

The Dearth of Technology-Based Intervention
for English Language Learners with Learning
Disability--A systematical Literature Review

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What specific controversy is addressed?

The intersection of efficacious interventions for **English learners** with evidence-based practice for **students with learning disabilities (LD)** and the issue of **digital divide** among disabled people.



Specific Learning Disabilities (SLD)

Specific Learning Disabilities (SLD) is defined as "experiencing problems in academic skills such as spelling, fluent reading, reading comprehension, writing and calculating while having normal or over-normal intelligence and having some or similar educational settings" by the World Health Organization and The Diagnostic and Statistical Manual of Mental Disorder 5(DSM-5). When the problems experienced by children with SLD are examined from a neurodevelopmental perspective, it was detected that the

children did not have typical sensory, motor, and cognitive developmental parameters (Barkin et.al.2022).

Digital Divide

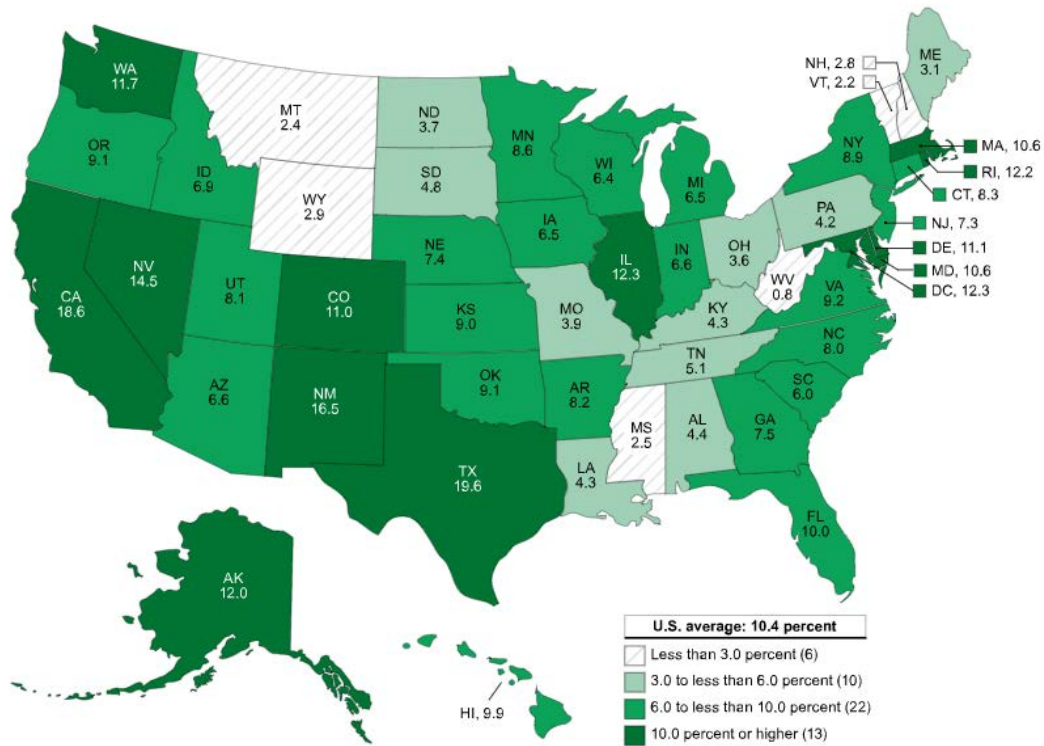
Digital divide is defined as inequities in the way technology is used. Tyson (2015) argued that marginalized populations, such as students with disabilities, continue to suffer from the digital divide.



Why is this problem important?

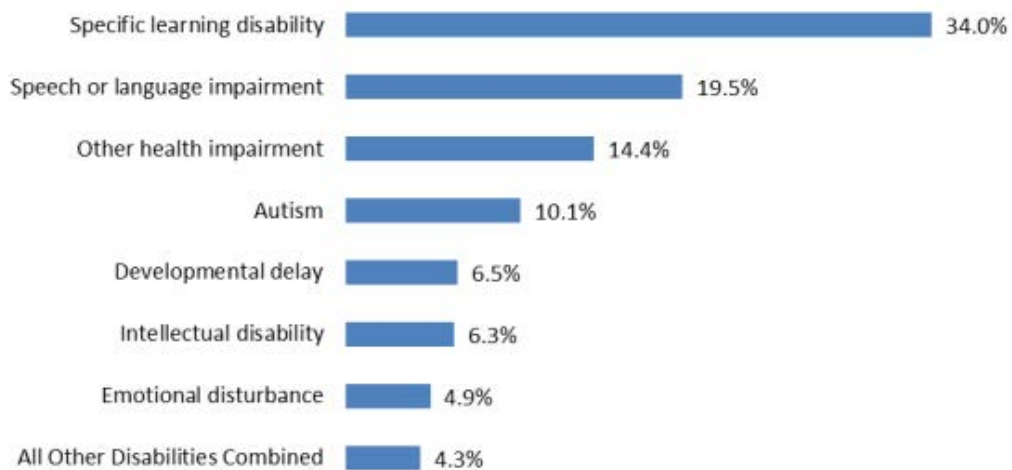
English language learners with learning disabilities

Figure 1. Percentage of public school students who were English learners (ELs), by state and categorized into specific ranges: Fall 2019



NOTE: U.S. average is for the 50 states and the District of Columbia. Categorizations are based on unrounded percentages.
 SOURCE: U.S. Department of Education, National Center for Education Statistics, EDData file 141, Data Group 678, extracted March 31, 2021; and Common Core of Data (CCD), "Local Education Agency Universe Survey," 2019–20. See *Digest of Education Statistics 2021*, table 204.20.

Percentage of public school students who were English learners (ELs), by state and categorized into a specific range: Fall 2019



Disability Distribution for Students Ages 3 through 21 Receiving Special Education and Related Services under IDEA, Part B: Fall 2017

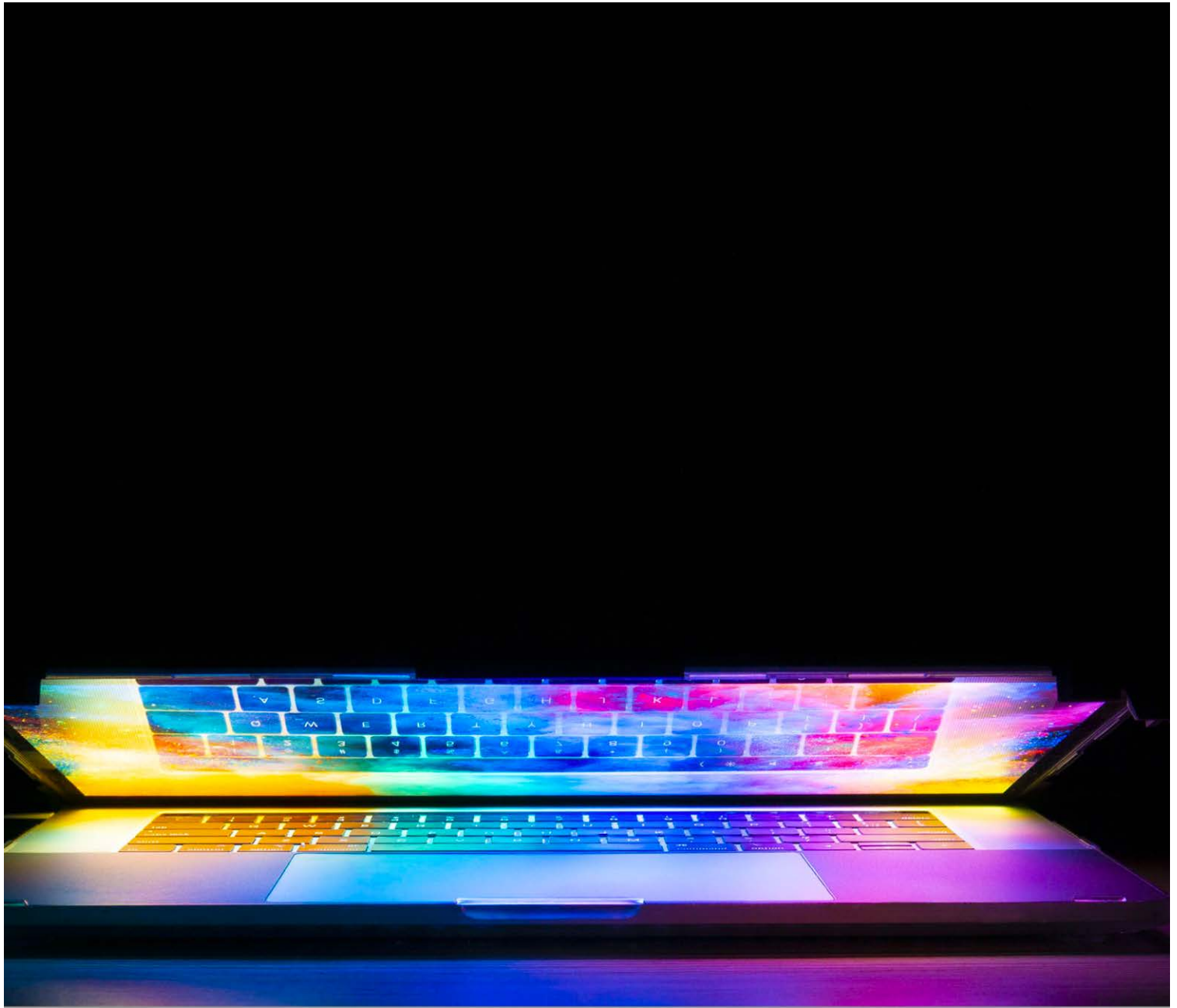
14% of all students have a disability. Of the 8 disability categories, **Specific Learning Disability (LD)** is the largest: 34% of student with disabilities qualify for special education services under this categories (Digest of Education Statistics, 2020; Table 204.30)

Approximately 720,000 English Language Learners are also identified as having a learning disability. 63% of students with disabilities spend 80% or more of their day in general education classrooms.

Students with Learning Disabilities (LD) are cognitively capable, but have difficulty learning for a specific reason (e.g. processing, working memory). The difficulty must not primarily be due to visual, hearing, or motor disabilities; intellectual disability; emotional disturbance, or environmental, cultural, or economic disadvantage to be identified with LD.



The majority of students with LD have difficulty with language, whether written, spoken, read, heard, or thought (Swanson, Harris, & Graham, 2013)



How will the study add to what we already know about this problem?

Many reviews of the literature have provided useful summaries of intervention research up to 2021, it is still unclear what technology-based interventions have been applied for English learners with learning disabilities (ELwLD)

and if there is any research-based evidence of technology-based interventions can facilitate learning for ELwLD.

The purpose of this research review was to fill in the gap in the current literature base by summarizing studies on technology-based interventions for ELwLD to understand in what way technology-based interventions have been used to facilitate ELwLD, and if there were research-based evidence to support learning.

Our research questions were as follows:

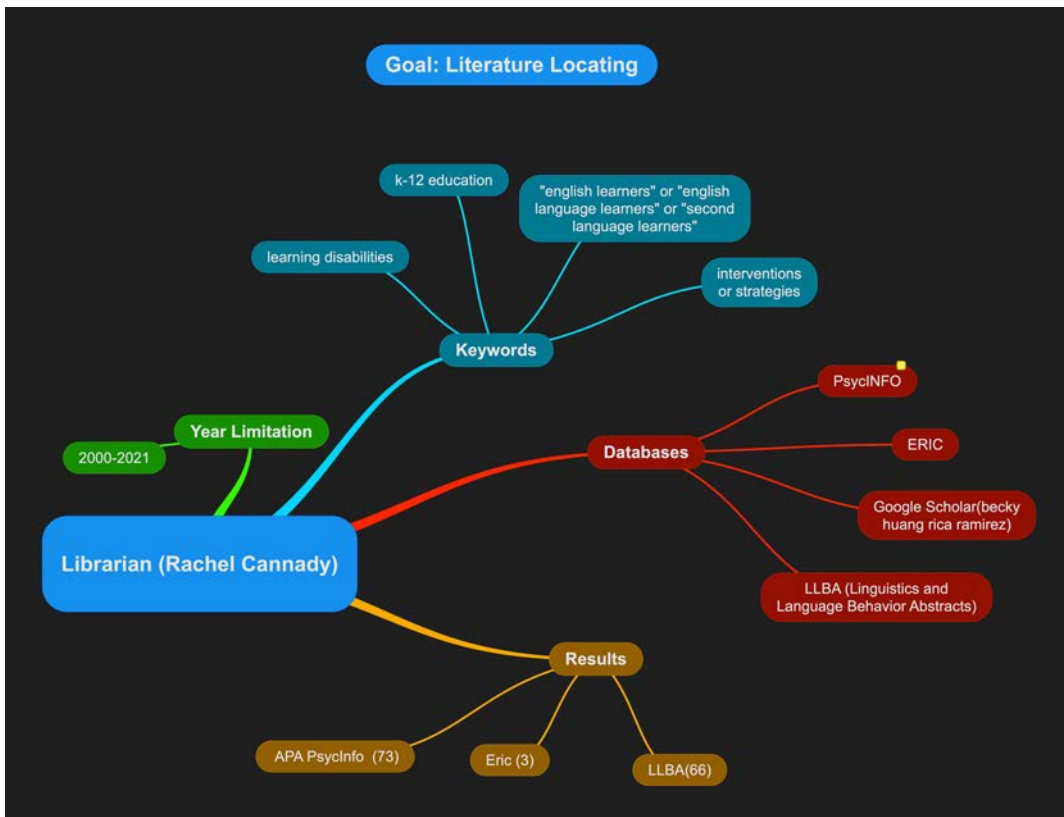
(1) What are the characteristics of the technology-based interventions designed for ELwLD (i.e., delivery formats and types of technology) in the included studies?

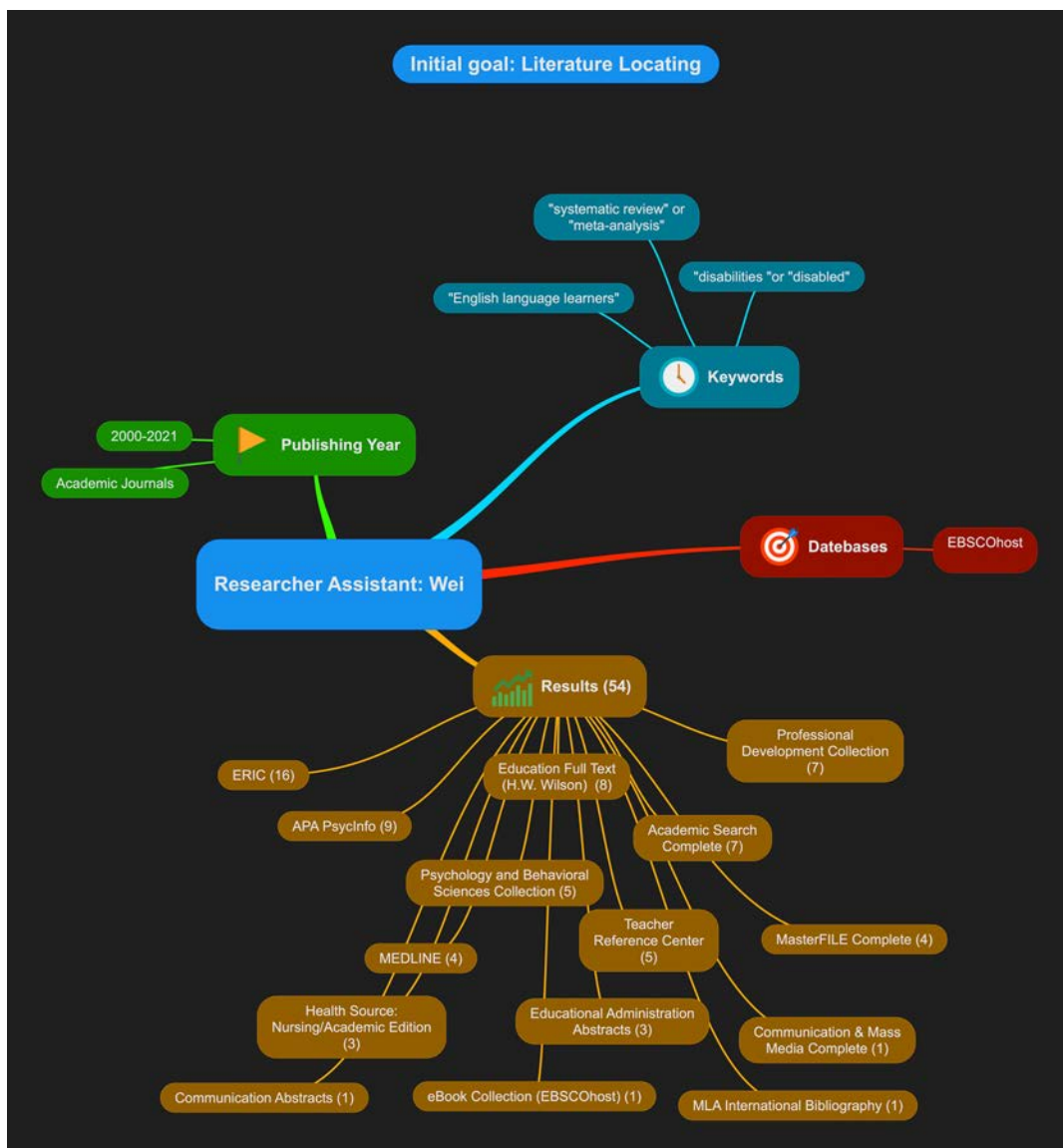
(2) What practical implications were outlined to inform future research and learning practice for technology-based Interventions designed for ELwLD?

| *Research Method*

1. Literature Screening

Literature screening criteria	
1. Reference type	
<ul style="list-style-type: none"> • Include if it is a journal article. • Exclude if it is any other reference type such as dissertation, book, abstract, report, or an informative/descriptive article etc. • Exclude if it is a literature review, meta-analysis 	
2. Language	
<ul style="list-style-type: none"> • Include if written in English • Exclude if written in any other language 	
3. Published year	
<ul style="list-style-type: none"> • Include if it was published between 01/01/2002—12/31/2022 • Exclude if it was not published between 01/01/2002—12/31/2022 	
4. Research Design	
<ul style="list-style-type: none"> • Include if study apply an intervention • Exclude if study does not apply an intervention. 	
5. Participant	
Disability Status	
<ul style="list-style-type: none"> • Include if participants have learning disabilities • Exclude if the primary disability of the Participants is other than Learning disabilities 	
English Language Learners	
<ul style="list-style-type: none"> • Include if participants are English Language Learners • Exclude if the participants are not English language learners. 	
School setting	
<ul style="list-style-type: none"> • Include if it is in K-12 • Exclude if it is not in K-12 	



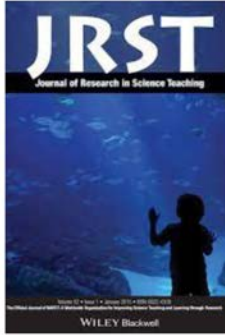


Journal of Research on Educational Effectiveness



The Journal of Research on Educational Effectiveness is an international, peer-reviewed journal publishing high-quality, original research. It aims to publish articles with the highest standards of methodological rigor that are relevant to practitioners, policymakers, and/or researchers. JREE publishes substantive research on factors important to educational success and methodological studies that improve our ability to conduct educational research. With a focus on educational effectiveness, most JREE articles have a connection to causal inference.

Journal of Research in Science Teaching



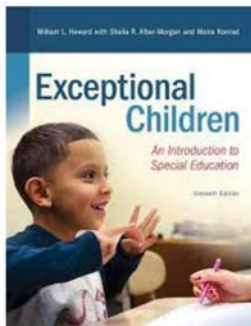
Journal of Research in Science and Teaching the official journal of the National Association for Research in Science Teaching publishes reports for science education researchers and practitioners on issues of science teaching and learning and science education policy. Scholarly manuscripts within the domain of the Journal of Research in Science and Teaching include but are not limited to investigations employing qualitative ethnographic historical survey philosophical or case study research approaches; position papers; policy perspectives; critical reviews of the literature; and comments and criticism.

American Educational Research Journal



The American Educational Research Journal (AERJ) is the flagship journal of AERA, with articles that advance the empirical, theoretical, and methodological understanding of education and learning. It publishes original peer-reviewed analyses spanning the field of education research across all subfields and disciplines and all levels of analysis, all levels of education throughout the life span and all forms of learning. Submissions reflect the highest quality in a wide range of perspectives, topics, contexts, and methods.

Exceptional Children

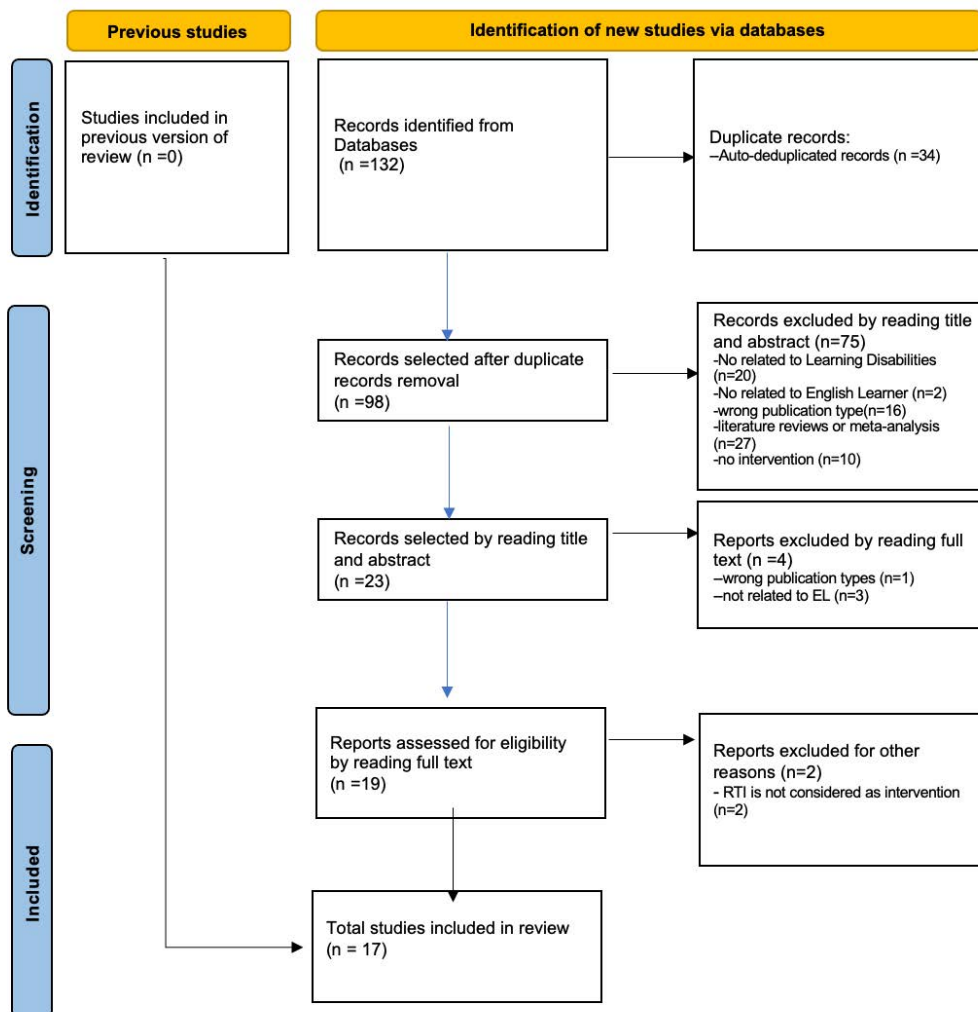


Insightful and pioneering research, topical issues and broad perspectives by leaders in the field for more than 75 years have made Exceptional Children (EC) the most respected scholarly journal in special education. This peer-reviewed journal publishes research, research reviews, methodological reviews of literature, data-based position papers, and policy analyses on the education and development of children and youth with exceptionalities. EC, published quarterly, is an official journal of the Council for Exceptional Children. This journal is a member of [COPE](#).

IRR Checking

APA Psycholo	73				Another set of discussion is pressing theories of word-recognition development. These theories combine to help us understand (1) the process through which reading emerges in their development, (2) how automatically with word recognition may be achieved, and (3) the impact this development has on more sophisticated aspects of reading. We propose that teachers consider four different purposes for word-recognition assessment: screening, diagnosis, progress monitoring, and outcomes. Specific examples of each type of assessment are described and illustrated. Finally, we discuss the use of word-recognition assessments with two populations of diverse learners: students with learning disabilities and English language learners.	book chapter		
APA Psycholo	73	2021	Journal of Learning Disabilities	O'Connor, Kellianna E., Sanchez, Victoria M., Jones, Brian T., Sackell, Luana, Yoshikawa, Victoria J., Beach, Kristin D., Williams, Keith	Systematic CRAMOS: Teaching vocabulary in English language arts special education classes in middle school	In this multi-year study, we taught English Language Arts teachers of students with learning disabilities in middle school to incorporate 15 min of daily vocabulary activities with students in their intact special education English Language Arts classes. During Year 1, teachers taught 48 words to their sixth grade students, who learned and retained the words significantly better than the students in business-as-usual (BAU) control classes. In the current study, we report the second year results, as the sixth grade students entered seventh grade. Students (n = 42) in treatment classes again learned 48 new vocabulary words significantly better than control students in BAU (n = 23) special education classes. In seventh grade, students also outperformed BAU students on maintenance of these age-appropriate words (p < .001) and on a standardized measure of fluency (p < .05). (Psycholo Database Record(s) 2021 APA, all rights reserved)	Journal Articles	Yes, if it's included
APA Psycholo	73	2021	Learning Disabilities Research and Practice	Aricomendi, Genaro D., Li, Ai-Feng, Van Hien, M. Lee, Paves, William D., Beaman, H. Lee	Language-focused interventions on math performance for English learners: A selective meta-analysis of the literature	This meta-analysis synthesized research on math performance outcomes for English learners (ELs) as a function of language-focused (math-vocabulary) interventions. We included group and single-subject design studies with children from kindergarten to fifth grade (236 students) for group, 50 for single-subject. Group studies yielded a mean Hedge's g of 0.26 in favor of the intervention relative to the control condition, whereas single-subject studies yielded a mean Percentage of Non-Overlapping All Pairs of Scales (P-NAS) of 0.65 relative to baseline. Although group studies yielded a mean effect size (ES), we found significant moderators for grade level, intervention focus, and length of intervention. Single-subject studies yielded higher ESs than group studies, and were considered generally effective, with a high ES. This finding was attributed to a direct focus on children with math difficulties and one-to-one instruction. The implications for practice and future research are discussed. (Psycholo Database Record(s) 2021 APA, all rights reserved)	Journal Articles	No meta-analysis
APA Psycholo	73	2021	Reading and Writing Quarterly	Alli, Arshadul, Mohd. Badi, & Mohan Kumar, Prithvika	The relationship among elementary English as a Foreign Language learners' herpetologic dominance, metacognitive reading strategies preferences, and reading comprehension	The present study has reviewed a picture of research to study the relationship between reading strategies and reading comprehension, but few studies have examined the brain functionality, more specifically the relationship between herpetologic dominance and reading strategies. Therefore, this study aimed to investigate whether there would be any relationship among elementary English as a Foreign Language (EFL) learners' herpetologic dominance (LH, Right and White-Inverse dominance), their reading strategies, and reading comprehension. To this end, 47 elementary EFL students were selected based on convenience sampling, after discussing the participant's basic demographics, they completed a series of reading strategies (RS) in order to identify their general preferences of reading strategies. Then a Reading Comprehension Test (RCT) was administered to examine the students' reading comprehension proficiency. The results demonstrated that most of the students were left-brain who generally preferred to employ problem-solving strategies (PSOS). Furthermore, no significant relationship was found between herpetologic dominance, reading strategies, and reading comprehension of these elementary EFL students. The results had also some implications for teachers teaching that they should consider their students' individual differences in terms of herpetologic and adopt or balance their teaching techniques based on the students' brain dominance types (herpetologic) and strategies or at least be sensitive to their. (Psycholo Database Record(s) 2021 APA, all rights reserved)	Journal Articles	NO - search researching an intervention
APA Psycholo	73	2020	Learning Disabilities Quarterly	Sandford, Amanda K., Pinsky, Christopher J., Brown, Mike, Espino, Elliott, Cameron O. Brown, Emily N. Sennott, Samuel C.	Culturally and linguistically responsive mathematics instruction for English learners in multilingual support systems: PLEIS interventions	This study examined the impact of linguistic and cultural interventions to enhance second mathematics instruction within a multilingual support system for English learners. The study employed a single subject changing criteria design for four fourth-grade students who were English learners with or at risk of a learning disability diagnosis in mathematics. Three dependent variables were mathematics vocabulary acquisition and application in item production. Student performance on identifying the correct mathematics vocabulary words when given the definition was measured across baseline and four phases of intervention. Students were also assessed on their ability to complete story problems that contained the target vocabulary. At each phase of the intervention, students showed an increase in performance on both vocabulary words correctly identified and story problems correctly completed. Implications for practice and future directions for research are discussed. (Psycholo Database Record(s) 2021 APA, all rights reserved)	Journal Articles	Yes
APA Psycholo	73	2020	Reading & writing quarterly	Xie, Yan Peng, Kim, Soo Jung, Lee, Qingli, Wei, Shuang Lin, Biqing, Wang, Waling, Kaufman, Roger, Chen, Yiqun, Yang, Xian, Mo, Xuequn, Richardson, Sue Ellen	The effect of computer-aided conceptual understanding intervention program on mathematics problem-solving performance of at-risk English learners	According to Every Student Succeeds Act, schools are accountable for the improvement of all children, including those with disabilities or difficulties, recently arrived English language learners (ELLs) as well as long-term ELLs and all students for whom English is not their native language. To meet the accountability requirements, it is essential to provide both linguistic and content-specific interventions to address these students' achievement gaps in mathematics. Using a single-subject design, the purpose of this study was to evaluate the effect of computer-aided Conceptual Model-based Problem Solving (COMPS) on an additive word problem-solving performance of ELLs with learning difficulties in mathematics. Findings indicate that all four participants improved their performance on researcher-developed criterion test as well as a generalization test following the intervention. It seems that features such as conceptual model-based visual scaffolding and linguistic scaffolding found in the COMPS may have contributed to students' access to learning mathematics and the positive outcome of this study. (Psycholo Database Record(s) 2021 APA, all rights reserved)	Journal Articles	Yes
APA Psycholo	73	2020	Journal of Learning Disabilities	Young, Susanna S., et al., Sergio, Robert	Teaching phoneme-phonics correspondences using a direct mapping approach for at-risk second language learners: A randomized controlled trial	Reading interventions developed to teach grapheme-phoneme correspondences (GPCs) were evaluated among 12 at-risk readers. In the direct mapping of grapheme (DM) condition, children's attention was explicitly drawn to the application of a grapheme taught on that day to shared reading of words in authentic text. In the control condition there was no such systematic daily linkage of the GPCs and text. The two reading interventions were otherwise identical. Two hundred-fifty-three Chinese Grade 1 and Grade 2 students were screened, and those who scored in the bottom 50% of an English word-reading test were identified as 12 at-risk readers. Seventy-one 12 at-risk readers were then randomly assigned to two conditions, both of which were single-group reading interventions: (a) DM or (b) text control. We hypothesized a significant main effect of intervention condition and significant interaction of intervention by Phonological Awareness (PA) effects on word reading, word attack, spelling, and sentence comprehension following the DM intervention. Results showed that predicted interaction effects were significant for word reading, spelling, and sentence comprehension. No other effects were significant. Results suggest that the daily Direct Mapping of single GPCs to shared book reading promotes reading.	Journal Articles	

IRR checking



Prisma

2. Coding

Code book		
Front Matter		
authors	definitions	codes
Year of publication	List first three then et al	
published in	Name of the Journal	
Publication title		
Research Design characteristics		
Research method		mixed methods(both groups) qualitative group study single case Research Design
Participants characteristics		
N_SAMPLE	total sample size	N=
Gender Reported		Yes Male Female No
Participant ethnicity	Only use "More than one" if that is specifically identified in the participant description in the methods section.	Caucasian/White Hispanic Asian Black More than one
participant location		urban suburban rural metropolitan not reported
participants Grades		N/A Not reported K Elementary Middle High Postsecondary
Disability Type		Only ELwLD ELwLD and other disabilities
Setting characteristics		
Intervention setting		N/A Academic performance Employment relevant behaviors or skills On-task behaviors Reduce Problem behaviors Socially relevant behaviors researcher (or research team)

◀ ▶
Inclusion Criteria
Codebook
Coding
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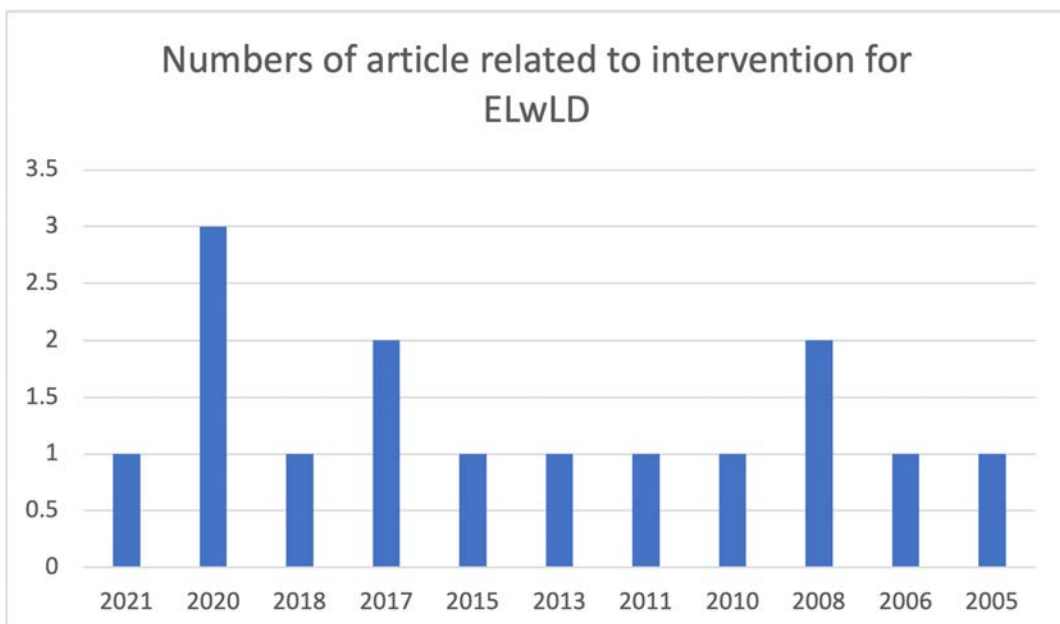
Study ID	Front Matter				Research Design		Participants							
	Author(s) (last three then et al)	Year of Publication	Publication	Publication Title	Research Methods	N-Group (Final Sample Size)	Gender Reported	Participant Ethnicity	Participant Location	Participant Grades	Disability Type			
1	O'Connor, Rebecca E., Sanchez et al.	2022	Journal of Learning Disabilities	Systematic COVID-19 Teaching vulnerability in English language learners with intellectual disability school	Group Study	multiple group study	68 students baseline assessment of Treatment n=68	Yes	68 male 23 female	Hispanic 15, white 50, Black 3, Asian 7, missing 7	California	7 grade	EL and/or other disabilities	77% learning disabilities 10% other health impairment 13% special language impairment
2	Garfield, Amanda K, Pinkney et al.	2020	Learning Disabilities Quarterly	Culturally and linguistically responsive mathematics instruction for English learners in middle school classrooms: PRACTICE enhancements	Single Subject Design	A-B-E-B-E-B-E-B changing criterion design	4 students	No	Hispanic 4	4 middle elementary schools in Florida, the Pacific Northwest	4 grade	EL and/or other disabilities	Learning Disabilities in both English and Mathematics	
3	Ma, Yan, Shen et al.	2020	Reading and Writing Quarterly	The effect of computer assisted contextual model based instruction on reading and mathematics reading writing performance of 168 English learners	Single Subject Design	self-paced multiple probe design in two parts groups	8 students	No	N/A	urban elementary in Florida the Midwest United States	N/A	EL and/or other disabilities	Learning Disabilities in both English and Mathematics	
4	Wilkins, Kelly, Douglas et al.	2020	Learning Disabilities Quarterly	Efficacy of an evidence-based intervention for middle-grade English learners with learning disability	Group Study	treatment and comparison	88 students	Yes	88 males 23 females	diverse in grades 4-6	diverse high school in a diverse urban midwestern U.S. school district	4 grade	EL and/or other disabilities	50-75 50-75 50-75 50-75
5	Carroll, Carline, Nguyen, Gopal et al.	2018	Reading and Writing Quarterly	The impact of self-regulated strategy development on the writing performance of English learners	Single Subject Design	a single subject multiple probe design	9 students	Yes	4 males 5 females	N/A	4 public elementary schools in the Midwest	2 grade & 4 grade	EL and/or other disabilities	Having a developmental delay Learning Disability
6	Isabel, Sara L., Douglas et al.	2017	Learning Disabilities Quarterly	Efficacy of multi-component academic vocabulary instruction for English learners with learning disabilities	Single Subject Design	multiple probe design	6 students	Yes	4 males 2 females	Mexican American	public elementary school	3 grade	Only EL and/or	
7	Brown, Melissa J., Powell et al.	2017	Learning Disabilities Quarterly	Culturally and linguistically responsive science instruction: Improving science writing for English language learners with mathematics	Group Study	a quasi-experiment	3 students	Yes	4 males 3 females	EL white Asian/lat	2 culturally and linguistically diverse public elementary schools in the mid-Atlantic	3 grade	Only EL and/or	Learning Disabilities in both English and Mathematics

Setting				Variables			Technology			Implementation & Outcomes			
Intervention	Comparison	Intervention Setting	Intervention Type	Measure	Measured Variable/Outcome	Technology Applied	Technology Features	Technology Implementation	Number of Participants	Measures of Impact	Statistical Control	Researcher Assessed	Risk for the outcome
Academic Performance	Control Group (no intervention)	Elementary School	Language Arts	Reading/Writing Score	Reading/Writing Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention
Academic Performance	Control Group (no intervention)	Elementary School	Mathematics	Mathematics Score	Mathematics Score	Yes	Interactive software	Yes	100	Effect Size	Yes	Yes	Control group received no intervention

IRR checking

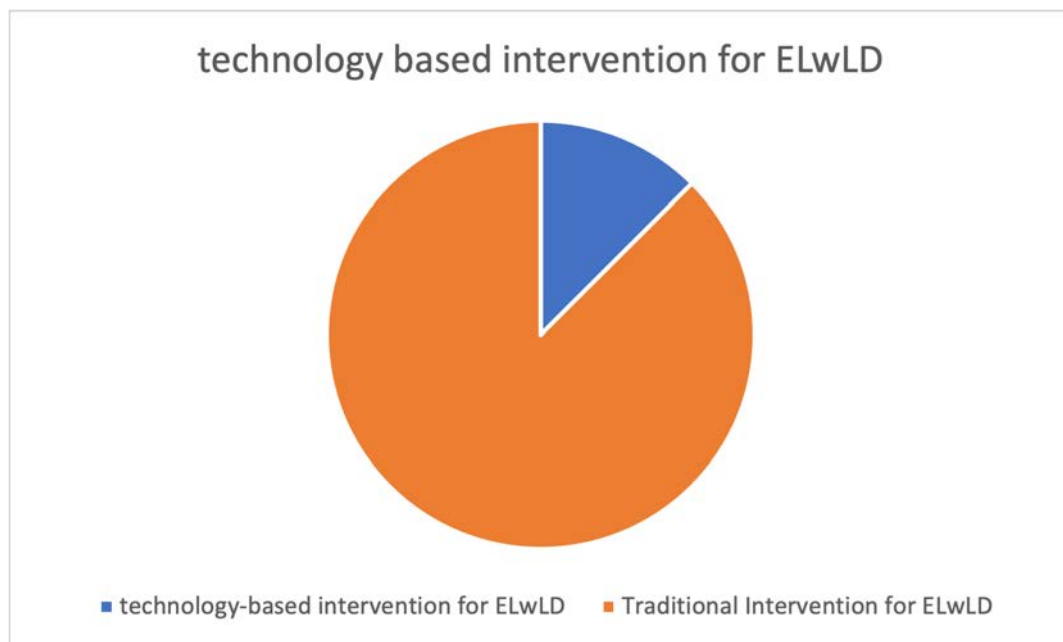
Publishing Year	Journal	Authors	Title
2021	Journal of Learning Disabilities	O'Connor, Bolland, E., Sanchez, Victoria M.; Jones, Brian T.; Suchlit, Luisana; Youkhanna, Valencia; Beach, Kristen D.; Widaman, Keith	Systematic CHAAS: Teaching vocabulary in English/Language Arts special education classes in middle school
2020	Learning Disability Quarterly	Sanford, Amanda K. Pinkney, Christopher J. Brown, Julie Esparza, Elliott, Cameron G. Roter, Emily N. Sennott, Samuel C.	Culturally and linguistically responsive mathematics instruction for English learners in multitiered support systems: PLUS enhancements
2020	Reading & Writing Quarterly	Xin, Yan Ping; Kim, Soo Jung; Lei, Qingli; Wei, Shuang; Liu, Bingxu; Wang, Wudong; Kastberg, Signe; Chen, Yingjie; Yang, Xuan; Ma, Xiaojun; Richardson, Sue Ellen	The effect of computer-assisted conceptual model-based intervention program on mathematics problem-solving performance of at-risk English learners
2020	Learning Disability Quarterly	Williams, Kelly, Vaughn, Sharon	Effects of an intensive reading intervention for ninth-grade English learners with learning disabilities
2018	Reading & writing quarterly	Cuenca-Carino, Yojanna; Gvoz, Marcelena; Jozwik, Sara; Krissinger, Emma	The impact of self-regulated strategy development on the writing performance of English learners
2017	Learning disability quarterly	Jozwik, Sara; Douglas, Karen H.	Effects of multicomponent academic vocabulary instruction for English learners with learning difficulties

3. Analyzing



For ELwLD Of the 63 intervention studies, only 28 articles (0.45%) addressed the needs of ELwLD . Three interventions had an experimental design (Denton et al., 2008; Sáenz, Fuchs, & Fuchs, 2005; Wanzek et al., 2016), seven were single subject studies (De La Paz & Sherman, 2013; Helman, Calhoun, & Kern, 2015; Jozwik & Douglass, 2016; Jozwik & Douglas, 2017; Kim & Linan-Thompson, 2013; Preciado et al., 2009; Viel-Ruma et al., 2010), and two were quasi experimental (O'Connor et al., 2015; O'Connor et al., 2017).

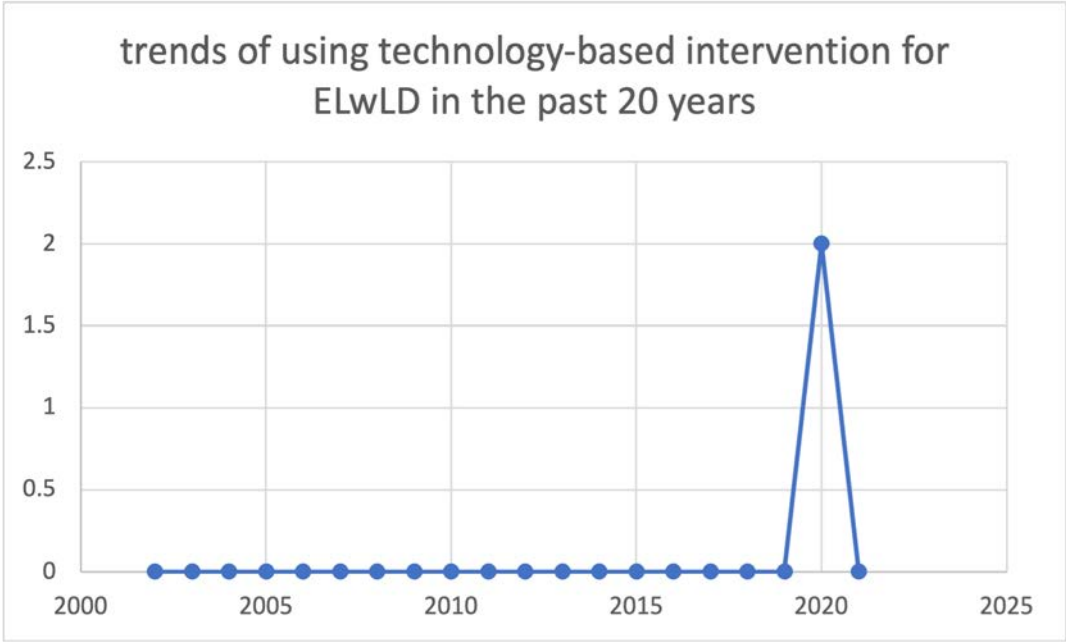
Technology based intervention for SLwLD



Among 16 articles related to intervention for ELwLD, only two articles(Sanford et.al., 2020, Xin et al., 2020) used technology-based intervention, approximately 12.5%.

Sanford et. al., (2020) conducted a single-subject design in their culturally and linguistically responsive mathematics instruction for English learners, and Xin et. al., (2020) also conducted a single-subject design in their research to test the effect of computer-assisted conceptual model-based

intervention program on mathematics problem-solving performance of at- risk English learners.





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<https://www.everycrsreport.com/reports/R41833.html>

<https://nces.ed.gov/programs/coe/indicator/cgf/english-learners>

U.S. Department of Education, EDFacts Data Warehouse (EDW): "IDEA Part B Child Count and Educational Environments Collection," 2017-2018,
<http://www2.ed.gov/programs/osepidea/618-data/index.html>.



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Credits:

Created with images by kitsana - "Golden powder explosion on black background." · Chris de Blank - "Bare tree in the mist in South West Western Australia" · eakarar - "Textures of natural abstract black leaves for tropical leaf background, black and white images" · Anastassiya - "Golden glitter bokeh lights on black background, unfocused. Holiday time." · Artinun - "Small green leaves texture background with beautiful pattern. Clean environment. Ornamental plant in the Eco garden. Organic natural background. Many leaves reduce dust in the air. Tropical forest." · alexskopje - "Thank you text and fountain pen"

