant time delay, were multi-component in nature and focused on two or more reading areas. Of these multi-component reading interventions, all but peer-tutoring (Sáenz et al., 2005), included a vocabulary building component, which is an important skill to teach since ELLs often struggle with language acquisition (Gersten & Baker, 2000). Even though overall the reading interventions in this review have proven to be effective for native English speakers with LD (Bursuck & Damer, 2015; Therrien & Hughes, 2008), additional research is needed to investigate further the effectiveness of these reading strategies for ELLs with LD on the different levels of English proficiency (from very limited to advanced), as well as to explore the benefits of other research-based reading interventions (e.g., collaborative strategic reading, etc.). Moreover, in order to boost potential positive effects on reading performance, future research on reading interventions for ELLs with LD should include the use of adaptations that might better address the instructional needs of this population (August & Shanahan, 2010; Goldenberg, 2011).

Fifth, it was noted that except for the Bos and Anders studies (1992), the majority of the studies included a small number of ELLs with LD among the participants. Of these, two group studies (Haager & Windmueller, 2001; Sáenz et al., 2005) included 20 ELLs with LD each, which represented approximately 6% and 17% of their sample population, respectively. However, in both studies, the authors did not conduct a statistical analysis on the effects of the reading intervention for ELLs with LD. Of the four single-subject studies, three included only one ELL student with LD among the participants. The small sample of ELLs with LD included in most of the studies limits our ability to draw confident conclusions on the effectiveness of the reading interventions for ELLs with LD. Thus, further research should investigate the effectiveness of reading interventions for ELLs with LD through single-subject research design studies targeting exclusively ELLs with LD and large-scale group research design studies that include larger samples of ELLs with LD in the inclusive classroom.

Sixth, of the few studies that assessed alphabetic knowledge, phonological awareness, and decoding outcomes, results indicated that, for the most part, the reading interventions were effective for ELLs with LD. However, on alphabetic measures, the results were mixed. The reading program, *Project PLUS* was highly effective to improve students' ability to name letters, in contrast, the *Read Well* program proved to be ineffective, but, it was however highly effective to improve letter-sound fluency. On phonological awareness, the computer-based

constant time delay intervention and both reading programs, *Project PLUS* and *Read Well*, were effective to improve the phoneme segmentation skills for ELLs with LD. In terms of decoding, the *Project PLUS* and the *Read Well* programs positively impacted the decoding skills. These results on word-level skills are consistent with research for ELLs (August & Shanahan, 2010), nevertheless, these findings deserve a wary interpretation since the two single-subject studies included only one ELL with LD (Chai et al., 2016; Santoro et al., 2006). Further, in the group study by Haager and Windmueller (2001), results on word-level skills were attained by the entire student sample, but the study did not report specific findings of the intervention for ELLs with LD, thus, the specific effects of the reading intervention for ELLs with LD could not be inferred.

Seventh, on reading fluency for ELLs with LD, consistent with previous research on repeated reading for students with LD (Therrien, 2004), repeated reading to a fluency criterion was more effective than three-times repeated reading to improve reading fluency for ELLs with LD; however, the magnitude of effect sizes were below those reported for students with LD. Smaller effect sizes on reading fluency of repeated reading interventions for ELLs with LD might be attributed to underdeveloped second language knowledge and fluency. On the other hand, the small effect sizes on fluency observed for peer-tutoring and the *Read Well* program are in alignment with previous research on these interventions for students with LD and ELLs, respectively.

Lastly, on reading comprehension, effectiveness of the reading interventions in this review for ELLs with LD were also mixed. In contrast with previous research on repeated reading (Therrien, 2004), the effects of the two repeated reading intervention studies with a vocabulary component on comprehension were minor. Large effect sizes on reading comprehension were noted for peer-tutoring, whereas effect sizes for graphic organizers (SM, SFA, & SSFA) were large in two studies (Bos & Anders, 1992, Studies #1 & #2) and small to moderate in another study (Bos & Anders, 1992, Study #3). However, results presented in Bos and Anders (1992) deserve careful interpretation since treatment fidelity and inter-observer agreement measures were not reported. Both, peer-tutoring and graphic organizer strategies included components that have been suggested to be beneficial for ELLs (Goldenberg, 2011), which might have contributed to the substantial positive effects observed on comprehension, such as activation of prior knowledge, making predictions, and the use of graphic organizers (Bos & Anders, 1992), and oral retell, summarization and prediction relay in peer-tutoring (Sáenz et al., 2005). These embedded components may have encouraged students to verbalize their thoughts thus promoting a potential increase of students' language proficiency in English, essential for reading comprehension (Goldenberg, 2011; Richards-Tutor, Baker, Gersten, Baker, & Smith, 2016).

In conclusion, future research is warranted on effective, research-based reading interventions for ELLs with LD in the elementary grade levels in school, particularly given the limited research in this area, and the steadily growing number of ELLs with LD in our classrooms. Research consistently shows a positive correlation between reading well, school performance, and success beyond school (Pressley, Gaskins, & Fingeret, 2006). Given the challenges that many ELLs have with reading well in English along with the benefits of proficient reading on academic success, substantial additional research is needed to extend the findings of the studies discussed in this review.

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