A Literature Review of Evidence-Based Literacy Assessment and Instruction Practices for English Learners with Significant Cognitive Disabilities

NCEO Report 422

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Executive Summary

Students with the most significant cognitive disabilities participate in states' alternate assessments based on alternate academic achievement standards (AA-AAAS). A growing number of these students are also English learners (Christensen et al., 2018). To fully and meaningfully participate in an AA-AAAS, English learners with significant cognitive disabilities need both appropriate high-quality assessments and meaningful access to the grade-level standards-based curriculum. This report summarizes an investigation of research published in 2000–2018 on evidence-based literacy assessment and instruction practices for English learners with the most significant cognitive disabilities.

For this report, we included research literature on students with intellectual disabilities, autism, and multiple disabilities because "significant cognitive disability" is not a disability category (as defined under the Individuals with Disabilities Education Act, or IDEA) and therefore there is dearth of research using the term. To locate articles addressing English learners with significant cognitive disabilities, we took a liberal approach. In addition to students identified in a study as English learners, we also included studies with any student in the included disability categories whose home language was not English.

We used a two-phase search process for our literature review. In Phase 1, we reviewed articles included in a previous review conducted by Liu, Thurlow, and Quenemoen (2015) using a similar, but slightly narrower, set of inclusion criteria focused on peer-reviewed research and dissertations with students ages 6–21 years. In Phase 2, we conducted a three-part search for research published from 2015 to the end of 2018 using selected academic search engines, a hand search of key special education journals, and forward and reverse citation searches. Six of the eight articles from Phase 1 met our inclusion criteria, and eight studies met our inclusion criteria in Phase 2, for a total of 14 studies.

None of the studies addressed appropriate literacy assessment practices for English learners with significant cognitive disabilities. All 14 of the studies addressed literacy instruction. The studies reported information about 29 students, ranging in age from 6 to 20 years, who were identified as English learners or likely English learners with significant cognitive disabilities. The majority of the students were in families that spoke Spanish.

Instruction investigated in the 14 studies tended to be well-researched special education interventions with supplemental language supports (e.g., use of the native language for directions or instruction, simplified texts, use of audio materials to accompany the text). The interventions included: (a) constant time delay, (b) shared stories (both traditionally delivered and technology delivered), (c) model-lead-test, (d) system of least prompts, (e) peer-delivered interventions, (f) story mapping, and (g) other interventions that were part of a multi-component intervention package.

Four major themes were identified in the 14 studies: processes for identifying students with significant cognitive disabilities, literacy intervention strategies investigated, linguistic supports provided to students during the intervention to address English language development needs, and the role of technology in delivering the intervention. In general, the reviewed literature suggested that, in the absence of extensive research, it is appropriate to adapt practices proven to be effective for native English speakers with significant cognitive disabilities to support the English proficiency of individual learners. In all of the studies, students' daily instruction was in special education classrooms. Thus, the literature did not address effective literacy instruction for English learners with significant cognitive disabilities in general education settings. Further, the literature did not reach a definite conclusion about providing first language supports to English learners with significant cognitive disabilities. Rather, the studies indicated that the effectiveness of first language supports depended on the individual student, with some students benefiting and others not benefiting. Many of the reviewed studies indicated the potential benefit of technology-enhanced interventions for teaching literacy skills to English learners with significant cognitive disabilities.

Our review of the literature identified two key areas missing from the research base: assessment, including assessment accommodations, of English learners with significant cognitive disabilities, and literacy interventions to support students with home language backgrounds other than Spanish. Recommendations are provided for needed research, both in terms of topics and research designs. In addition, the development of explicit criteria for identifying students who are English learners with significant cognitive disabilities will help to ensure that future research contributes useful information for the field.

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Overview

Students with the most significant cognitive disabilities participate in states' alternate assessments based on alternate academic achievement standards (AA-AAAS). A notable and likely growing number of these students are also English learners (Christensen et al., 2018). The Every Student Succeeds Act (ESSA) requires 95% participation in state achievement testing and allows for up to 1.0% of all test-takers in a subject area to participate in AA-AAAS. For English learners with significant cognitive disabilities, the AA-AAAS should be designed to meet their linguistic and cultural needs. To accomplish this, assessment developers and implementers need evidence-based practices for appropriately assessing these students.

However, a well-designed assessment is not enough in itself. To fully and meaningfully participate in an AA-AAAS, English learners with significant cognitive disabilities need meaningful access to the grade-level standards-based curriculum prior to taking the assessment. Literacy is one key area in which evidence-based practices—specifically for second language learners with disabilities—are urgently needed. Students with extensive needs for instructional support, a group that includes students with significant cognitive disabilities, often may not have the opportunity to develop traditional literacy skills due to a pervasive belief that they are not capable of acquiring skills like independently decoding written text (Hudson & Browder, 2014; Keefe & Copeland, 2011). When general education teachers do not know how to adapt content to meet a student's specialized learning needs, more segregated instructional placements with lower literacy expectations may result (Agran et al., 2019; Ruppar et al., 2014). A lack of literacy skills then limits students' potential to engage with the grade level standards-based curriculum in other content areas and to engage with their peers in literacy-related activities. The potential for isolation, segregation, and a lack of opportunity to learn English literacy skills can be compounded for students with disabilities who are also second language learners (Kangas, 2019).

Keefe and Copeland (2011) argued that a broader view of literacy is needed to improve academic outcomes for students with extensive support needs, a view that allows students to make meaning from text in a variety of ways. Such a definition of literacy would be inclusive of students with significant cognitive disabilities who can, with intensive individualized instruction, learn conventional literacy skills such as decoding text. It would also include students with significant cognitive disabilities who may struggle with decoding but who can comprehend a story presented in an appropriate format (e.g., read aloud, simplified text with pictures for key vocabulary), respond to comprehension questions, and participate in shared classroom discussions of readings with appropriate support. For students who are also English learners, this broader definition of literacy may incorporate using or developing literacy skills in the language used in their homes (Krashen, 1999) and modifying language to be simpler and more comprehensible (Goldenberg, 2008). Thus, to reach their full potential, English learners with significant cognitive disabilities must be taught English literacy skills using evidence-based instructional methods suited to

both their disability-related needs and their second language development. Educational teams working with these students need information on evidence-based practices in literacy to drive instruction, develop appropriate Individualized Education Program (IEP) goals for multilingual learners, and ensure access to grade-level content in English.

Challenges of Defining the Population

Previous research has tended to focus either on students with significant cognitive disabilities or students who are English learners, not students who are both. Conducting research focused specifically on English learners with significant cognitive disabilities is complicated by the fact that the term "significant cognitive disability" is not a disability category identified in the Individuals with Disabilities Education Act (IDEA). The term appears only in ESSA Title 1 legislation and regulations in reference to students who may participate in the AA-AAAS. The term is not defined in ESSA; instead, ESSA regulations require states to provide guidelines for who should participate in the AA-AAAS and to provide a definition of students with the most significant cognitive disabilities within those guidelines. Thus, each state makes its own determination of the characteristics of students with significant cognitive disabilities, and variation in definitions across states occurs (Thurlow et al., 2019). Several studies have shown that students participating in AA-AAAS largely are those with intellectual disabilities, autism, or multiple disabilities (Erickson & Geist, 2016; Kearns et al., 2011; Thurlow et al., 2016; Towles-Reeves et al., 2009).

Research is also complicated by the fact that it can be difficult for schools to determine which students with disabilities are English learners. Assessment procedures typically used to identify a student with language-related disabilities may give biased results for English learners with lower levels of English proficiency (Geisler, 2011). These students may not know the English words used in the assessments and may have lower English reading levels than their native-English speaking peers (Abedi, 2014). In addition, Kangas (2019) found that some educators believe achieving proficiency in two languages is too difficult for English learners with disabilities. Thus, low expectations for these students may, in some cases, mean that providing special education services takes priority over conducting English proficiency assessments and providing English language development services. This situation occurs despite the fact that English learners with disabilities are entitled to receive English language development instruction (U.S. Department of Justice & U.S. Department of Education, 2015). The impact of challenging identification procedures combined with low expectations may be particularly evident for the population of English learners with significant cognitive disabilities. A multi-state study of English learners and likely English learners with significant cognitive disabilities (Christensen et al., 2018) found that approximately one-quarter of these students were not receiving English language development services to which they were entitled (also see Karvonen & Clark, 2019).

The complexities of identifying English learners with significant cognitive disabilities are evident in the lack of studies specifically addressing this population. By the early 2000s, there were more than 128 studies addressing reading instruction of students with significant cognitive disabilities who were not specifically identified as English learners (Browder et al., 2006). There is also a growing body of literature on AA-AAAS in the area of literacy (for more, see the National Center on Educational Outcomes AA-AAAS searchable bibliography at https://nceo.info/Resources/bibliographies). In contrast, as of 2015, only eight instructional intervention studies addressed literacy skills for children with significant cognitive disabilities who were also English learners (Liu et al., 2015; Rivera et al., 2019). None of the published studies addressed the assessment of literacy skills. There is a clear and continuing need for researchers, policymakers, and educators to understand assessment practices and instructional interventions that have been shown to work specifically with students who are English learners and have significant cognitive disabilities.

This report summarizes a comprehensive investigation of research published between 2000–2018 on evidence-based literacy assessment and instruction practices for English learners with the most significant cognitive disabilities. Our goal is to provide policymakers and educators with actionable findings from the literature.

Methods

For this study, we conducted a two-phase literature review. In Phase 1, we reviewed the research cited by Liu et al. (2015). At the time of the Liu et al. review, there was little research available on English learners with significant cognitive disabilities, so all relevant articles were included, regardless of the age of the students, the type of publication (e.g., article, report, or dissertation), or the existence of multiple published versions of the same research. By the end of 2018, there was more research available. Thus, we applied the inclusion criteria from Liu et al. more narrowly. In Phase 2, we conducted an additional search for literature published from 2015 to 2018.

As shown in Table 1, our study inclusion criteria, modified from those used by Liu et al. (2015), were: (a) published as a peer-reviewed journal article or Ph.D. dissertation between 2000 and 2018; (b) contained empirical research findings on literacy assessment or instruction in school settings; and (c) addressed English learners, or likely English learners, with significant cognitive disabilities ages 6–21. We modified the inclusion criteria of Liu et al. in four key ways. First, we narrowed our focus to only peer-reviewed journal articles and doctoral dissertations as a measure of quality. Second, we included only research on students ages 6–21 to align with IDEA Part B reporting requirements for students with disabilities who are served in U.S. elementary and secondary schools. Third, we examined the literature for documents on both literacy assessment and instruction. Fourth, when there were multiple related publications (e.g.,

a dissertation and a later research article) based on the same research activity, we included only the most recent publication.

Table 1. Literature Reviews Targeting Assessment and Academic Instruction of English Learners with Significant Cognitive Disabilities

	Liu et al. (2015)	Current Review (2019)
Dates addressed	2000–2015	2000–2018
Number of studies in the review	8	14
Inclusion criteria	(a) Relevant literature published in English; (b) Contained empirical research findings directly relevant to English language arts or English language proficiency assessment or instruction (listening, speaking, reading, writing) in any setting; (c) Addressed any students who were English learners or bilingual students with significant cognitive disabilities (e.g., intellectual disability, autism, multiple disabilities)	(a) Peer-reviewed journal article or Ph.D. dissertation published in English; (b) Contained empirical research findings on assessment or instruction of English literacy in public or private school settings; (c) Addressed K-12 (ages 6–21) students who were English learners or likely English learners with significant cognitive disabilities
Search Terms	(a) Bilingual OR English language learner OR Spanish; (b) Significant cognitive disability/ies OR severe disability/ies OR intellectual disability OR autism OR mental retardation OR Down syndrome OR assistive technology, AND; literacy.	(a) Bilingual or English language learner OR Spanish OR English Learner, AND; (b) Significant cognitive disab** OR significant disab* OR severe disab* OR intellectual disab* OR autism OR mental retardation OR assistive technology, AND; (c) literacy.

Phase 1

Six of eight articles identified by Liu et al. (2015) met the narrower inclusion criteria and were included in this review. These articles were:

- Ainsworth (2013)
- Kemper (2012)
- Rivera et al. (2012)
- Rivera et al. (2013)
- Rohena et al. (2002)
- Spooner et al. (2009)

Phase 2

For Phase 2, we used three search strategies, consistent with the approach taken by Liu et al. (2015), to identify documents for inclusion. First, we conducted searches using academic search engines such as MNCat Discovery, Academic Search Premier, OVID Medline, the Education Resources Information Center (ERIC), and Google Scholar (limited to the first 200 "most relevant" documents identified). Compound search terms included a word indicating students' status as an English learner or likely English learner (e.g., *bilingual*, *English [language] learner, Spanish*). Search terms also included a word that either described the student's disability (*significant cognitive disability/ies, significant disability, severe disability, intellectual disability, autism, mental retardation, Down syndrome*) or indicated that their complex communication needs required specialized support in the classroom (*assistive technology*). Last, the search terms also included *literacy*, encompassing both literacy assessment and instruction.

As a second step, to identify any potentially relevant studies missed by the database searches, members of the research team hand-searched five special education journals: (a) *Research and Practice for Persons with Severe Disabilities*, (b) *Journal of Policy and Practice in Intellectual Disabilities*, (c) *Multiple Voices for Ethnically Diverse Exceptional Learners*, (d) *Focus on Autism and Other Development Disabilities*, and (e) *Education and Training in Autism and Developmental Disabilities*. Third, after we developed a preliminary list of articles for inclusion, we conducted both forward and reverse citation searches to find any remaining documents we might have missed. The three search strategies we used in Phase 2 resulted in 2,084 potential articles for inclusion (see Appendix A).

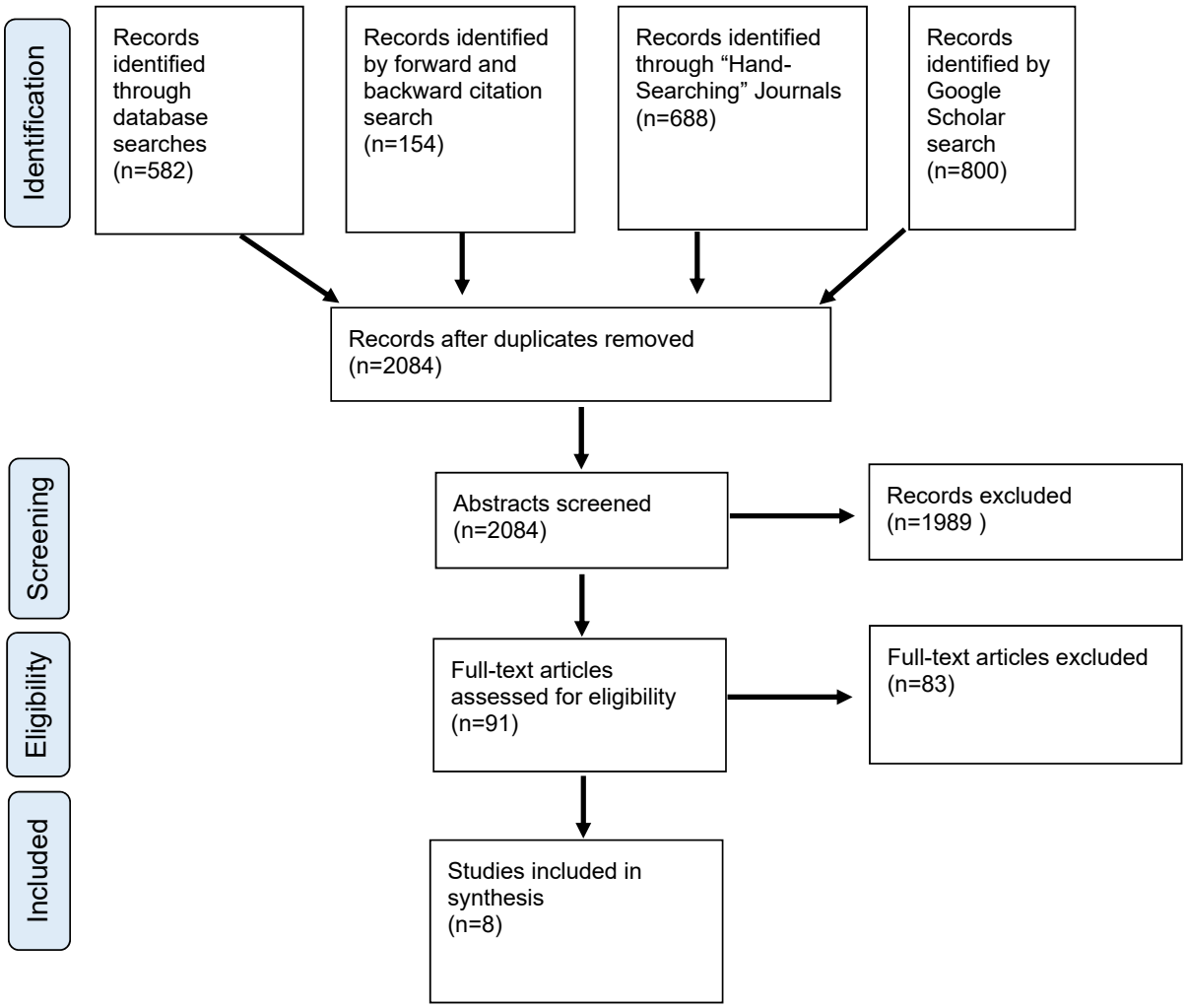
Two members of the research team then used Rayyan QCRI (https://rayyan.qcri.org/welcome), a computer application used for systemic inclusion screening, to review and evaluate all articles according to our inclusion criteria (Ouzzani et al., 2016). We conducted title and abstract screening first, followed by a review of complete articles where we needed additional detail to determine whether articles met the inclusion criteria (n=91). Rayyan QCRI calculated inter-rater reliability between the two researchers at 92.8% agreement on inclusion decisions. The two researchers resolved disagreements by discussion, reaching consensus on whether to include or exclude all articles. Out of the 2,084 articles reviewed in Phase 2, we selected eight for inclusion in this review. The eight additional articles identified in Phase 2 were:

- Alison et al. (2017)
- Browder et al. (2017)
- Evmenova et al. (2017)
- Hudson and Browder (2014)
- Rivera et al. (2014)

- Rivera et al. (2016)
- Rivera et al. (2017)
- Spooner et al. (2015)

Figure 1 shows a visual representation of the Phase 2 process, as suggested by Moher et al. (2009), using an adapted PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram. The figure shows the methods used to identify potentially relevant articles and the screening process for determining eligibility for inclusion in this review.

Figure 1. Visual Representation of Phase 2 Literature Review Process



Results

The final set of 14 articles included in this literature review (from Phases 1 and 2) was:

- Ainsworth (2013)
- Alison et al. (2017)
- Browder et al. (2017)
- Evmenova et al. (2017)
- Hudson and Browder (2014)
- Kemper (2012)
- Rivera et al. (2012)
- Rivera et al. (2013)
- Rivera et al. (2014)
- Rivera et al. (2016)
- Rivera et al. (2017)
- Rohena et al. (2002)
- Spooner et al. (2015)
- Spooner et al. (2009)

None of the 14 articles addressed literacy assessment of English learners with significant cognitive disabilities. All of the included articles addressed some type of instructional intervention that involved the development of students' literacy skills. In the majority of studies, students were developing literacy skills in English but may have used their native language to do so.

Literacy Focus of Studies

There were four aspects of literacy addressed in the 14 included studies. First, ten studies addressed text comprehension in some way (Alison et al., 2017; Browder et al., 2017; Evmenova et al., 2017; Hudson & Browder, 2014; Kemper, 2012; Rivera et al., 2013, 2014, 2017; Spooner et al., 2009, 2015). All but one of these studies focused on developing students' listening comprehension skills when a text was read aloud. The exception was Evmenova et al. (2017). The researchers in this study designed a video-based intervention to provide social studies content knowledge to students with significant cognitive disabilities. Videos had subtitles that included words and picture symbols, as well as an interactive search function to find specific pieces of information in the videos or subtitles.

The second aspect of literacy that was commonly addressed was vocabulary (Ainsworth, 2013; Rivera et al., 2012, 2013, 2016, 2017; Rohena et al., 2002; Spooner et al., 2009, 2015). All but two of the vocabulary related studies examined interventions to teach English vocabulary as a component of developing students' English literacy skills. The two studies that were the exception (Rivera et al., 2012, 2014) included native language vocabulary development along with English vocabulary development. Teaching vocabulary in the students' native language was intended to enhance students' ability to connect the native language word to the corresponding English word that was the eventual instructional target.

A third literacy component addressed by studies (Ainsworth, 2013; Rohena et al., 2002) was reading mechanics. Ainsworth (2013) taught five pairs of English letter-sound combinations and sight word reading to students with significant cognitive disabilities. Sight words were selected from packaged curricula, based on teacher recommendation, or were those determined to be high interest (e.g., happy, yellow, lunch, see, bus). Rohena et al. (2002) also developed an intervention to teach shopping-related sight words that students might find in their community. It is important to note that while these studies aimed to teach sight word reading, the researchers intentionally chose words that were new to the students and taught students the meaning of those words. Thus, the teaching of sight words is also considered vocabulary development here.

Finally, two studies (Spooner et al., 2009, 2015) embedded instruction on emergent literacy skills into a larger literacy intervention. These skills included pointing to or saying the title, pointing to or saying the author's name, orienting the book in the correct direction, opening the book, and turning the pages.

Sample Characteristics

The 14 studies included in this literature review reported information about 29 students, ages 6–21, who were identified as English learners or likely English learners with significant cognitive disabilities (see Appendices B and C). Sample sizes in the studies were relatively small, ranging from studies with just one English learner or likely English learner (Browder et al., 2017; Evmenova et al., 2017; Rivera et al., 2014, 2016, & 2017; Spooner et al., 2009, 2015) to a group of five English learners or likely English learners (Ainsworth, 2013). Students ranged in age from 6 years (Rivera et al., 2017; Spooner et al., 2009) to 20 years (Evmenova et al., 2017). The mean student age was 10.8 years (SD=3.6). The mean number of eligible students per study was 2.2 (SD=1.4). Some studies had additional participants who were not English learners with significant cognitive disabilities (Alison et al., 2017; Browder et al., 2017; Evmenova et al., 2017; Rivera et al., 2017; Spooner et al., 2015). We excluded these additional participants from our review.

For one study, we differed in our view of whether a student the researchers identified as an English learner should be included for this review. Alison et al. (2017) called one student an English learner who had a parent who was deaf. This student used a combination of American Sign Language and English at home. For the purposes of this review, we did not consider the student with American Sign Language as a primary home language to be an English learner.

Students' English Learner Status, Home Language, and School Language Use

English Learner Status

The table in Appendix B describes the number of English learners or likely English learners in each study, their age, language background, and the language of school instruction as well as the language of the research study intervention. As seen in the table, slightly fewer than half of the studies included at least one student who had been formally identified as an English learner by the school they attended (Alison et al., 2017; Browder et al., 2017; Rivera et al., 2012, 2013, 2014; Spooner et al., 2015). Researchers did not describe school procedures for identifying English learners.

Home Language Backgrounds

The majority of the 29 students (n=20) were Spanish speakers (Ainsworth 2013; Alison et al., 2017; Browder et al., 2017; Evmenova et al., 2017; Kemper 2012; Rivera et al., 2013, 2014, 2016; Rohena et al., 2002; Spooner et al., 2009, 2015). Typically there was little information provided on how students' home language skills were determined. The work of Rivera et al. (2014, 2016), however, did provide home language assessment information. Spanish-speaking students in those studies were given native language-based assessments, including the Expressive One-Word Picture Vocabulary Test, Spanish-Bilingual Edition (EOWPVT; Brownell, 2001), and the Receptive One-Word Picture Vocabulary Test, Spanish-Bilingual Edition (ROWPVT; Brownell, 2001). The EOWPVT tests a student's ability to name pictures, while the ROWPVT tests the student's ability to comprehend spoken vocabulary. The assessments, administered in Spanish and English, helped the researchers better understand the students' comprehension and use of both languages. Two studies (Rivera et al., 2017; Rohena et al., 2002) included students who were described as bilingual in Spanish and English. The researchers did not provide information on how students were determined to speak two languages or indicate how well they spoke each language.

Other languages spoken by the families of students in the 14 studies included Amharic (n=1 student; Ainsworth, 2013), and Bengali (n=1 student; Ainsworth, 2013). Hudson et al. (2014) described their three study participants as English learners whose primary language was English.

No further details were provided to indicate how these students had been identified as English learners or about their language skills.

Language Use During Typical Instruction

Only five of the 14 articles described the language students used during regular classroom instruction. When instructional language was mentioned, it was typically English (Kemper, 2012; Rivera et al., 2013, 2016; Rohena et al., 2002; Spooner et al., 2009) or English mixed with Spanish (Kemper, 2012; Rivera et al., 2014). For studies that did not mention the typical language of instruction, it is likely that students were instructed in English. The students who used their native language during instructional time typically interacted with a Spanish-speaking bilingual paraprofessional (Kemper, 2012; Rivera et al., 2014).

Despite the fact that more students were instructed only in English than in their native language, approximately half of the 29 students (n=14) in the included studies participated in a bilingual instructional intervention (Kemper, 2012; Rivera et al., 2012, 2013, 2014; Rohena et al., 2002; Spooner et al., 2009). A slightly smaller number of students (n=13) received the literacy intervention only in English (Ainsworth, 2013; Browder et al., 2017; Evmenova et al., 2017; Hudson & Browder, 2014; Rivera et al., 2016, 2017; Spooner et al., 2015) and for two students there was no information provided on the language of the intervention (Alison et al., 2017).

Students' Disabilities, Communication Skills, and Instructional Settings

Students' Disabilities

The two most common disabilities represented by students in the included studies were intellectual disabilities (for this review, we only included studies of students with moderate or severe intellectual disabilities), followed by autism (see Appendix C for details). Other less common disabilities represented included cerebral palsy, Rhett syndrome, Williams syndrome, Fragile X syndrome, and Down syndrome. Students often had two or more identified disabilities, such as autism and a severe intellectual disability. In some cases, students had a combination of identified disabilities and medical conditions, such as one student in Kemper's (2012) study who was described as having Fragile X syndrome, speech delay, seizure disorder, and a severe intellectual disability.

Communication Skills

More than half of the students in the included studies had some ability to communicate verbally (see table in Appendix C). Researchers clearly identified 18 of the 29 students as able to communicate verbally to some degree in English, their home language, or both languages (Allison

et al., 2017; Browder et al., 2017; Evmenova et al., 2017; two students in Hudson & Browder, 2014; Rivera et al., 2012, 2013, 2014, 2017; Rohena et al., 2002; Spooner et al., 2009). Eight students were identified as nonverbal in any language (Ainsworth, 2013; one student in Hudson & Browder, 2014; one student in Kemper, 2012; Rivera et al., 2016), and there was limited or unclear information about the oral communication skills of the remaining three students (two students in Kemper, 2012; Spooner et al., 2015). For the students who were nonverbal, most of them used a combination of gestures, American Sign Language, some type of picture communication strategy, an iPad with a communication application, or a speech-generating device like a Dynavox or Vantage Lite. Overall, researchers stated that 13 of the 29 students had some receptive or expressive communication skills in their native language (Evmenova et al., 2017; Rivera et al., 2012, 2013, 2016; Rohena et al., 2002; Spooner et al., 2009). Only two students were explicitly identified as lacking a formal communication system (see "Garth" in Ainsworth, 2013, and "Marco" in Kemper, 2012).

Instructional Setting

All 29 of the included English learners or likely English learners with significant cognitive disabilities received their instruction in a self-contained special education classroom. Nine of these students attended special education schools rather than their neighborhood public school.

Themes in the Literature

To identify themes in the literature, we read each of the included articles, recorded potential themes, and identified any unique features of specific articles. We discussed potential themes, including those identified by Liu et al. (2015). Discussion led to agreement on four themes:

(1) processes for identifying students with significant cognitive disabilities as English learners,

(2) literacy intervention strategies investigated,

(3) linguistic support provided during the intervention to address students' English language development needs, and

(4) the role of technology in providing the intervention.

The first three themes were discussed by Liu et al. (2015), but the addition of a technology component was new to this review. Many of the more recent studies added to this review included the use of technology to deliver an intervention.

Theme 1: Identifying Students with Significant Cognitive Disabilities as English Learners

The 14 studies in this review did not provide information on the specific assessment procedures schools used to identify students' disabilities. The determination that a student has a "significant cognitive disability" happens when the state assessment participation decision occurs. Students taking the AA-AAAS are those an IEP team has determined to have the most significant cognitive disabilities, and are typically in grade three or above. There was a clear indication that nine of the students in the literature had taken an AA-AAAS (see table in Appendix D). These students were the five middle school or junior high students with intellectual and other disabilities in Ainsworth's (2013) study, the two elementary students with autism in Alison et al.'s (2017) study, the 20-year old student with a severe intellectual disability and a brain disorder in Evmenova et al.'s (2017) study, and one elementary student with autism in Spooner et al.'s (2015) study. Researchers identified one student as too young for AA-AAAS participation (Browder et al., 2017). AA-AAAS participation was not addressed for the remaining 19 students, some of whom were likely also too young to meet their state's AA-AAAS participation criteria (Hudson & Browder, 2014; Kemper, 2012; Rivera et al., 2012, 2013, 2014, 2016, 2017; Rohena et al., 2002, Spooner et al., 2009). Where information on AA-AAAS was lacking, we determined that students with moderate to severe intellectual disabilities, autism, and multiple disabilities would be considered students with significant cognitive disabilities for this review.

In contrast, several of the studies provided some degree of information about the students' English learner or likely English learner status. Nine of the 29 students in the included studies were formally identified as English learners by the school they attended and were receiving English language development services (e.g., English as a second language classes). Participating in an English learner program implied that some type of English proficiency evaluation had taken place. Another eight of the total 29 students were called English learners by the researchers (Kemper, 2012; Spooner et al., 2009), but the studies provided few details to indicate whether the student had participated in an English proficiency assessment and received English learner services. We determined that the remaining 13 students were "likely English learners" because their home language was not English (Ainsworth, 2013; Evmenova et al., 2017; one student in Rivera et al., 2013, 2016; Rohena et al., 2002), they were described as bilingual (Rivera et al., 2017), and in some cases, they had been in the U.S. a relatively short amount of time (Ainsworth, 2013; Rohena, 2002).

Theme 2: Literacy Intervention Strategies Investigated

The 14 included studies incorporated multiple types of literacy interventions, drawing intervention strategies from applied behavior analysis and special education, with embedded supports for English learners. These interventions were: (a) constant time delay (CDT), (b) shared stories

(both traditionally delivered and technology delivered), (c) model-lead-test, (d) system of least prompts, (e) peer-delivered interventions, (f) story mapping, and (g) other interventions that were part of a multi-component intervention package. In this section, we describe each intervention strategy and provide a summary of the findings where it is possible to determine the effects of an individual strategy. For the most part, studies examined the teaching of English literacy skills even if instruction primarily occurred in the student's native language. The two exceptions to this were Rivera et al. (2014) and Spooner et al. (2009). Both of these studies taught students to comprehend text and vocabulary in their native language as well as in English.

Constant Time Delay (CTD). Constant time delay, or CTD, is a teaching strategy that gradually phases out the use of a teacher-provided prompt when a student is asked to answer a question or perform a specific behavior after receiving instruction. Initially, there is no delay between instruction and the teacher prompt. Over time the length of the delay increases until the student shows independent mastery of the skill. The use of the delay is intended to reduce the errors students make. Six studies incorporated the use of CTD to teach literacy skills (Ainsworth, 2013; Browder et al., 2017; Kemper, 2012; Rivera et al., 2013; Rohena et al., 2002; Spooner et al., 2015).

Only one of the six studies had findings specific to the effectiveness of CTD. Browder et al. (2017) used CTD in several aspects of a larger instructional strategy to teach story element definitions in preparation for story comprehension activities. First, they instructed students on the definitions of elements in a story map (e.g., character, setting, problem, solution). The researchers then asked the students to define the terms and began with a zero-second time delay, meaning that initially, the researcher gave the student the answers to prompts. Over time, the researcher progressed to using a four-second time delay before providing the correct answer if students were unable to answer correctly. Second, when students were asked to complete a story map individually, they were given up to 10 seconds to identify the elements in the story. They also were given up to 10 seconds to answer text comprehension questions before the researcher provided support. With the CTD strategy, English learners with significant cognitive disabilities immediately experienced an increase in the number of prompts they could answer correctly.

The other five studies incorporated CTD as part of a bigger intervention package, and generally did not collect data on the effectiveness of CTD alone for English learners with significant cognitive disabilities. Ainsworth (2013) used a curriculum designed to teach basic literacy skills—such as letter-sound correspondence for selected English letters and sight word recognition—to students with significant intellectual disabilities and communication disorders. The adult implementing the intervention used the scripted lessons provided in the Accessible Literacy Learning, or ALL, curriculum developed by Dr. Janice Light and Dr. David McNaughton. The interventionist presented students with a variety of ways to demonstrate their phonics learning (e.g., Velcro letters, visual displays, and letter-sound response plates). Initially, the interven-

tionist modeled how to say each of the five selected letter sounds and showed the student the representation of the letter. Over time, the student progressed to the independent identification of sounds and sight words.

According to Ainsworth, CTD was built into the scripted ALL curriculum, but the researcher did not provide a detailed description of the amount of the time delay. Although Ainsworth did not examine the effectiveness of the CTD strategy alone for English learners with significant cognitive disabilities, she found that direct instruction on basic English literacy components helped these students to make statistically significant gains, regardless of their intellectual functioning, disability, or verbal communication skills. Even though there were English learners with significant cognitive disabilities from three different language backgrounds (i.e., Spanish, Bengali, and Amharic) in this study, Ainsworth did not make any conclusions about the effectiveness of the intervention for students with differing language backgrounds.

Three additional studies incorporating CTD (Kemper, 2012; Rohena et al., 2002; Rivera et al., 2013) were interested in the potential effectiveness of an intervention provided in English compared to one provided in the students' native language of Spanish. These studies did not examine the effectiveness of CTD alone. Rohena et al. (2002) determined that the CTD strategy was effective and compared the outcomes of implementing it in both Spanish and English interventions to teach English vocabulary. Kemper (2012) and Rivera et al. (2013) used CTD, in combination with other strategies, as part of a shared story intervention. After an initial delay of 0 seconds when asking students to respond to a question or stimulus on material previously instructed, the researchers progressed to providing time delays ranging from 4 seconds (Rohena et al., 2002; Rivera et al., 2013) to up to 10 seconds (Kemper, 2012) before the teacher offered support. In these studies, the amount of time delay was the same for both language conditions.

The final results indicated that it was not easy to separate the effect of the CTD strategy from the effects of the language in which the intervention was provided. For example, in Kemper's (2012) study, CTD was effective in increasing both the total number of student responses to comprehension questions, and the number of communication attempts for both the English and bilingual condition. There were slightly larger increases in the number of responses when Spanish instruction was included. Likewise, Rohena et al. (2002) found that, for three students, the English and Spanish instructional conditions containing the CTD procedure were equally effective; and for one additional student, Spanish instruction was more effective (Rohena et al., 2002). Rivera et al. (2013) found that two English learners with significant cognitive disabilities made gains in English vocabulary learning using a shared story procedure with an embedded CTD process, but one student made larger gains with English instruction, and the other made greater gains with Spanish instruction (Rivera et al., 2013).

Finally, Spooner et al. (2015) used a 4-second CTD procedure to teach emergent literacy skills such as page-turning and following text with a finger as part of a larger English-only shared story intervention. The researchers believed that these text-related skills were important to teach students as part of the total literature-based experience, but they did not measure students' attainment of the skills. The one student who was an English learner with a significant cognitive disability was able to demonstrate acquisition of emergent literacy skills after participating in the CTD process, but there were no other data available on the effectiveness of the strategy for students in this population.

Across these six studies incorporating a CTD process to teach literacy skills to English learners with significant cognitive disabilities, researchers were largely not able to provide data on the effect of the CTD procedure by itself. Browder et al. (2017) provided a limited amount of data to suggest that CTD was effective for this population.

Shared Stories. Shared stories are interventions that have an oral reading component, sometimes shared between the student and the teacher, and other times conducted primarily by the teacher with the student demonstrating some type of text engagement while the teacher reads. Shared story interventions, also known as shared reading interventions, are primarily defined by the interaction between student, text, and teacher. Desired student outcomes of a shared story intervention may include basic literacy skills, vocabulary development, and text comprehension. Because students typically listen to text read aloud, they may have exposure to adapted versions of grade-level texts that have been simplified and shortened. Five of the studies included in our review directly described their interventions as "shared stories" (Alison et al., 2017; Rivera et al., 2013, 2014, 2017; Spooner et al., 2015). Additionally, Kemper (2012) described an instructional process (i.e., previewing vocabulary, reading a story summary and the story aloud to the student multiple times, asking comprehension questions) similar to shared stories even though she did not use that term to identify the intervention.

In the six studies that implemented a shared story intervention, five of them delivered the intervention via technology in what was called a "multimedia shared story" or MSS (Alison et al., 2017; Rivera et al., 2013, 2014, 2017; Spooner et al., 2015), and one delivered it in a traditional face-to-face teacher-student interaction (Kemper, 2012). We describe each of these approaches as they were implemented in the literature.

Multimedia Shared Stories. In the five studies that incorporated multimedia or technology into the delivery of shared stories, a change in the method of delivering the story was evident over the years included in this review. As technology became more sophisticated, researchers relied on it to deliver more of the intervention. For example, the earliest study, Rivera et al. (2013), featured an interventionist reading aloud Microsoft PowerPoint slides to deliver the story, probes, and related vocabulary tests. The slides included some pictures and sound effects

(e.g., rain). Key vocabulary in the story was underlined and accompanied by a chime sound. However, the student largely could not interact directly with the technology. The researchers did not examine the effectiveness of the multimedia delivery of a shared story. Instead, they assumed the effectiveness of the strategy for students with significant cognitive disabilities and examined the effectiveness of providing it in English versus Spanish. There were mixed results for the language of instruction associated with greater learning gains. One student performed better with Spanish instruction than with English instruction, and one student performed better with English instruction than with Spanish.

The following year, Rivera et al. (2014) examined the use of multimedia shared stories to teach English and Spanish vocabulary. The researchers used an Apple iBooks Author application on a laptop to create English and Spanish digital books that could be uploaded to the iTunes Store and downloaded on the student's iPad. The iBooks Author application allowed for the digital story to incorporate both text and video clips to illustrate vocabulary in the stories. The interventionist read the story aloud from the text on the iPad screen as the student used a finger to follow the text. Occasionally the interventionist gave the student the opportunity to imitate a repeated storyline. The student could also interact with the text using a touch screen to turn pages, zoom in on text or pictures, click on videos to watch them, highlight text, and click on definitions of words. Again, the researchers did not examine the effectiveness of the multimedia shared story strategy at improving the student's literacy outcomes. Instead, they examined whether the student performed better with English or Spanish shared stories.

Spooner et al. (2015) also used multimedia shared stories as one component of a larger intervention strategy to investigate the acquisition of emergent literacy skills. The researchers adapted chapters of a grade level book to be approximately four to eight sentences long and to highlight one important vocabulary word. After the interventionist pre-taught key vocabulary and emergent literacy skills (e.g., identifying the author and title), the student used an iPad text-to-speech application to interact with the story. The application allowed researchers to embed a variety of features that were similar to those on an assistive technology device (e.g., text-to-speech, picture-based response options to comprehension questions with an auditory cue). It also allowed different screens to be linked so that a student could listen to the story, touch a key vocabulary word, and jump to a page with a question to measure his or her knowledge of the word definition. The student could then jump back to the story after correctly answering the vocabulary question. The iPad application read the comprehension questions aloud to the student and provided four options of pictures associated with key vocabulary. The student touched the screen to choose the correct answer or touched a question mark to hear the portion of the text with the correct answer read again.

A student who could correctly complete eight consecutive steps in a nine-step shared story task analysis met the mastery criteria. The task analysis included steps relating to basic literacy skills

(e.g., touching the title or author name, turning the page), vocabulary learning, and answering story comprehension questions. The researchers focused on documenting the effectiveness of the overall intervention strategy that included multimedia shared stories along with the use of systemic instruction and multiple exemplars. They did not specifically examine the effectiveness of the multimedia shared story by itself. However, the one English learner with a significant cognitive disability included in Spooner's study met the mastery criteria by her 8th intervention session. She demonstrated emergent literacy skills and gave correct answers to comprehension questions. Her ability to answer comprehension questions increased from zero correct before the intervention began to answering more than 70% of the comprehension questions correctly during the intervention and maintenance phases of the study. She did so without using the prompting feature on the iPad to re-listen to the section of text with the correct answer. She was able to generalize skills across adapted chapters and could continue to complete the steps of the task analysis independently. According to the researchers, the data for this student, as well as for the others who were not English learners, established evidence of a functional relationship between the iPad shared story, systematic instruction, listening comprehension, and successful completion of the task analysis.

Rivera et al. (2017) also created multilingual, English and Spanish, multimedia shared stories on an iPad. Similar to Rivera et al. (2014), the researchers developed two texts with themes from the students' science class, using the iBooks Author application on a laptop. They then uploaded the books to iTunes and downloaded them to the students' iPad through the iBooks app. Stories had a pre-determined structure with an introduction to important science vocabulary from their unit of study and a relevant story that included the key vocabulary, a repeated storyline, and a summary. Each story was designed to teach the same ten vocabulary words but incorporated different themes. Stories contained images from Google Images, along with short (30–45 second) YouTube videos.

Rivera et al. (2017) created a twenty-seven step task analysis, in part, to ensure that the interventionist delivered the intervention in the same way to each student in every session. Sessions began with pre-teaching the process for learning picture vocabulary (i.e., "I will point to a word, and you say it after me"). During the next step, the interventionist read the text aloud and stopped at pre-determined spots to teach key picture vocabulary such as "petal," "roots," and "stem." After vocabulary instruction, the student watched a video clip illustrating the vocabulary word (e.g., a video showing petals on a flower), and the interventionist discussed the video with the student. At the end of the story there was a final vocabulary review. After the intervention, researchers conducted generalization and maintenance probes to determine whether the student retained the vocabulary and could apply it to new situations.

Rivera et al.'s (2017) findings suggested that the one six-year-old English learner with a significant cognitive disability who participated in the intervention eventually achieved mastery,

but took almost twice as many sessions to do so as the native English speaking students with significant cognitive disabilities who also participated (17 interventions sessions vs. 9 or 10 sessions). His vocabulary knowledge grew at a slower pace compared to the other two students. The researchers indicated that this student had more difficulty paying attention to instruction and was frequently absent due to illness. The English learner with a significant cognitive disability was able, with some difficulty, to maintain the knowledge and skills developed during the intervention and generalize them to new situations. However, his ability to apply vocabulary to new situations weakened over time. The researchers believed that he might have benefited from a longer intervention.

Finally, in what appeared to be the most sophisticated use of technology for multimedia shared stories, Alison et al. (2017) used the GoTalk Now application on an iPad as a component of a larger intervention strategy to improve eight to ten-year-old students' ability to correctly define WH- question words (e.g., who, what, why) and to provide correct responses to WH- questions about a story they heard. The researchers modified grade-aligned novels by shortening the chapters, simplifying the language to a second or third-grade reading level, and providing a chapter summary at the end of the text. They did so while maintaining the emphasis on the same key vocabulary as in the grade-aligned text. The student used GoTalk Now, a customizable application with features similar to an assistive communication device, on an iPad to do the following: (a) touch the screen to match WH- question words (e.g., who, what, when) with definitions or examples, (b) hear the story, (c) hear comprehension questions about a story, (d) choose among possible answer choices provided via pictures, and (e) hear a modified system of least prompts to assist with answering the comprehension questions. As with other studies, the GoTalk Now application allowed researchers to link screens so that students could jump from a vocabulary word on one screen to a definition or picture on another screen, and then go back to the story.

Alison et al. (2017) implemented a complex intervention strategy that included the use of multimedia shared stories, an embedded system of least prompts, and constant time delay. They did not specifically examine the effectiveness of multimedia shared stories alone. With the multi-component strategy, the two participating English learners with significant cognitive disabilities showed relatively fast improvement in their ability to accurately and independently define WH- question words and to answer WH- comprehension questions about the story in comparison to a third student who primarily used English and American Sign Language. One English learner met intervention mastery criteria in eight sessions and the other in nine sessions.

For the most part, the studies investigating multimedia shared stories used an iPad with some type of application as a key component to the intervention strategy but did not examine the effectiveness of delivering the intervention via technology. For example, instead of examining the effectiveness of multimedia shared stories, Rivera et al. (2013, 2014) presumed effectiveness of the strategy for English learners with significant cognitive disabilities and focused on whether

conducting the stories in English or Spanish had a greater effect on student's English literacy learning. Further, Spooner et al. (2015) and Rivera et al. (2017) included multimedia shared stories as part of a larger, multifaceted instructional strategy. The overall approach proved effective at increasing literacy learning, but the researchers did not isolate the effects of the multimedia shared story. Only Alison et al. (2017) showed a notable improvement in students' ability to match vocabulary words and definitions, as well as to answer text comprehension questions in English that were directly attributed to the use of the shared story process. However, these researchers did not determine whether the multimedia component of the strategy increased the strategy's effectiveness.

Some teachers and paraprofessionals of the student participants were initially wary about the use of technology in interventions. Rivera et al. (2014) found that the teacher had limited technology skills and may have been somewhat intimidated by the fact that the participating student had to help her understand how to use the iPad. Still, teachers and paraprofessionals liked the use of multimedia shared stories and found the strategy to be valuable, practical, and easy to incorporate into the school day (Rivera et al., 2013, 2017; Spooner et al., 2015). They saw notable gains in student vocabulary learning, and in some cases, greater student use of expressive language in response to embedded videos (Rivera et al., 2014).

Educators particularly liked the use of iPads during shared reading activities for several reasons. First, they believed digital literacy to be an important skill for students with significant cognitive disabilities to develop (Rivera et al., 2017). Second, they perceived students to be more engaged in instruction, with more sustained attention to the lesson, using an iPad (Rivera et al., 2014, 2017; Spooner et al., 2015). Third, students were able to better generalize new skills to other contexts because the technology incorporated multiple means of representation, including video (Rivera et al., 2017; Spooner et al., 2015). Fourth, educators believed that iPads were less stigmatizing than other forms of assistive technology because students without disabilities often used iPads in school (Spooner et al., 2015). Fifth, educators stated that iPads were a relatively low-cost and important support for developing students' independence (Spooner et al., 2015). Sixth, iPads were versatile and easily customizable to the needs of an individual student (Spooner et al., 2015). In short, teachers indicated that iPads made literacy-related instructional activities accessible to students with significant cognitive disabilities.

Parents also believed the use of technology to deliver shared stories was practical and useful, in part because technology and literacy skills could be transferred to other instructional settings (Spooner et al., 2015). Students found learning via iPad enjoyable (Rivera et al., 2017; Spooner et al., 2015). They particularly liked the embedded music and videos (Rivera et al., 2017). Spooner et al. (2015) asked the one participating English learner how she felt about the technology; the student was enthusiastic and wished it could be available in every class at school.

Traditional Shared Stories. Kemper (2012) examined the effectiveness of a traditional shared story intervention that relied on a human reader. The researcher modified 10 age-appropriate books by adding a one- or two-sentence text summary at the end of the book and visual symbols next to key vocabulary words needed to answer text comprehension questions. The researcher also developed a communication board that included the 10 vocabulary symbols along with symbols for "like" and "don't like." Ten text comprehension questions accompanied each book. During each intervention session, the interventionist used either English or Spanish to preview the English vocabulary and to introduce the related symbols in each book prior to reading the text aloud to the student in English. While reading the text, the interventionist displayed the communication board symbols for the key vocabulary as the words were used. Next, the interventionist read the summary while students had the written summary in front of them. Finally, the adult read the book again before asking the text comprehension questions in either English or Spanish. The books were always in English, but on alternating days, the interventionist communicated with the student and asked comprehension questions in either English or Spanish, depending on the intervention condition for the day. Students could answer the question through multiple means—by speaking, pointing to the book, pointing to a picture symbol on their communication boards, or using their assistive technology device.

Kemper did not document the specific effectiveness of the shared story intervention. She was focused on whether the use of a bilingual multicomponent intervention package, as compared to a package only in English, increased students' success. The results were somewhat inconclusive about the intervention's effect on the accuracy of students' text comprehension question responses. The three participating English learners with significant cognitive disabilities generally showed improvement in the number of correct answers to comprehension questions after participating in the intervention, but their initial ability to answer these types of questions was quite low. According to the researcher, two of the three students had no formal communication system at the time the study began. Further, the English learners did not appear to be more engaged in one of the language conditions compared to another. The researcher hypothesized that their restricted literacy experiences at home and school likely played a role in their engagement during the intervention.

As a result of the intervention package, students did communicate more and exhibited a greater number of attempts to answer comprehension questions. Two of the three English learners with significant cognitive disabilities seemed to answer more questions in the bilingual condition where the researcher communicated in Spanish, and the story was in English. The third student was not able to perform well in either language condition and eventually dropped out of the study. The two students who remained in the study never reached the criterion for success of 80 percent correct over three consecutive sessions in either Spanish or English. The researcher attributed this lack of success to a number of student absences that caused missed intervention sessions, as well as to a school break that interrupted the intervention. She hypothesized that if

the intervention could have continued for a longer period of time, there might have been greater evidence supporting the effectiveness of the bilingual condition for delivering English shared stories. In addition, she noted that as students participated in the intervention, they seemed to enjoy shared stories more.

Model-Lead-Test. The model-lead-test strategy is a process where the interventionist models a skill, practices it with a student, and then has the student perform the skill independently. Two studies in our literature review included the use of a model-lead-test strategy to teach literacy skills (Rivera et al., 2012, 2014). Rivera et al. (2012) compared English to Spanish versions of an intervention that used a combination of systematic, explicit instruction, educational technology (i.e., PowerPoint presentation on an iPad), and a model-lead-test procedure to teach English learners with significant cognitive disabilities 50 English vocabulary words. The researchers created 10 sets of PowerPoint slides focused on teaching five English picture vocabulary words per set. Each set of slides included an introduction to the new vocabulary in Spanish, a review of any English vocabulary learned in previous sessions, and instruction on five new words.

Although new vocabulary was always taught in English, the introduction to new English picture vocabulary occurred first in Spanish to help address students' limited English skills. Then the interventionist alternated using either Spanish or English for the model-lead-test portion of the intervention. For this portion, the interventionist said the new words aloud in English while having the student point to the pictures, then the interventionist and the student said the words together in English, and finally, the interventionist asked "What is this?" for the English condition, or "What is this?" followed by *¿Qué es esto?* for the bilingual condition. The student had four seconds to correctly identify the word in English that corresponded to a picture. If the student was not able to provide the correct answer in English, the interventionist provided the correct answer and moved on to the next word.

Rivera et al. (2012) did not determine the effects of the model-lead-test strategy in isolation because it was part of a larger package of intervention elements. Generally, the intervention package, as a whole, was effective at supporting student learning. All three English learners with significant cognitive disabilities made English vocabulary gains after participating, regardless of the language of instruction. However, the focus of Rivera et al. (2012) was on examining whether administering the intervention in English or Spanish showed greater increases in student learning. Two of the three students were able to identify more English vocabulary words at a faster rate with Spanish instruction compared to English instruction. The researchers noted that these two students might have been more proficient in Spanish than they were in English. The third student had similar English vocabulary acquisition gains in both Spanish and English instructional conditions. The researchers hypothesized that this student might have had comparable proficiency levels in English and Spanish. Data documenting students' relative language proficiency levels in English and Spanish were not available to confirm these observations.

Nevertheless, all students could generalize a greater number of English vocabulary words from Spanish sessions compared to English sessions.

The researchers stated that embedding a few key English learner instructional practices into the strategy most likely supported student learning. First, the interventionist previewed all new English vocabulary in the student's native language. Second, new vocabulary words were accompanied by pictures. Third, words learned in previous sessions were reviewed at the start of each new session. Fourth, in the probe following the Spanish language intervention sessions, the interventionist provided directions in both languages to ensure student understanding of the task. Students did not rate the effectiveness of the intervention or how much they enjoyed participating. However, the students' teachers indicated that the strategy was practical and useful. They believed teaching students new English vocabulary by reviewing the terms in their native language first was beneficial.

Rivera et al. (2014) also used a multicomponent approach that incorporated the use of a model-lead-test procedure to teach English and Spanish vocabulary using an iPad multimedia shared story intervention. Prior to the shared story, the interventionist pre-taught 10 key vocabulary words one at a time by modeling the words while pointing to a related picture, pointing to the pictures and saying the words together with the student, and then asking the student to point to the pictures and say the words independently without prompting. The words and the corresponding pictures then appeared in the shared story. As the interventionist reached a word and the related picture, they would stop and conduct another model-lead-test round on that word. At the end of the shared story the interventionist would conduct a final model-lead-test round. During any model-lead-test procedures, if the student did not identify the picture vocabulary correctly, the interventionist would provide the correct answer and repeat the model-lead-test procedure. After the story, the interventionist showed the student the pictures of the 10 vocabulary words and asked the student to independently identify them, first in English and then in Spanish.

The researchers designed the study to compare the effects of delivering the larger multi-component intervention strategy in Spanish and English. They did not specifically isolate the effects of the model-lead-test strategy in either language for the one participating English learner with a significant cognitive disability. Overall results showed that the student did learn at least 80% of the words in English as well as in Spanish. The 10-year-old student had lived in a Spanish speaking country until age eight and had lived in the U.S. for two years at the time of the study. He initially learned new vocabulary words more quickly in the Spanish condition compared to English. However, the rate at which he learned the words in the English condition increased at a faster pace than the rate at which he learned the words in Spanish. Researchers observed that the student began to use the vocabulary words in English during the Spanish intervention condition (i.e., "codeswitching") in an intentional attempt to connect learning in the two languages. For him, mixing the two languages appeared to be an efficient way to communicate.

System of Least Prompts. A system of least prompts involves an interventionist providing a student with a series of increasingly explicit prompts to help that student learn a new skill or answer a question. The interventionist, either an adult or a peer, starts by giving the student with a significant cognitive disability the most general prompt and then increases the specificity of the prompt (e.g., interventionist reads the paragraph containing the answer, reads the sentence with the answer, points to the answer) until the student can perform the desired behavior correctly. For this reason, it is considered a way to provide a student with an opportunity to learn without making mistakes.

Four studies in this review incorporated a system of least prompts into instruction (Alison et al., 2017; Browder et al., 2017; Hudson & Browder, 2014; Spooner et al., 2015). Hudson and Browder (2014) trained fifth-grade general education students to read aloud adapted grade-level texts to students with significant cognitive disabilities, three of whom were also English learners. The researchers provided 75 minutes of training to peer tutors. The training addressed: (a) how to present an adapted read-aloud to a classmate with a significant cognitive disability, and (b) how to use a script with a system of least prompts to engage classmates with significant cognitive disabilities incorrectly answering six inferential and factual comprehension questions for each of three chapters adapted from a grade-level book. The questions were framed using WH- words (e.g., who, what, why, when, and where). For example, after reading aloud an adapted chapter of a grade-level book to the student with a significant cognitive disability, the peer would ask a question such as, "Where do/does [event] take place?" The student with a significant cognitive disability pointed to a picture on a response board to communicate the answer. Each type of question had a unique response board. For example, the response board for questions starting with the word "Who" had pictures of different characters from the chapter as well as a picture indicating a request for help. Each board contained one correct answer for the question, along with several possible incorrect answers. The board also contained a reminder of what the question was asking (e.g., "Who tells about a person").

If the student with a significant cognitive disability could not answer the question, the peer tutor initiated a series of prompts that began with the most general prompt (e.g., peer reread the paragraph of text containing the answer) and progressed to the most specific prompt (e.g., the peer said the correct answer and pointed to the response board) if the student with a significant cognitive disability continued to have trouble. The peer-student team then counted the number of correct prompted and unprompted responses to comprehension questions.

Prior to the study, the three English learners with significant cognitive disabilities were unable to answer any WH- questions correctly. Their special education teachers taught them the meaning of WH- question words and how to ask for help. After the intervention, these students all showed an immediate increase in the number of prompted correct responses to literature-based comprehension questions. In addition, one student was able to show increases in the number

of unprompted, independent correct responses to comprehension questions while the other two students did not. The researchers hypothesized that the two students who did not increase the number of correct, independently answered comprehension questions had not listened to the text read aloud, but had focused instead on listening to the prompts. The student who did increase the number of independently answered comprehension questions had listened to the text the first time it was presented. Of note, the teacher indicated that this student had excellent listening comprehension skills in English, whereas one of the two other students had more limited listening comprehension skills in English and could only pay attention to read-alouds for a short period of time.

Browder et al. (2017) also investigated the use of a system of least prompts in conjunction with electronic story mapping to teach students to identify the structural elements of a story (e.g., character, setting, solution). First, the interventionist taught participating students the names and definitions of the story elements. Then they asked students to fill in an electronic story map, created with the SMART notebook application, and to provide the specific story elements for a text with a problem-solution structure. If the student could not supply a requested story element within 10 seconds, the interventionist provided the following prompts as needed: (a) asked the student to activate the read-aloud feature of the story on their iPad to listen to the definition of the element, (b) reread to the student a portion of the text containing the correct answer, (c) reread to the student the sentence or phrase with the correct answer, and (d) provided the answer and had the student fill it in on the electronic story map. The interventionist then counted the correct number of independently completed story elements in each map.

After completing the story map, the student used it to answer comprehension questions about the story elements in the text. If students could not answer a question within 10 seconds, the interventionist provided the following prompts: (a) encouraged the student to use the story map and the story to help answer the question, (b) reread to the student a portion of the text with the correct answer, (c) reread to the student the sentence or phrase with the correct answer, and (d) provided the answer and had the student restate it.

Browder et al. (2017) implemented a multicomponent intervention strategy and did not examine the effects of the system of least prompts by itself. However, as a result of the larger intervention strategy, the one English learner with a significant cognitive disability showed an immediate increase in the number of independent correct responses to questions about story element definitions, an increase in his ability to correctly label a story map with the names of relevant story elements, and an increase in his ability to correctly answer story comprehension questions using the map. He reached mastery on all of these skills and was able to maintain them over time.

Alison et al. (2017) also looked into the effects of shared story reading intervention that incorporated an embedded system of least prompts provided via the GoTalk Now application on an

iPad. The application was programmed to deliver a modified system of least prompts aimed at teaching the student to use the text to find answers to comprehension questions. After hearing the story read aloud, students saw a comprehension question with answer choices. If the student selected the correct answer choice, the application continued to the next comprehension question. If the student asked to hear the text read aloud again, chose the wrong answer, or did not respond to the question within five seconds, the application provided the first level prompt (i.e., showed the chapter with a highlighted three-sentence chunk of text containing the answer and read the text aloud). The application then returned to the question screen. If the student could not answer the question a second time, the application provided the second level prompt (i.e., showed a sentence containing the correct answer and read the sentence aloud) before returning to the question screen. If the student still could not answer the question, the application showed the third level prompt (i.e., showed the correct word and read the word aloud), and again returned to the question screen. If the student was unable at that point to answer the comprehension question, the interventionist pointed to, and said aloud, the correct answer on the response board. The interventionist then restated the question and the answer and asked the student to either repeat the answer or touch it on the response board.

The two English learners with significant cognitive disabilities in this intervention study started with very little ability to correctly answer comprehension questions about a text. Over the course of the intervention, they showed an increase in their ability to correctly and independently answer comprehension questions using the system of least prompts. One jumped from an average of one correct response per six questions prior to the intervention, to an average of 3.9 correct responses per six questions after the intervention. The first student met mastery criteria after eight sessions and maintained his ability to correctly answer questions after the intervention. The second student started with an average of less than one correct response per six questions prior to the intervention and increased to an average of 4.2 correct responses per six questions. He met mastery criteria after nine sessions and maintained his ability to correctly answer text comprehension questions.

Finally, Spooner et al. (2015) used a shared story format in combination with a system of least prompts paired with constant time delay and multiple exemplar training to teach emergent literacy skills. Following the oral presentation of the shared story via an iPad application with text-to-speech capabilities, a new page in the digital book showed a text comprehension question with four possible picture-based answers. One picture was a correct answer, two were incorrect, and the fourth was a picture of a question mark. When the student pressed the question mark they could hear the text read aloud again. The interventionist provided the student with verbal directions about how to respond to the question, then the interventionist modeled how to choose the correct option or press the question mark to hear the story again. Finally, the interventionist provided physical prompts to the student to help him or her press the answer choices or question mark. The first time the student pressed the question mark in response to a comprehension

question, they saw a chunk of the text containing the correct answer. Then the application returned to the comprehension question. If the student pressed the question mark again, they saw a smaller amount of text containing the correct answer and had another opportunity to answer the comprehension question.

The one English learner with a significant cognitive disability in Spooner et al.'s (2015) study initially could not answer any text comprehension questions aloud prior to the start of the intervention and did not press the question mark to receive the prompt. However, by the sixth intervention session she could answer 26 out of 36 text comprehension questions correctly and independently. She did not need to hear the prompts. The student was able to maintain her ability to answer questions correctly over time.

Peer-Delivered Intervention. Only Hudson and Browder (2014) used general education peer tutors to deliver an intervention. The English learners with significant cognitive disabilities in this study typically received instruction in a self-contained classroom but moved to the 5th-grade general education classroom for the intervention. Both the peer tutors and the English learners with significant cognitive disabilities received training to facilitate their involvement in the intervention. The three English learners with significant cognitive disabilities received instruction in the special education classroom on the meaning of WH- words, requesting help, and tracking the number of correct answers to comprehension questions using self-monitoring worksheets. Peer interventionists received 75 minutes of training, over a two-week period, in reading an adapted book chapter, asking WH- comprehension questions, and delivering a system of least prompts. For example, the peer tutor was trained to ask a comprehension question, then ask if the student needed help or was ready to answer.

If a student needed help, the available prompts, in increasing level of specificity, were: (a) ask the student to identify the type of WH- question, (b) state the rule for the type of WH- question, (c) state the answer verbally, and (d) point to the correct response on the response board. The peer tutor started with the most general prompt and would only ask the more specific prompts when the student with a significant cognitive disability required extra support to answer the question. Results showed that the intervention was effective in increasing the number of prompted correct responses to WH- comprehension questions for these students. Additionally, social validity measures indicated that after the intervention, more fifth-grade general education peers were interested in or willing to interact with students with significant cognitive disabilities at a deeper level. Although this study did show the benefits of this type of intervention, the authors also discussed the extensive amount of time it took to prepare peer tutors, possibly limiting the applicability of this procedure.

Story Mapping. Story mapping refers to using a graphic organizer, or diagram, to identify the structural components of a book or story. Browder et al. (2017) investigated the use of this

intervention strategy, delivered via the SMART notebook application on the iPad, in combination with a system of least prompts. Together, each of the elements formed a multicomponent intervention package aimed at enhancing students' story listening comprehension. The study investigated the effects of the story mapping intervention on the number of correct story elements (e.g., character, setting, problem, solution) placed on the electronic story map and on the students' correct responses to comprehension questions about the story elements. The researcher created a blank story map using the SMART notebook application. The interventionist then modeled for the student how to use the features of the application to put specific examples of story elements into the map (e.g., zooming, scrolling, drawing, typing) and which button to push to hear definitions of story elements read aloud. In each session, the interventionist reviewed the definitions of the story elements, read the story aloud, taught story mapping, and then asked the student comprehension questions related to the solution to a problem that could be answered using the story map (e.g., "How did Mr. Wolf warm-up?").

The intervention conducted by Browder et al. (2017) had several inter-related components to it. Thus, the effect of the story mapping alone could not be determined. However, the one English learner with a significant cognitive disability showed positive outcomes of the intervention package that included story mapping. Prior to the intervention, this student was only able to correctly map about 20% of the elements from a story he heard read aloud, and was able to correctly answer about one-third of the story element comprehension questions. During the intervention he showed significant growth in his ability to perform both skills, and he reached mastery criteria on both of the skills after 12 intervention sessions. Maintenance probes showed the student maintaining performance five sessions later. This demonstrated a functional relationship between a modified system of least prompts and labeling a story map, as well as a functional relationship between using a copy of the story map and a system of least prompts, and correctly responding to related comprehension questions.

Forward Chaining of Skills (Task Analysis). Four studies used some form of task analysis to support the learning of literacy skills (Rivera et al., 2014, 2017; Spooner et al., 2009, 2015). Task analysis is the process of breaking a complex task into small chunks for the student to learn sequentially, building toward performing the complex task. Task analysis protocols are lists of the smaller, chunked sub-tasks that can function as an intervention or teaching tool. For example, if a student is learning digital literacy skills, a task analysis can list all of the individual steps a student needs to complete to turn on the iPad, locate the book, and open it. The interventionist then teaches the student to perform each step, and the task analysis can be used to document a student's ability to complete each task independently as a result of the intervention.

Rivera et al. (2014) developed a 25-step task analysis protocol that a special education teacher and a bilingual paraprofessional used as a guide to consistently implement a shared reading intervention in English and Spanish for an English learner with a significant cognitive disability.

The first nine steps of the task analysis addressed things the interventionist did to teach emergent literacy skills on the iPad (e.g., give the student a chance to open the book, read the title, have the student repeat the title). These digital literacy skills were not associated with specific student outcomes for the intervention, but the researchers believed them to be an important part of a shared literacy experience. The remaining 16 steps addressed three key areas: (a) pre-teaching vocabulary and modeling the correct answer for the student, (b) conducting the shared story, and (c) conducting the probe. The task analysis served as a way for the researchers to ensure fidelity of strategy implementation across educators. Researchers observed the intervention sessions, checking off each step in the task analysis as it was completed and writing notes. However, the effectiveness of using the task analysis was not the primary goal of the study. Thus, there was no data to document the effectiveness of this strategy alone. The larger intervention, with the combined task analysis and shared reading intervention in English and Spanish, did increase the student's ability to correctly define English and Spanish vocabulary words. Additionally, both of the instructors who presented the intervention reported that the task analysis protocol helped them implement the shared reading intervention (Rivera et al., 2014).

Rivera et al. (2017) built their task analysis protocol from the one used in Rivera et al. (2014). The 27-step task analysis that guided the intervention included nine steps aimed at teaching the student digital literacy skills such as unlocking the iPad, turning it on, locating the shared story, opening it, and holding the iPad-based story in the correct direction (Rivera et al., 2017). The task analysis also emphasized early literacy skills, like text awareness and vocabulary. Prior to the study, the interventionist measured students' ability to complete the nine digital literacy tasks in the task analysis as a baseline measure. During the shared story, the interventionist modeled the nine digital literacy tasks and asked students to perform them, along with those relating to early literacy skills. If the student could not do a task correctly, the interventionist either moved on to the next task or helped the student complete it. The researchers used a copy of the task analysis to observe intervention sessions and document that each task was completed consistently across sessions.

After the intervention, Rivera et al. (2017) gave a digital literacy post test as part of the study outcome measures. The one student who was a likely English learner with a significant cognitive disability was able to correctly complete three of nine steps of the digital literacy portion of the task analysis on the pretest and all nine steps independently and correctly on the post test. However, he took longer to learn the steps, to generalize them to new stories, and to learn early literacy skills compared to the two other students with significant cognitive disabilities who were not English learners. The researchers stated that his difficulty concentrating and repeated absences during the intervention played a role in the study outcomes.

Spooner et al. (2009) also used task analysis as part of implementing a culturally-contextual shared story intervention. The researchers developed a 14-step task analysis with three sub-sets

of items such as, "points to or says title," "turns at least one page," and "reviews prediction question to determine if correct." The interventionist, a bilingual paraprofessional, was trained to use the task analysis to teach the student each of the three skill subsets, one at a time, with a new shared story for each set. The skills were chained so that the first four of the 14 total skills appeared in the first subset. The student had to master a subset before moving on to the next one. By the end of the intervention the student was asked to demonstrate in the final shared story all 14 tasks related to digital literacy skills, text awareness, and comprehension. As with other studies involving forward-chaining of skills or task analyses, the task analysis was not the primary component of Spooner et al.'s (2009) study. Thus, study results were not able to isolate the effect of just this component of the intervention. However, the English learner with a significant cognitive disability was able to increase successful responses in all three subsets of skills, and show gains in textual awareness, pre-reading skills, vocabulary skills, and listening comprehension.

Finally, Spooner et al. (2015) used students' correct responses to a nine-step task analysis, adapted from Spooner et al. (2009) and other studies, as an outcome variable for a shared story intervention based on the book *Charlotte's Web.* The task analysis addressed early literacy skills (e.g., identifying the story title, identifying the author's name, turning the digital pages, following the text by pointing at words, selecting vocabulary definitions) and story comprehension (e.g., answering story comprehension questions, repeating elements of the storyline). The interventionist used the task analysis to guide the teaching of each individual skill. Student responses to the steps in the task analysis were collected prior to, during, and after the intervention. The interventionist did not provide correction on the steps of the task analysis.

As with other studies, the task analysis was not the primary component of Spooner et al.'s (2015) study. Instead, the researchers looked at a package of inter-related intervention strategies such as using multiple exemplars, systematic instruction, multimedia shared stories, and the task analysis. The one English learner with a significant cognitive disability was able to increase correct responses to the task analysis from a mean of 2.6 correctly completed skills during the baseline phase to a mean of 8.9 correctly completed skills during the intervention phase. She was able to maintain the increased level of correct responses during the maintenance phase.

Other Interventions. Some studies used multicomponent literacy intervention packages that contained less common intervention components in addition to the other intervention strategies discussed previously. These other components included multiple exemplar training (use of multiple examples to teach a concept or skill; Spooner et al., 2015), discrete trial training (a process that breaks a complex skill into simpler steps that are taught one at a time; Rivera et al., 2017), and explicit instruction (focused, explicit instruction broken into steps and supplemented with examples and non-examples; Rivera et al., 2016). These techniques were not a

defining component of the multicomponent interventions, and little information was provided about them by study authors.

Theme 3: Linguistic Support for English Learners

Although all of the reviewed studies included English learners with significant cognitive disabilities, only six of them focused exclusively on teaching literacy to students from this population (Alison et al., 2017; Kemper, 2012; Rivera et al., 2012, 2013, 2014; Spooner et al., 2009). One additional study by Rohena et al. (2002) focused on Hispanic students with significant cognitive disabilities, and although the researchers did not indicate the students were English learners, we determined that they were likely to be English learners.

The majority of the studies focusing exclusively on English learners adapted well-researched special education interventions to provide some degree of native language (i.e., Spanish) instruction or support (Kemper, 2012; Rivera et al., 2012, 2013, 2014; Rohena et al., 2002, Spooner et al., 2009). The overall effectiveness of the specific intervention strategy—for example, shared stories—was typically not the focus of these studies. Instead, researchers either compared the effectiveness of implementing the given intervention in English versus the home language (Rivera et al., 2012, 2013, 2014; Rohena et al., 2002) or the effectiveness of delivering the intervention in a mixture of both languages (Kemper, 2012; Spooner et al., 2009). Appendix E includes a study-by-study breakdown of findings, author-listed limitations, and implications for practice. The use of students' native languages relied on the use of bilingual adults to deliver the intervention, the incorporation of native language texts, the use of native language vocabulary, and in some cases, native language assistive technology or iPad apps. It is important to note that most students in these studies incorporating native language supports had only received classroom instruction in English. Only two of the studies included students who had previously received some K-12 instruction in their native language (Kemper, 2012; Rivera et al., 2014).

Findings on the effectiveness of native language supports were mixed across studies and across individual students. They produced better outcomes for some students in some cases, but there was no clear pattern of improved efficacy for all students. For example, Rivera et al. (2012) found that two of three Spanish speaking English learners with significant cognitive disabilities learned more vocabulary in a Spanish intervention condition compared to an English condition. In contrast, one student learned the same amount of vocabulary in both the Spanish and English conditions. The researchers hypothesized that the students' language proficiency in each language, although unmeasured, most likely played a role in the effectiveness of each of the instructional conditions. Other studies proposed that students' lack of communication system (Kemper, 2012), lack of access to literacy experiences in any language (Kemper, 2012), and the limited time in which to conduct the intervention (Ainsworth, 2013; Rivera et al., 2014;

Spooner et al., 2009) may have limited the researchers' ability to document the most effective language of instruction for the students.

One other study by Ainsworth (2013) also focused exclusively on English learners with significant cognitive disabilities but provided the intervention entirely in English. Ainsworth used a curriculum developed for nonverbal students with disabilities to provide explicit instruction on English phonological awareness and letter-sound correspondence, as well as English sight word recognition. Ainsworth taught these features of basic English literacy to English learners who spoke Spanish, Bengali, and Amharic. All students demonstrated an increased awareness of letter-sound correspondence over time, although their ability to do so was not always consistent. The researcher found a statistically significant relationship between the use of the curriculum and student progress in learning letter-sound correspondence and sight-word recognition. The researcher did not address how the curriculum may have functioned differently for students who spoke Spanish, a language that shares some words and sounds with English, and for students who spoke less closely related languages like Bengali or Amharic.

The remainder of the studies were not designed to specifically address the needs of English learners who had significant cognitive disabilities, nevertheless, the interventions did contain elements of effective instruction for English learners (for more information on effective instructional strategies see Goldenberg, 2008; Office of English Language Acquisition, 2019). Linguistic supports in these studies included: (a) having text read aloud in English (Alison et al., 2017; Browder et al., 2017; Hudson & Browder, 2014; Kemper, 2012; Rivera et al., 2013, 2014, 2017; Spooner et al., 2009, 2015); (b) creating simplified English text (Alison, 2017; Hudson & Browder, 2014; Spooner et al., 2009, 2015); (c) explicit instruction in English vocabulary (Kemper, 2012; Rivera et al., 2012,2013, 2014, 2016, 2017; Rohena et al., 2002); (d) providing multiple means of representation and incorporating redundancy to assist with comprehension (e.g., visuals to accompany texts, as captions for videos) (Evmenova et al., 2017; Rivera et al., 2016); and (e) developing a graphic organizer such as a story map to aid in reading comprehension activities (Browder et al., 2017). These supports were integrated into larger multi-component interventions so we cannot draw conclusions about the direct effects of individual language learning supports. Despite this, social validity measures for these supports, when collected, were high across multiple studies. For example, students reported that picture-word captioning and review features were helpful (Evmenova et al., 2017; Rivera et al., 2017; Spooner et al., 2015). See Appendix E for a comprehensive breakdown of linguistic supports.

Theme 4: Technology Integration

Technology integration was an essential component of the interventions used in many of the studies included this literature review (Alison et al., 2017; Browder et al., 2017; Evmenova et al., 2017; Rivera et al., 2013, 2014, 2016, 2017; Spooner et al., 2015). The most popular form

of technology used to deliver interventions was an iPad. These interventions included shared stories, digital story mapping, and interactive or adapted videos. Studies used various software to create their shared story activities, with one study using a text-to-speech application to read a story (Spooner et al., 2015), one using GoTalk Now (Alison et al., 2017), and another two studies using stories created in iBooks Author (Rivera et al., 2014, 2017). In a couple of older studies, multimedia shared stories were created using Microsoft PowerPoint and presented via a projector (Rivera et al., 2012, 2013). Additionally, other applications for the iPad were used to create a digital story mapping activity developed in SMART notebook to help students understand story structure (Browder et al., 2017), and interactive or adapted videos used to deliver literacy instruction (Evmenova et al., 2017; Rivera et al., 2014, 2016, 2017). Evmenova et al. (2017) selected lengthy videos associated with standards-based instructional units and edited them down to be roughly 3½ to 5 minutes in length. Rivera et al. (2014, 2016, 2017) embedded YouTube videos into shared stories to illustrate key vocabulary and concepts.

Due to the way interventions were structured and the integrated nature of technology as part of the intervention, researchers did not determine the specific effects of technology use. For example, it is impossible to know whether the shared reading interventions examined in Alison et al. (2017) or Rivera et al. (2014) would have shown the same effects if it had not been technology-based and instead had been conducted in a more traditional human-delivered shared story format. Some of the studies hypothesized that technology integration improved the attention and motivation of the students compared to traditional lessons (Rivera et al., 2014, 2017; Spooner et al., 2015). Lessons involving modified videos provided interactions with content that would not be available in other formats. These included adaptive captioning (picture/symbol captioning) and displaying a specific section of the text or video in which to find the answer to a comprehension question (Evmenova et al., 2017; Rivera et al., 2016). Studies that included social validity measures (e.g., student or teacher interviews) reported high social validity and minimal student and teacher concerns about the integration of technology (Rivera et al., 2013, 2014, 2017; Spooner et al., 2015).

Author-Identified Limitations

For each study included in this review, we compiled researcher-identified limitations and implications for educators (see Appendix Table E). The five most commonly listed limitations included small sample size, lack of appropriate interventionists, a failure to collect maintenance or generalization data, an inability to separate the effects of each component in a multi-component intervention (e.g., technology use during shared stories delivered bilingually), and the short duration of the intervention.

First, many authors identified limited generalizability of the findings as a limitation imposed by their single-case design and small sample sizes (Ainsworth, 2013; Browder et al., 2017; Rivera

et al., 2012, 2014, 2016; Rohena et al., 2002; Spooner et al., 2009, 2015). Second, limitations due to a lack of appropriate intervention staff were common. These limitations included the following: (a) a lack of a bilingual interventionist (Kemper, 2012), (b) the classroom teacher did not conduct intervention and therefore this may limit validity or generalization evidence for real world applications (Rivera et al., 2012, 2013), (c) use of a Hispanic interventionist may have influenced student responses (Rivera et al., 2013), and (d) the need for a bilingual paraprofessional to deliver the intervention limited the choice of study locations (Rivera et al., 2014).

Third, some authors discussed their failure to collect complete maintenance or generalization data (Alison et al., 2017; Evmenova et al., 2017; Rivera et al., 2012; Rohena et al., 2002). In two studies citing this limitation the authors did not collect the data (Evmenova et al., 2017; Rivera et al., 2012). For example, in Rivera et al.'s (2012) study, generalization data were only collected after the intervention was completed and maintenance data were not collected at all. In other studies the researchers planned to collect maintenance and generalization data but ran out of time. For example, Rohena et al. (2002) indicated that scheduling problems limited the collection of maintenance and generalization data for one participating student. In the case of Alison et al. (2017), the researchers collected generalization data, but the intervention took place at the end of the school year and there was not enough time to collect the maintenance data.

Fourth, two authors explicitly discussed their inability to disentangle separate effects for each component of a multi-component intervention (Evmenova et al., 2017; Rivera et al., 2017). Evmenova and colleagues (2017) found that a complex intervention design did not allow them to separate out the effects of video captioning, adaptive captioning, or use of a search function to find information in the video. Similarly, Rivera and colleagues (2017) embedded a number of distinct strategies into their shared reading intervention (e.g., multimedia shared stories, English and native language instruction, task analysis) and they could not determine the effect of any individual strategy.

Fifth, the length (short duration) of the intervention was listed as a limitation by three authors (Ainsworth, 2013; Rivera et al., 2014; Spooner et al., 2009). The interventions ranged from four weeks (Rivera et al., 2014) to 10 weeks (Ainsworth, 2013), sometimes covering school holidays and days when many students were absent. With additional time, students may have been able to make greater learning progress. For example, Spooner et al. (2009) scheduled their data collection near the end of the school year when both the student and the teacher had a number of absences. To complete the intervention, the researchers had to move their student to the second phase prior to the student meeting mastery criteria, which may have led to the student making smaller gains than anticipated.

Less commonly addressed limitations included: (a) confounded study results due to mixing languages during the intervention (Spooner et al., 2009), (b) possible inability of the student in

a bilingual intervention to maintain performance of the literacy skill in English over time, (c) the intervention design may have affected the students' ability to generalize vocabulary to new situations (Rivera et al., 2012, 2013), (d) a lack of a comparison condition meant that the researchers could not establish comparative effectiveness of the intervention (Rivera et al., 2016), (e) the intervention delivery method might not be feasible in typical classroom conditions (Rivera et al., 2017), (f) generalization sessions were unstructured due to the community-based setting for the related activities (Rohena et al., 2002), (g) a small number of vocabulary words were identified for use in each intervention condition which may have limited variability in student outcomes (Rivera et al., 2016), and (h) the absence of student mastery criterion (in a study that emphasized speed of learning) may have limited students' generalization and maintenance data (Rivera et al., 2013).

Author-Identified Implications for Educators

Researcher-identified implications of study findings tended to be more study specific than the limitations, but some themes did emerge. These themes were about language of the intervention decisions, use of accommodations, instructional intervention techniques, and technology integration. First, to decide on the most appropriate language for a literacy intervention with English learners, or potential English learners, with significant cognitive disabilities, authors tended to advocate for a process driven by individual student needs (Rivera et al., 2013) and formative assessment results or qualitative data gathering (Kemper, 2012). For example, Kemper (2012) called for the collection of information on home communication patterns and family literacy skills. With such information, she argued, activities and instruction could be designed to build from students' existing communication skills, which may be in the student's native language or in English.

Second, recommendations for instructional accommodations for English learners with significant cognitive disabilities included offering shorter sessions (Ainsworth, 2013), adapting typical English learner instructional techniques and using universal design principles (Rivera et al., 2011), and using the exact symbols from students' communication boards in adapted books and lesson materials (Kemper, 2012).

Third, although recommendations about instructional intervention techniques and technology were somewhat intertwined due to the integrated nature of technology in some of the interventions (e.g., multimedia adapted shared reading lessons), authors indicated that regardless of the technology used to deliver an intervention, the foundation of that intervention should be high quality, evidence-based instructional practices (Alison et al., 2017; Browder et al., 2017; Hudson & Browder, 2014; Rivera et al., 2013, Spooner et al., 2015). The researchers of the studies reviewed tended to examine practices that have already been found effective with native English speaking students with significant cognitive disabilities and adapted them to be

more applicable for students acquiring English as a second language. As noted previously, these practices included constant time delay, shared stories, model-lead-test, system of least prompts, peer-delivered interventions, and the use of story maps.

Finally, many of the studies suggested the potential for technology to personalize lessons so that they were more attentive to individual student skills, needs, and interests (Alison et al., 2017; Browder et al., 2017; Evmenova et al., 2017; Rivera et al., 2013, 2014, 2016, 2017; Spooner et al., 2015), as well as to support student independence and engagement (Alison et al., 2017; Rivera et al., 2017) with more complex content (Browder et al., 2017). Technology allowed for more complex, grade-aligned information to be accessible because it was represented in multiple ways (e.g., words, pictures, videos, audio) consistent with the needs of the student (Rivera et al., 2017). Similarly, students could respond to questions or prompts in multiple ways (e.g., words said aloud, pictures, symbols). In addition, the use of technology allowed students to be active learners (Rivera et al., 2017) and to develop independence (Alison et al., 2017) because the student no longer needed another human to deliver the intervention. Instead, the student could choose to hear a read-aloud repeated, see a definition of a word, or get access to a system of least prompts to support correct answers to comprehension questions.

Limitations of This Review

Our review of the literature has several limitations that emerged from the chosen methodology (i.e., systematic literature review) and the topic area (i.e., assessment and instruction for English learners with significant cognitive disabilities). First, ESSA does not specifically define "students with significant cognitive disabilities," so research studies largely did not use this terminology either. Other than for those studies that indicated the student participated in the AA-AAAS, we were limited to reviewing student characteristics and making educated guesses about students who might likely be identified for an AA-AAAS.

Second, studies provided limited information on whether, and how, students with significant cognitive disabilities were evaluated for English learner services. Again, where this information was lacking, we made educated guesses based on characteristics such as a student's home language, and occasionally their time in the U.S. In doing so, there is an increased chance that we incorrectly identified some students as likely English learners with significant cognitive disabilities. Without detailed descriptions of identification procedures, the risk of misidentification remains a limitation.

Further, we were limited to reviewing and making recommendations based on the quantity and variety of studies that have been conducted in this area. No studies were published that focused on the topic of assessment. Further, the studies focused on instruction were relatively few in number and conducted by a small group of authors from primarily one region of the

southeastern United States. Finally, the studies typically addressed Spanish-speaking students and did not speak to the effectiveness of students with significant cognitive disabilities from other language backgrounds.

Discussion

Although the assessment of special populations and appropriate accommodations for these students is a growing policy interest, we found no empirical studies that addressed literacy assessment of English learners with significant cognitive disabilities. Research is needed on appropriate assessment practices for students who are both English learners and have significant cognitive disabilities. This likely includes research on accommodations, including technology supports and first language supports.

The available literature has a number of implications for literacy instruction of English learners with significant cognitive disabilities. First, the evidence base that is available suggests that, in the absence of extensive research on this topic, it is appropriate to take practices proven to be effective for native English speakers with significant cognitive disabilities (e.g., constant time delay, shared stories, task analysis, system of least prompts, model-lead-test, discrete trial training, explicit instruction, peer-delivered interventions, story mapping, multiple exemplar training) and to adapt them to better support the English proficiency of individual learners. It should be noted that these strategies require intensive support from an adult or peer to implement. All of the 29 students in these studies received their daily instruction in special education classrooms where the ability to provide intensive one-on-one instruction is much more likely than in a general education classroom. Thus, the literature does not have a great deal to say just yet about effective literacy instruction for English learners with significant cognitive disabilities in general education settings.

When using more intensive instructional strategies such as those discussed in this paper, adding linguistic supports like the judicious use of the student's native language is important to make instruction accessible for a student who is learning English. Accessible instruction does not always imply the use of the student's home language. The benefits of using native language instruction must be determined on a case-by-case basis, depending on the characteristics of an individual learner. Across all studies using first-language supports (Kemper, 2012; Rivera et al., 2012, 2013, 2014; Rohena et al., 2002; Spooner et al., 2009), there was not a clear conclusion about providing first-language supports to English learners with significant cognitive disabilities. In many cases, authors of studies concluded that the effectiveness of first-language supports depended on the individual student, with some students benefiting and others not benefiting. Thus, we recommend that decisions about providing first-language supports to English learners with significant cognitive disabilities be a team-based decision and include information about

family language and preferences, student first and second language skills, and use of any alternative and augmentative communication (AAC) systems.

When native-language instruction is not possible or may not benefit an individual student, adaptations to English-only instruction must be made so that a language learner with significant cognitive disabilities can participate. These adaptations may include supports such as additional simplification of grade-level texts, allowing students to use listening comprehension skills to respond to text read aloud, and teaching students to interpret and create graphic organizers as visual supports for learning text content and structure.

Our review highlights how technology can be used effectively to improve the literacy of English learners with significant cognitive disabilities. Although researchers were not able to collect data to demonstrate the effectiveness of technology by itself, technology-based interventions showed generally positive results and good potential for working with English learners with significant cognitive disabilities. One reason for this may be that technology allows for individualization to meet the specific learning needs of students. A second reason is that the use of technology allows for some unique language supports that could be difficult to implement otherwise. These include adaptive captioning (picture/symbol captioning); the use of multimedia videos, graphics, and animation; and review features allowing students to return to the portion of the story or video that contained the information needed. Via technology, a teacher can provide the type of redundant information that is beneficial for students who may not understand words presented only in print. For example, a student can listen to a story read aloud on an iPad while viewing pictures and seeing text. Third, students seemed to respond well to technology. Multiple studies (Alison et al., 2017; Rivera et al., 2014, 2017; Spooner et al., 2015) reported that integrating technology improved student attention and engagement.

Need for Future Research

This review of the literature did not identify any research on literacy assessment for English learners with significant cognitive disabilities published between 2000 and 2018. More research is required on this topic to help educators understand issues such as appropriate accommodations that meet students' English language development and disability-related needs, and how to appropriately decide whether a student should participate in an alternate assessment of English proficiency.

The available literature did highlight a number of promising practices for teaching literacy skills to English learners with significant cognitive disabilities, but it also identified areas missing from the research base. For example, studies focused primarily on students with a home language of Spanish, even though English learners in the U.S. come from over 400 different language groups (U.S. Department of Education, n.d.). Ainsworth (2017) did include a speaker of Bengali

and Amharic in her study addressing the teaching of basic English phonics skills. However, study results did not address the students' English learner status so it is difficult to determine whether there were any differential effects of the intervention associated with students' native language background. The field has a great need for research aimed at documenting effective literacy interventions for English learners with significant cognitive disabilities who come from language backgrounds in addition to Spanish.

Included studies were not designed to break down the effects of individual intervention components and often did not include enough information about the specific students in each study. Therefore, research needs to address both of these limitations. First, developing a research design that allows for the separation of intervention components would be beneficial. Second, studies on instructing English learners with significant cognitive disabilities could be improved by providing more in-depth information about the students' language skills in both their home language and English. It would also be beneficial to develop guidelines with explicit criteria for identifying students who are English learners with significant cognitive disabilities (see, for example, Liu, et al., in publication).

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Appendix A

Search Strategies

- MNCAT Discovery, OVID Medline, ERIC, and Academic Search Premier:
  ("Bilingual" OR "English language learner" OR "Spanish" OR "English Learner")
  AND
  ("Significant cognitive disab*" OR "significant disab*" OR "severe disab*" OR "intellectual disab*" OR "autism" OR "mental retardation" OR "assistive technology")
  AND ("literacy")
- Google Scholar:
  ("Bilingual" OR "English language learner" OR "Spanish" OR "English learner") AND "literacy" AND "significant cognitive disability"
  ("Bilingual" OR "English language learner" OR "Spanish" OR "English learner") AND "literacy" AND "significant disability"
  ("Bilingual" OR "English language learner" OR "Spanish" OR "English learner") AND "literacy" AND "severe disability"
  ("Bilingual" OR "English language learner" OR "Spanish" OR "English learner") AND "literacy" AND "intellectual disability"

Google Scholar has notable limitations that must be addressed when using to supplement a systematic literature search process. Google scholar operates with the AND, OR bullion logic functions but does not accept wild card operators such as * and only allows one level bullion logic meaning that it does not allow groupings of (___ OR ___) AND (____ OR ___). In addition to this they limit the total search term length to 256 characters which is auto truncated. It also limits results that you can view to 1,000. Due to these limitations the search strategy included multiple individual searches shown below to replicate the search strategy used with MNCAT and other databases. Additionally, only the first 200 "most relevant" citations of each search were used due to the large scope and number of irrelevant findings.

Appendix B

Intervention Details and Student Demographics

Study	Purpose	*English Learners or Likely English Learners Out of Total Students	Home Language	Age	Instruction Language	Intervention Language
Ainsworth (2013)	Determine if middle school students with significant intellectual disabilities and communication disorders could be taught basic literacy skills using the Accessible Literacy Learning (ALL) curriculum.	5 of 8	Spanish (3) Bengali (1) Amharic (1)	11–16	No information	English
Alison et al. (2017)	Evaluate effects of shared story reading using e-texts and embedded prompting on vocabulary and reading comprehension of grade-level narrative texts for elementary English learners with autism.	2 of 3	Spanish (2)	8–10	English	No information
Browder et al. (2017)	Investigate the effects of a modified system of least prompts and an electronic story-mapping intervention for elementary students with autism.	1 of 3	Spanish	8	English	English
Evmenova et al. 2017	Determine the effects of adapted videos with picture/word-based captions and interactive searching on comprehension of non-fiction academic content by high school students with significant intellectual disabilities.	1 of 4	Spanish	20	English	English
Hudson & Browder (2014)	Evaluate effects of a peer-delivered least prompts intervention and adapted read-alouds of a grade-level novel on correct listening comprehension responses for students with moderate intellectual disabilities.	3 of 3	EL with primary language English	9–11	English	English
Kemper (2012)	Examine the use of a bilingual listening reading comprehension intervention package for nonverbal English learners with a severe intellectual delay.	3 of 4	Spanish	5–8	2 English only 2 English & Spanish	English Spanish

Study	Purpose	*English Learners or Likely English Learners Out of Total Students	Home Language	Age	Instruction Language	Intervention Language
Rivera et al. (2012)	Compare the effectiveness of English and Spanish vocabulary instruction that incorporated systematic, explicit instruction and technology, within a model-lead-test approach on the oral English vocabulary of English learners with moderate intellectual disabilities.	3 of 3	Spanish	8–10	No information	English Spanish
Rivera et al. (2013)	Examine the comparative effects of an English and Spanish multimedia shared story intervention, with a constant time delay procedure, on the acquisition of English vocabulary for two English learners with moderate intellectual disabilities.	2 of 2	Spanish	9	English	English Spanish
Rivera et al. (2014)	Explore the use of a multimedia shared story to increase the number of correct English and Spanish vocabulary words used by an English learner with a moderate intellectual disability.	1 of 1	Spanish	10	English Spanish	Mostly English Some Spanish support
Rivera et al. (2016)	Examine the effects of a computer-based video intervention, using Apple iBooks on an iPad, for teaching literacy skills to a student with moderate intellectual disability.	1 of 1	Spanish	9	English	English
Rivera et al. (2017)	Examine a multicomponent multimedia shared story (MSS) intervention via an iPad to teach science vocabulary.	1 of 3	Spanish	6	English	English

Study	Purpose	*English Learners or Likely English Learners Out of Total Students	Home Language	Age	Instruction Language	Intervention Language
Rohena et al. (2002)	(a) Investigate the effectiveness of Spanish and English constant time delay instruction on English sight word learning and incidental information by middle school students with mental retardation; (b) examine the generalization of English sight words and incidental information to the community; and (c) compare the efficiency of the instructional conditions on learning English sight words.	4 of 4	Spanish	12–15	English	English Spanish
Spooner et al. (2009)	Investigate the effectiveness of teaching a bilingual paraprofessional to use a task analysis to teach the student a series of responses for interacting with culturally relevant, native language, bilingual and English books to promote emergent literacy skills for an elementary-aged English-language learner with an intellectual disability.	1 of 1	Spanish	6	“Most” in English	English Spanish
Spooner et al. (2015)	Examine the use of systematic instruction and training multiple exemplars of emergent literacy skills through a shared story format on the iPad2® to increase acquisition and generalization of emergent literacy skills for elementary-aged students with severe disabilities.	1 of 5	Spanish	8	English	English

Notes. For studies where only a subset of the participants were eligible for inclusion in our review, the number total and number eligible are reported, then attributes of the eligible are described. One student described as an English learner by Alison et al. (2017) was excluded from this literature review because his home languages were English and American Sign Language.

Appendix C

Students' Disability-Related Characteristics

Study	Student Pseudonym (Age/Grade)	Disability	Verbal Skills	Use of Communication System	Instructional Setting	Took Alternate Assessment
Ainsworth (2013)	Ash (12/6th)	Autism and severe intellectual disability	No	Multimodal—gestures, 1 ASL sign	Self-contained classroom in a special school	Yes
	Bobby (11/6th)	Autism and moderate intellectual disability	No	Multimodal—PEC book a little, signs and gestures	Self-contained classroom in a special school	Yes
	Chuck (15/9th)	Autism and moderate intellectual disability	No	Multimodal—communication iPad application, mostly gestures and facial expressions	Self-contained classroom in a special school	Yes
	Garth (16/9th)	Down syndrome and moderate intellectual disability	No	No formal communication system; gesture, point, 1 ASL sign	Self-contained classroom in a special school	Yes
	Jo (13/7th)	Cerebral Palsy and moderate intellectual disability	No	Some use of iPad speech application; smiling, gesturing, nodding	Self-contained classroom in a special school for students with disabilities	Yes

Study	Student Pseudonym (Age/Grade)	Disability	Verbal Skills	Use of Communication System	Instructional Setting	Took Alternate Assessment
Alison et al. (2017)	Juan (10/4th)	Autism	Yes	Limited information	Self-contained classroom in elementary school	Yes
	Sal (8/2nd)	Autism	Yes	Limited information	Self-contained classroom in elementary school	Yes
Browder et al. (2017)	Stuart (8/2nd)	Autism	Yes	Oral language primary, able to express thoughts opinions and preferences in English	Self-contained classroom in a suburban public elementary school	NA (too young)
Evmenova et al. (2017)	Oliver (20/no info)	Severe intellectual disability and brain disorder	Yes	The primary language was Spanish but difficult to understand; also used AAC	Special education self-contained school	Yes
Hudson & Browder (2014)	Mason (11/no info)	Moderate intellectual disability and Down syndrome	Yes	Used verbal English, but speech was often unintelligible	Self-contained special education class for students with Intellectual disability	No information
	Robert (9/no info)	Moderate intellectual disability and Williams syndrome	Yes	Verbal English and language skills were described as strong	Self-contained special education class for students with Intellectual disability	No information
	Verla (10/no info)	Moderate intellectual disability and severe physical disabilities	No	Used a combination of AAC devices (DynaVox), yes/no words on wheelchair, and book of picture symbols	Self-contained special education class for students with Intellectual disability	No information

Study	Student Pseudonym (Age/Grade)	Disability	Verbal Skills	Use of Communication System	Instructional Setting	Took Alternate Assessment
Kemper (2012)	Diego (7/2nd)	Autism, speech delay, severe intellectual delay	Unclear, refers to all students as non-verbal but "has 20 spoken words"	Twenty spoken words, follows picture schedule	Self-contained special education class	No information
	Marco 8/3rd	Severe intellectual delay and speech delay	No	No formal communication system, uses facial expressions and pointing	Self-contained special education class	No information
	Santiago (8/4th)	Fragile X syndrome, speech delay, seizure disorder, and severe intellectual disability	Unclear, "limited verbal ability"	Vantage Lite, limited verbal ability, pointing and facial expressions	Self-contained special education class	No information
Rivera et al. (2012)	David (9/3nd)	Moderate intellectual disability and Down syndrome	Yes	Spoken English and Spanish	Self-contained special education classroom	No information
	Isabella (10/5th)	Moderate intellectual disability	Yes	Spoken English and Spanish	Self-contained special education classroom	No information
	Manny (8/2nd)	Moderate intellectual disability	Yes	Spoken Spanish and English	Self-contained Special education classroom	No information
Rivera et al. (2013)	Juan (9/3rd)	Moderate intellectual disability	Yes	Bilingual spoken English and Spanish	Self-contained classroom	No information
	Myra (9/3rd)	Moderate intellectual disability	Yes	Bilingual spoken Spanish and English	Self-contained classroom	No information

Study	Student Pseudonym (Age/Grade)	Disability	Verbal Skills	Use of Communication System	Instructional Setting	Took Alternate Assessment
Rivera et al. (2014)	Carlos (10/no info)	Moderate intellectual disability	Yes	Spoken English (school)	Self-contained special education classroom	No information
Rivera et al. (2016)	Selena (9/2nd)	Moderate intellectual disability	No	Primarily non-verbal, understood limited English and Spanish	Self-contained classroom for students with moderate to severe ID.	No information
Rivera et al. (2017)	Pablo (6/no info)	Developmental delay	Yes	Oral English and Spanish	Self-contained classroom	No information
Rohena et al. (2002)	Jose (12/no info)	Moderate mental retardation	Yes	Bilingual spoken communication, preferred Spanish	Self-contained life skills special education classroom	No information
	Junior (15/no info)	Moderate mental retardation	Yes	Bilingual spoken communication, preferred Spanish	Self-contained life skills special education classroom	No information
	Maria (13/no info)	Moderate mental retardation	Yes	Bilingual spoken communication	Self-contained life skills special education classroom	No information
	Yari (13/no info)	Moderate mental retardation	Yes	Bilingual spoken communication, preferred Spanish	Self-contained life skills special education classroom	No information
Spooner et al. (2009)	Yari (6/no info)	Moderate intellectual disability	Yes	Picture schedule, limited ability to vocally verbalize in English and Spanish (yes, no, stop, please, colors)	Self-contained classroom	No information
Spooner et al. (2015)	Miranda (8/3rd)	Autism	Not enough information	Unintelligible expressive communication	Self-contained classroom	Yes

Appendix D

English Learner Identification Procedures Used Including Students' Time in U.S. Schools

Study	Total English Learners or Likely English Learners	Number of English Learners Formally Identified by School	Number of English Learners Indicated by Researchers	Number of Likely English Learners Determined by Authors	How EL Status Determined	Time in U.S. Schools
Ainsworth (2013)	5	0	0	5	Home language not English and time in U.S. schools	2½–12 years
Alison (2017)	2	2	0	0	School procedures	Not provided
Browder et al. (2017)	1	1	0	0	School procedures	Not provided
Evmenova et al. (2017)	1	0	0	1	Home language not English	Not provided
Hudson & Browder (2014)	3	0	3	0	Unclear	Not provided
Kemper (2012)	4	0	4	0	Unclear	Not provided
Rivera et al. (2012)	3	3	0	0	School procedures; additional researcher assessments	Born in the U.S.–3 years
Rivera et al. (2013)	2	1	0	1	School procedures (1); Identified by teacher as home language not English (1)	Not provided
Rivera et al. (2014)	1	1	0	0	School procedures; additional researcher assessments	2 years
Rivera et al. (2016)	1	0	0	1	Home language not English	Born in the U.S.

Study	Total English Learners or Likely English Learners	Number of English Learners Formally Identified by School	Number of English Learners Indicated by Researchers	Number of Likely English Learners Determined by Authors	How EL Status Determined	Time in U.S. Schools
Rivera et al. (2017)	1	0	0	1	Bilingual in Spanish and English	Not provided
Rohena et al. (2002)	4	0	0	4	Home language not English	4–7 years
Spooner et al. (2009)	1	0	1	0	Home language not English	Not provided
Spooner et al. (2015)	1	1	0	0	School procedures	Not provided
Total	30	9	8	13		

Appendix E

Study Focus, Linguistic Supports Provided, and Findings

Study	Literacy Focus	Linguistic Supports	Findings for English Learners with Significant Cognitive Disabilities
Ainsworth (2013)	English letter-sound correspondence and sight word recognition	Explicit instruction on English phonology and sight words	A statistically significant relationship between the use of the ALL curriculum and student progress on letter-sound correspondence and sight word recognition. No performance differences by disability types, ways of responding, ages, IQ scores, or native language.
Alison et al. (2017)	WH- question comprehension and English vocabulary; comprehension of English text	Simplification of grade-level English texts included a summary of key plot events; audio recorded text read aloud	The intervention showed effective in improving Why definition knowledge and correct responses to WH- questions in the context of a shared story for all three participants. All three students showed notable improvement in both dependent variables.
Browder et al. (2017)	Comprehension of English text, especially story elements	Graphic organizer of story map as visual support for learning story elements; text read aloud	Participants were able to acquire mastery of story elements within the context of a story map. A functional relationship between constant time delay and identifying story element definitions was demonstrated. Development of story maps assisted students in answering comprehension questions that they were not previously able to.
Evmenova et al. (2017)	Comprehension of English text and videos	Redundancy—English subtitles for videos included picture symbols	Picture/word captioning and interactive videos showed a positive effect on the comprehension of non-fiction content for all students in the study. Data analyzed using percent of non-overlapping data (PND). PND 88% across students 87% for Oliver (a student who is an EL). Improvement from baseline but Oliver did show large variability within both baseline and intervention portions. All the students enjoyed watching the adapted videos and enjoyed using the review button. Students felt that the review button was very helpful.

Study	Literacy Focus	Linguistic Supports	Findings for English Learners with Significant Cognitive Disabilities
Hudson & Browder (2014)	Comprehension of English text	Simplified grade-level text with summaries of key plot events; text read aloud to student	Low, stable baseline, with improvement for all students in several prompted correct listening comprehension questions. High procedural fidelity and social validity. Students also showed generalization to the teacher asked questions. Peers were able to implement the intervention with fidelity with very little support.
Kemper (2012)	Comprehension of English text using bilingual listening comprehension strategy	Text read aloud to student in English; native language instruction including use of native language teacher, vocabulary and assistive technology	All students demonstrated increases in the total number of responses to comprehension questions and the number of communication attempts for both the English and bilingual interventions. There were slightly larger increases for the Spanish intervention compared to English. The accuracy of student responses was lower than the established 80% criterion in both L1 and L2.
Rivera et al. (2012)	Acquisition of English vocabulary	Native language instruction; explicit vocabulary instruction	All students learned new English vocabulary words in both language conditions. Two of the three students learned more quickly with Spanish instruction compared to English. One student made similar progress under both conditions. Generalization scores were lower than expected.
Rivera et al. (2013)	Acquisition of English vocabulary; English and Spanish story comprehension	Native language instruction; text read aloud to student in English and Spanish; explicit vocabulary instruction	Both students made gains in English vocabulary learning, but each one made larger gains in a different language. Language of instruction did not meaningfully affect generalization and maintenance of vocabulary over time. Teachers thought multimedia shared stories were practical and useful.

Study	Literacy Focus	Linguistic Supports	Findings for English Learners with Significant Cognitive Disabilities
Rivera et al. (2014)	English and Spanish vocabulary acquisition; listening comprehension in English and Spanish	Explicit instruction on English and Spanish vocabulary; text read aloud to student in English and Spanish	Spanish vocabulary increased faster compared to English. At the end of intervention week four, student was able to acquire a minimum of 80 percent of both English and Spanish vocabulary. Provides evidence of a functional relationship between vocab learning and multimedia shared story intervention.
Rivera et al. (2016)	English vocabulary acquisition; English listening comprehension	Explicit instruction on English vocabulary; redundancy—use of pictures to accompany vocabulary	Results suggest a functional relationship between computer-based shared reading and learning picture vocabulary. Student met criteria in their conductive sessions and was able to maintain 93 percent of picture vocabulary after one week break. Though not explicitly taught, consistent exposure to sight words lead to a 53% increase in insight word accuracy. The student showed the ability to learn non-targeted information through indirect exposure.
Rivera et al. (2017)	English vocabulary acquisition; English listening comprehension	Explicit instruction on English vocabulary; text read aloud to student in English	During the intervention, a significant change in trend was achieved for all participants; however, the immediate change in level was not as conspicuous with EL participants compared to non-EL participants. Pablo's performance had a range of 20 to 90% of words correct with a mean of 54% of words when in the intervention. He reached mastery after 17 sessions. Students were able to maintain gains at an 80% level during four weeks of maintenance sessions. The study showed strong procedural fidelity and social validity. Students improved digital literacy skills from baselines of 33%, 44%, and 55% respectively to completing 100% of digital literacy tasks successfully.

Study	Literacy Focus	Linguistic Supports	Findings for English Learners with Significant Cognitive Disabilities
Rohena et al. (2002)	English sight word/vocabulary acquisition	Native language instruction for English sight words; explicit vocabulary instruction	Language of instruction may not greatly affect English word learning. For three of four students, both Spanish and English time delay conditions were effective and efficient for promoting English sight word reading compared to no time delay. The Spanish time delay was more effective and efficient than English for the fourth student. All four students could apply the shopping sight words learned in class to stores in the community and learned most of the incidental information about words (e.g., definitions, descriptions).
Spooner et al. (2009)	Emergent literacy skills in English and Spanish; listening comprehension in English and Spanish	Books relevant to the student's heritage; began with native language instruction and transitioned to English instruction; text read aloud to student in Spanish and English; simplified English texts	The student increased correct responses from baseline (no culturally relevant book, no Spanish instruction, no forward chaining) to intervention in skill sets 1, 2 and 3. The student also made improvements when returning to baseline conditions. To some degree, the intervention improved the student's book awareness, vocabulary knowledge, and listening comprehension.
Spooner et al. (2015)	Emergent literacy in English, listening comprehension	Text read aloud to student in English; simplified text	The student reached mastery criteria in three sessions by her 8th session. Was able to generalize across adapted chapters and maintain steps of the task analysis. Overall function relationship established between iPad and systematic instruction implementing the successfully shared story. The intervention showed high procedural fidelity and social validity.

Appendix F

Study Limitations and Implications for Educators

Study	Limitations	Implications for Educators
Ainsworth (2013)	Short intervention time length (10 weeks including holidays and days students were absent). A small number of students. The teacher did not conduct the interventions.	Do not exclude students from literacy instruction based on IQ scores, primary disability category, age, or behavioral issues. Offer shorter sessions to accommodate physical effort of responding. Minimize students' behavioral challenges by attending to the environment.
Alison et al. (2017)	Limitations include generalization due to population included in the study and choice of literature for student reading. Scope of generalization as not assessed, do not know if the skills would generalize to "' normal" books. Maintenance data was not collected due to the end of the school year.	Teach students the meaning of WH- questions before shared reading activities. Use constant time delay or other evidence-based practices to teach WH- word definitions. Use systematic prompting to teach digital literacy and technology use skills. Provide systematic instruction, even when using technology-based instruction. One way of doing this is "embedding" prompts into the technology-based shared reading so that students can access the prompts without instructor intervention.
Browder et al. (2017)	Limited generalizability due to single-case research design and a small number of participants. Differences in the amount of exposure to story maps due to the implementation schedule and student attention. Lack of social validity measures.	Pre-teach story element definitions before story mapping activities. Use constant time delay or other evidence-based practices to teach this vocabulary. Enhance story mapping activities with computer-assisted instruction and text read aloud.

Study	Limitations	Implications for Educators
Evmenova et al. (2017)	Complex intervention does not allow separation of causes such as captioning and adaptive captioning vs. search function. Maintenance, retention, or generalization of skills was not tested in this study.	Adaptive captioning and interactive videos may be a way to provide access to age/grade level appropriate material for students with intellectual disabilities. Specific software used in this study is not (yet) commercially available.
Hudson & Browder (2014)	Limited to EL for whom English is the primary language; limits generalizability or applicability for whom English is a second language. Researcher presence may affect implementation fidelity. Only one strategy used to assess listening comprehension and large time commitment required to implement the intervention.	Consider the use and effects of culturally contextual books. Pre-teach important academic and nonacademic skills (e.g., the WH-word concepts, requesting help, and self-monitoring) for better transfer to general education settings. Peers can be taught to implement interventions such as least prompts, but training does require notable student and teacher time. Once trained, peer tutors can implement with fidelity.
Kemper (2012)	Lack of bilingual interventionist (poor Spanish pronunciation). Multiple student absences during the intervention. Engagement definition (i.e., eye contact) did not work well for students with autism. Some students lacked prerequisite skills for answering comprehension questions.	Collect information on home communication patterns, family literacy skills, and activities. Design instruction to build from students' existing communication skills, which may be in the native language. Use the same symbols in the adapted text and on the student's communication board. Model physically matching the symbols to the new vocabulary words while reading the text. Define student engagement in ways that are relevant for specific students.

Study	Limitations	Implications for Educators
Rivera et al. (2012)	No maintenance data collected and generalization data only collected after intervention. Instruction with only one visual example (e.g., picture) may have limited students' ability to generalize vocabulary to new examples. Classroom teacher did not conduct the intervention and may have inadvertently provided instruction on some words. A small number of students (n=3) influenced results.	Use PowerPoint to set up and deliver supplemental vocabulary instruction in short increments (10–15 minutes), using basic instructional language in the student's native language. Incorporate interactive whiteboard technology to promote student engagement. Know students' needs and use culturally responsive instruction methods. Use a variety of visual examples of a single word.
Rivera et al. (2013)	Cannot generalize results to larger populations of students with intellectual disabilities. Students not trained to apply vocabulary to a variety of pictures or objects. Lack of student mastery criterion. A Hispanic interventionist may have influenced student responses. Classroom teacher did not conduct an intervention.	Multimedia shared stories and systematic instruction can provide effective vocabulary instruction. Select language of instruction based on individual student need. Understand systematic instruction and applied behavior analysis. Be familiar with computers. Adapt techniques for group instruction of ELs using SMART Boards and Universal Design for Learning principles.
Rivera et al. (2014)	Limited time did not allow for investigation of longer-term vocabulary development trends. Student and educator data cannot be generalized due to small sample size. Required and therefore limited to sites with a bilingual paraprofessional.	Multimedia shared stories on the iPad are easy to incorporate into daily instruction. Creating multimedia stores takes some familiarity and practice but can be used multiple times and modified to meet specific student needs. Students may find technology-based shared reading, engaging, and motivating compared to traditional lessons.

Study	Limitations	Implications for Educators
Rivera et al. (2016)	Single-subject research design useful for demonstrating functional relationship but cannot test generalizability. A low number of words was used in each condition, possibly limiting variation. Did not test the intervention in comparison to other more traditional teaching techniques, so comparative effectiveness is not established.	Incorporate additional instructional information using multimedia-rich features to save on educational time. Utilize mobile technology such as the iPad to reduce downsides of technology-based intervention (including shared reading) and maximize student access and engagement.
Rivera et al. (2017)	Multi-component intervention, including many best practices, limits causal inferences. Instruction provided by outside interventionist, not classroom staff. Intervention delivered in a one-on-one setting which may not be feasible for all classrooms.	Personalize books and lessons using MSS and iPads to specific student interests and needs. iBooks Author and other software offer the opportunity for individualized books with relative ease. Development of MSS resources can be beneficial, but time-consuming; plan for this. Use a system of least prompts or other EBPs to teach digital literacy skills and technology use skills.
Rohena et al. (2002)	A small number of students limits the applicability of findings. Scheduling problems prevented the collection of generalization data for one student. Generalization sessions held in stores were unstructured because of the nature of activities.	Select words that are functional. Use repetition, modeling, and verbal and visual cues during instruction. Match the language required for activities to the student's English proficiency. Provide culturally relevant activities.

Study	Limitations	Implications for Educators
Spooner et al. (2009)	The student may not have maintained performance in the English-only condition over the long term. Limited time for the intervention required moving the student to the second phase of the intervention before meeting mastery criteria. Only one student participated, limiting the generalizability of the results to other groups. Mixing the language of instruction may have confounded study results.	Provide native language support during academic instruction to help ELs with an intellectual disability transition to English and develop optimal literacy skills.
Spooner et al. (2015)	Limited generalizability due to research design. The intervention occurred in small teacher office, not the classroom, and the interventionist was not the student's teacher.	When designing technology-based shared reading activities, embed response or student participation options. Consider offering re-read or options for students to listen again. Systematic instruction is a critical component of the tech-based intervention.

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