A systematic review of language and literacy interventions in children and adolescents with English as an additional language (EAL)

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Currently in the England, more than one in five primary school children and one in six secondary school children speak English as an additional language (EAL) (Department for Education 2018). Historically, children with EAL have underperformed in state exams in primary school (Demie 2018) and have a smaller vocabulary than their English-speaking peers (Mahon and Crutchley 2006). This systematic review presents a synthesis of evidence regarding the effectiveness of language and literacy interventions targeting children with EAL. It updates the systematic review by Murphy and Unthiah (2015), using the same methodology. Four databases were searched resulting in 2217 records identified. After screening 25 interventions, found in 26 studies, were eligible for inclusion. The results provide collective evidence that explicit vocabulary instruction and targeted oral language practice yield language gains for EAL learners, with a tendency for larger intervention gains in learners with the lowest initial pre-test scores. Shared reading interventions show positive effects when combined with the pre-teaching of vocabulary, embedded definitions into the text, or post-reading reinforcement activities. The review also highlights the paucity of interventions in the UK and in particular, a lack of interventions for adolescents, especially those in upper secondary school (ages 14-18).

Keywords: English as an additional language, intervention, language skills, literacy, reading comprehension

Introduction

EAL in the UK

The Department of Education defines a pupil as having English as an additional language (EAL) if that pupil was exposed to a language other than English during early development, and continues to be exposed to that language in the home or community. EAL children are a heterogeneous group with varying levels of English fluency ranging from little to no English language in the case of new arrivals, to those who were born in in the UK and are English-dominant. In January 2018 21.2.% of pupils in English state-funded primary schools were classed as having English as an additional language which is a rise of approximately 3.7% since 2012 (Department for Education 2012 2018). In state-funded secondary schools, 16.6% of pupils are classed as EAL, a rise of 3.7% over 6 years.

With a steadily increasing population of EAL children across the UK, schools are having to adapt in order to ensure suitable provision is made for pupils to access the curriculum. Historically, EAL pupils have underperformed in state-wide Key Stage 2 examinations in reading, writing and maths at age 11 compared to their monolingual English-speaking peers (Demie 2018) and numerous studies have shown that children with EAL have an English vocabulary deficit (Mahon and Crutchley 2006), persisting until the end of primary school (Strand, Malmberg and Hall 2015). Although it appears that EAL pupils can 'catch up' by the end of secondary school (Strand et al. 2015), the heterogeneity of this group can lead to misleading assessments of overall group performance. The low attainment of pupils at the early stages of developing fluency are masked by those who are fully fluent in English (Demie 2018). EAL attainment is multifaceted, depending upon variables such as age of arrival and home language (Hutchinson 2018). For example, children who arrived in the UK before secondary school achieve on average a grade C at GCSE examinations taken at age 16, compared to grade D for children who arrived between the ages of 11 and 15, and lower than an E on average is achieved by children who arrive during the final year of Key Stage 4, prior to GCSEs (Hutchinson 2018). There is a pressing need to identify language interventions able to improve the educational outcomes of EAL pupils, especially those most at risk of underachievement.

Objectives

The United Kingdom context features current growth in the number of EAL children and (up to 2014) a paucity of scientific evidence on effective intervention to support these children. The first aim of the review is to synthesise the language and literacy outcomes of recent interventions with a population of EAL pupils undertaking their schooling in English. It seeks to investigate which methods of intervention are most effective for language and literacy outcomes and which do not have a significant impact. A second purpose of this study is to identify areas for further research, particularly within the context of the UK.

Methods

Information sources and search

Searches were conducted using the databases British Education Index, Web of Science, Educational Resources Information Center and Language and Linguistics Behavioural Abstracts. Search terms used were from the original systematic review (Murphy and Unthiah 2015), as listed in Table 1. The final search was conducted on the 20th March

2017. All searches were exported into an Endnote Library and combined, resulting in 2217 search items. After de-duplication, there remained 1849 items.

[Table 1 about here]

Eligibility criteria

For the purpose of this review, the population included children with EAL and their monolingual peers. The main focus was on school children in education (i.e. at primary or secondary school). Papers were excluded if they focused on preschool children or students in higher education. The papers chosen were published between 2014 and 2017, peer reviewed and written in English. One researcher screened all titles and abstracts. A second researcher screened a random sample of 10% of the results (based on a random sequence generated by random.org). Inter-rater agreement was 96% at first screening, and after discussion inter-rater agreement was 100%. The main elimination reasons at abstract screening were: a lack of randomised control trial/quasi-experimental trials (n =405); learners were not in the targeted age-bracket (pre-school or post-secondary) (n = 399); or the learners did not have English as an additional language (n = 350). One hundred and eighty-five texts remained for full text screening according to the inclusion and exclusion criteria shown. The same screening procedure was followed with full texts, with 100% agreement between raters. Full text screening resulted in 26 texts eligible for data extraction.

Inclusion and exclusion criteria

The inclusion criteria were as follows:

1. Must include children in education
2. Must include a control or comparator group
3. Must involve or report on a language or literacy intervention
4. Must collect and report on empirical data
5. Must analyse progress of EAL learners
6. Language of instruction must be English
7. Language of the wider community must be English

The exclusion criteria were:

1. The studies are not research studies
2. There is no language or literacy related intervention
3. The learners are of the wrong age
4. There is no body of empirical data or systematic analysis
5. The learners do not have English as an additional language
6. The study is published before 2014
7. The learners have a special educational need
8. There is no comparator and/or control group
9. The learners are in bilingual immersion classrooms

[Figure 1 about here]

Data extraction

Full text screening revealed 26 texts eligible for inclusion in this review, corresponding to 25 interventions. Data were extracted using an adaptation of the Cochrane data extraction

form (Chandler, Mckenzie, Boutron and Welch 2014). Data were extracted for all texts (*n*= 26) by two researchers (50% of studies each). All data extraction forms were then scrutinised for accuracy. Data extraction considered participant numbers, sex, age, language status, intervention types, use of a control or comparison group, baseline measures and the dependent variables. All disagreements following data extraction were resolved following discussion.

Assessment of bias

Assessment of bias was carried out using the Risk of Bias tool (Cochrane 2014). This method of bias assessment considers effective selection and randomisation methods, as well as the blinding of participants to the intervention and selective outcome reporting. Due to the specific nature of the interventions in this study, the researchers additionally considered bias based upon the outcome measures used. For example, studies which used only researcher-developed outcome measures with no validity measurements would be classed as having a high risk of bias, whereas standardised outcome measures would be classed as having low risk of bias. Studies which included both were considered as having a medium risk of bias. Two researchers assessed the risk of bias for all interventions in this report. Each researcher rated the studies listed as having either a low, medium or high risk of bias. Inter-rater agreement was 84.6%. Where disagreements occurred, we conservatively took the lowest judgement. For example, if reviewer one gave a study a bias rating of 'low' and reviewer two gave a rating of 'medium', we judged the overall bias as 'low'. When one reviewer gave a rating of 'high' and a second gave a rating of 'low', we assessed the bias as 'medium'. The reviewers were experienced language researchers.

Characteristics of the studies

Twenty three of the 26 studies in this review originated in the USA; one intervention study originated in the United Kingdom, one in Canada and one in Lesotho.

[Table 2 about here]

It is unsurprising that the majority of the research studies in this review originated in the USA. Murphy and Unthiah (2015) reported similar findings and concluded a need for high quality EAL interventions in the United Kingdom. The present review highlights that this paucity of interventions still remains, three years later.

Our inclusion criteria stated that the language of the wider community must be English. We decided to allow in this synthesis a study from Lesotho as English is one of the country's official languages and is used as a language of education. In this context, children arrive at school with no knowledge of the language of instruction, as is the case with new arrival EAL pupils in the UK.

Participants' languages

[Table 3 about here]

Across the 25 interventions, reported in 26 studies, there was a total of 32 languages spoken (in addition to English). Fifteen of the 26 studies included pupils who spoke Spanish, three of which were with groups of pupils all of whom spoke Spanish. Six interventions did not specify the languages spoken by the pupils.

[Table 4 about here]

Results

All interventions consisted of language or literacy support and intervention types were broken down by the primary focus. This focus was either language (e.g. vocabulary, morphology, oral language skills) or literacy (e.g. reading comprehension, writing, reading fluency, family literacy). A breakdown of the interventions by type can be seen below (*n*=26).

[Table 5 about here]

Language-focused interventions

Of the 11 language-focused interventions, 10 had a primary focus on vocabulary, implemented with differing intervention methods (see Table 6), such as academic vocabulary taught through morphology (Crosson and Moore 2017), vocabulary taught with sign-language support (Marshall and Hobsbaum 2015) or vocabulary encountered during shared reading (August et al. 2016; Vadasy and Sanders 2015). The remaining intervention (Greenfader et al. 2015), looked at vocabulary among other language areas following an oral language intervention which focused not only on vocabulary but also on voice projection, narrative discourse, story construction, and story recall.

The interventions had small to large effects on language development of EAL children (see Table 8). However, six interventions were classified as having a high risk of bias (see Table 7), and therefore large effects must be interpreted with caution. The interventions are presented in more detail in the sections below.

[Table 6 about here]

Academic vocabulary

Three interventions had a specific focus on academic language through explicit teaching, with a fourth intervention (Crosson and Moore 2017) teaching academic language through morphology. Two interventions were classed as having a high risk of bias (August et al. 2014; Crosson and Moore 2017) so should be interpreted with caution. The remaining studies were classed as medium (Hwang et al. 2015) and low risk (Lesaux et al. 2014). The intervention effects seen ranged from small (August et al. 2014; Lesaux et al. 2014) to large (Crosson and Moore 2017). Effect sizes were not reported by Hwang et al. (2015).

Hwang et al. (2015) report a Word Generation (WG) intervention. Word Generation has been used several times in the United States (see Murphy and Unthiah 2015, for a review). The WG intervention focuses on explicit teaching of academic vocabulary which fits into a weekly theme. This study specifically looked at individual differences between EAL learners, depending on their classification. In the USA, EAL students are classified on the basis of a language assessment, the California English Language Development Test (CELDT), as either 'initially fluent English proficient' (IFEP), 'redesignated fluent English proficient' (RFEP) or 'limited English proficient' (LEP). If a child scores at the 'beginning', 'early intermediate' or 'intermediate level' on the first assessment, they are identified as LEP. Scoring at the 'early advanced' or 'advanced level' of language proficiency gives a child the classification of IFEP. Upon demonstrating English language proficiency comparable to their monolingual peers, children can be upgraded to RFEP, so long as they meet state standards in English and the parents consent to the reclassification.

Hwang et al.'s study had overall non-significant results meaning that the whole sample did not significantly improve their vocabulary as a direct result of the

intervention. However RFEP students who participated in this programme made significant gains in their academic vocabulary knowledge, suggesting the more proficient learners were better equipped to learn vocabulary than those with limited English. The authors attribute this to the academic vocabulary being too difficult for those with weaker English skills.

The opposite effects were found by Lesaux et al. (2014) during their 'Academic Language Instruction for All Students' (ALIAS) programme. This intervention focused primarily on vocabulary, with added elements of reading comprehension, writing development and instruction. Each unit of the intervention revolved around a short text from 'Time for Kids' magazine, from which a list of academic words was chosen. Pupils were exposed to new words in the text, with lessons then focusing on connections to prior knowledge, new word definitions and morphology. Finally, the students used the vocabulary in their own writing. The effects of the intervention were generally larger for students whose primary home language was not English, and for those students who began the intervention with underdeveloped vocabulary knowledge. In other words, the intervention benefited most those with the smallest vocabularies. August et al. (2014) report a similar intervention study ('QuEST2') in which explicit vocabulary was taught alongside word learning and comprehension strategies. For EAL pupils, significant improvements occurred for vocabulary, which was taught with the help of Spanish translations.

Crosson and Moore (2017) reported a morphology intervention teaching the morphological Latinate roots of academic vocabulary to adolescents. This study was within-subjects, meaning that all pupils took part in the intervention condition. The control condition (Robust Academic Vocabulary Encounters) consisted of academic vocabulary instruction without morphology. The largest treatment effects were observed among the older learners but the younger learners did still make some gains, albeit smaller than the older adolescents (see Table 8).

Three of the explicit vocabulary teaching interventions (Hwang et al. 2015; August et al. 2014; Lesaux et al. 2014) showed positive effects for some learners. However, some results conflict across studies. Hwang et al. (2015) found intervention effects for more proficient learners, whereas Lesaux et al. (2014) found the largest intervention effects for children with the most impoverished baseline vocabularies. August et al. (2014) and Crosson and Moore (2017) reported intervention effects for all EAL learners; however the largest effects were for the older learners suggesting an age effect with regards to morphology instruction.

Taught vocabulary during shared reading

Shared reading is a frequently used intervention for the enhancement of language and is relatively easy and low-cost to administer. Schools frequently carry out one-on-one reading with teaching assistants or volunteers so it is useful to understand how to best foster vocabulary growth during such sessions. The interventions discussed here used adult-supported shared reading, one of which (Leacox and Jackson 2014) used additional computer software to facilitate the reading. Four interventions included giving definitions to new vocabulary items when they occurred in the story (August et al. 2016; Crevecoeur et al. 2014; Leacox and Jackson 2014; Vadasy and Sanders 2015). Two interventions were carried out in the home language (Spanish) (August et al. 2016; Leacox and Jackson 2014). In addition, there was pre-teaching of vocabulary items (August et al. 2016; Leacox and Jackson 2014) post-reading reinforcement (August et al. 2016; Crevecoeur et al. 2014) and spelling and pronunciation activities (Vadasy and Sanders 2015). All shared reading interventions showed post-test gains, with small to large effect sizes (see Table 10).

[Table 9 about here]
[Table 10 about here]

General vocabulary

We classified studies as focusing on 'general vocabulary' when the authors did not specify a genre in which the taught vocabulary would belong. Two studies fell into this category, including the only intervention in this synthesis which was carried out in the UK (Marshall and Hobsbaum 2015). The authors of this study did not report effect sizes and the intervention was classified as having a high risk of bias; therefore caution is advised with the results. The second intervention in which general vocabulary was taught (Vadasy et al. 2015) was found to have a low risk of bias and reported small to medium overall intervention effects.

[Table 11 about here]
[Table 12 about here]

Marshall and Hobsbaum (2015) explicitly taught sign supported English (SSE) as an aid to boost the general vocabulary of 4-5 year old children with English as an additional language. Children from one primary school in which SSE was already embedded into the school's curriculum acted as the intervention class, and a 'business-as-usual' matched classroom in an alternative primary school acted as the control. Post-test results found no differences between the intervention group (using SSE) and the control group, over and above vocabulary growth over time which was observed across both groups. However, the authors reported that control condition teachers used gestures instinctively, which may have led to confounding results.

Vadasy et al. (2015) compared an explicit general vocabulary intervention to a shared reading intervention. The children assigned to the explicit condition outperformed the shared reading group on measures of vocabulary reading and decoding. No other interventions in this review compared an explicit condition to shared reading; therefore these results prove insightful in comparing two popular intervention techniques. In a follow-up study one year later, the gains for the explicit condition remained, albeit with a smaller effect size (see Table 12).

Oral language

One intervention in this synthesis included multiple oral language components. This intervention, classed as having a medium risk of bias, did not show an effect on the language outcomes of pupils.

[Table 13 about here]
[Table 14 about here]

The intervention consisted of creative movement to build oral language skills during performing arts. Children were taught skills of voice projection, vocabulary, dialoguing or narrative discourse, story construction, and story recall. In the early stages of the intervention, children acted out the answers to questions, then at intermediate level they were tasked with attentive listening to stories and carrying out dramatic interpretations. There was no significant improvement in listening skills and the effect size on speaking skills was small. The authors report, however, that EAL pupils with the lowest baseline scores on oral language made the most gains from the programme, a finding similar to that of Lesaux et al. (2014).

Literacy –focused interventions

Fifteen interventions in this synthesis focused on the literacy development of children with EAL. Three interventions used technology as the primary intervention platform and five focused primarily on teacher-led reading comprehension. Four interventions focused on continued professional development (CPD) with reading comprehension as a primary outcome. A further two interventions were family literacy programmes in which parents were heavily involved. The interventions had small to medium effects on language and literacy development (see Tables 17, 19 and 21) However, the risk of bias across studies was mainly high (*n*=6) or medium (*n*=8), with only one study being classed as low (Matuchniak et al. 2014). Therefore results should be interpreted with caution (see Tables 16, 18 and 20).

[Table 15 about here]

Technology-enhanced literacy

Interactive reading software is a form of intervention which has been developing with the advancement of voice recognition technology. Three interventions used technology software to enhance the literacy skills of EAL learners, each showing small to medium intervention effects. Interventions were classed as having a high (Reeder et al. 2015) or medium risk of bias (Schechter et al. 2015; Trainin et al. 2016).

[Table 16 about here]
[Table 17 about here]

Schechter et al. (2015) adopted a blended learning approach, in which English language instruction was both teacher-led and technology-based. The blended learning approach combined the school's English language curriculum with Lexia Reading Core5 software. This software incorporated six strands of reading skills: phonological awareness, phonics, structural analysis, automaticity/fluency, vocabulary, and comprehension. Standardised reading assessments at post-test revealed greater gains for the treatment children over controls, with the greatest reading comprehension gains for the initially low-performing EAL pupils.

Similar results were found by Trainin et al. (2016) and Reeder et al. (2015). Trainin et al. (2016) conducted a reading fluency intervention using QuickRead. QuickRead is software that is used to build reading fluency, vocabulary and comprehension, delivered through 15-minute instructional sessions. Teachers initially model reading, the student then reads the passage silently while listening to the read-aloud and finally the student reads the text aloud under timed conditions. The software measures the student's rate and accuracy of reading fluency. Trainin et al. (2016) reported significant gains for children in two separate conditions: 'Print-Only' where children used QuickRead print materials only, and 'Technology + Print' where children used the QuickRead computer programme along with the print materials. Significant gains were made with regards to fluency, comprehension and vocabulary.

Reeder et al. (2015) report a reading practice intervention using The Reading Tutor. The Reading Tutor listens to oral reading through speech recognition and gives online feedback. Two groups received normal classroom teaching with additional EAL support. However, the treatment group had additional feedback via the Reading Tutor. The software's logging system showed significant gains for participants. At the end of the intervention, children were undertaking reading tasks with reading ages one year above their reading age at initial testing.

Reading comprehension

Most of the interventions in this report aimed to improve reading comprehension, given its key role in learning and assessment. The studies reported below targeted reading comprehension as the overarching aim of the intervention. Their effect ranges from none to medium. The lack of a large effect size is not surprising, given the complex and multifaceted nature of reading comprehension and the relatively short time-span of interventions. Furthermore, bias assessments were classed as high (*n*=4) or medium (*n*=2) (see Table 18).

[Table 18 about here]
[Table 19 about here]

Goodwin (2016) carried out an intervention based on guided reading with support for comprehension and morphological problem solving. She reported positive effects for multiple choice vocabulary knowledge and morphological awareness (with the lowest-scoring children at pre-test benefitting the most), but no significant improvement in reading comprehension and reading fluency. The other interventions did show positive *trends* of reading comprehension improvement. Vaughn et al. (2017) found specific reading comprehension effects with regards to the content taught during the intervention. However, this did not transfer to general reading comprehension. The significant gains in content knowledge acquisition are likely due to the acquisition of specialised vocabulary. Barber et al. (2015), Van Staden (2016) and Tong et al. (2014) also reported reading comprehension gains, with both studies encountering additional language-related intervention effects including vocabulary and fluency. An additional finding in Tong et al. (2014) was that older pupils gained more content knowledge if they had previously taken part in the reading intervention, suggesting long-term effects.

Continued professional development

Four interventions in this synthesis focused on continued professional development (CPD). The interventions had small to medium effects on the language and literacy development of EAL children (see Table 21). The risk of bias for the continued professional development interventions were medium to low (see Table 20). Two studies report on the same intervention, the Pathway Project (Matuchniak et al. 2014; Olson et al. 2017), but the papers report results from different participant samples.

[Table 20 about here]
[Table 21 about here]

Two interventions focused on specific content teaching (science) and one focused on academic writing. Cervetti et al. (2015) report high effect sizes., However, this study was measuring the increase in teacher strategy use. No effect size was given for any improvement in pupil outcomes, and no differences between conditions were identified in pupils' science and vocabulary learning. Maerten-Rivera et al. (2016) developed the P-SELL (promoting science to English language learners) intervention, with the aim of promoting the understanding of science concepts and inquiry and to support English language development. The intervention curriculum was based around the state-wide science curriculum, but addressed EAL achievement by providing explicit guidance for teachers about English language and literacy support for all pupils. This support included the use of questioning, differentiation techniques and useful websites for further inquiry. Pupil booklets also provided translations of key vocabulary in the most common home languages (Spanish and Haitian Creole). The results indicated differences in science

proficiency between the treatment and control groups in the second and third years of treatment, but not in the initial year of implementation. This would suggest that focused curriculum specific interventions which embed English language and literacy support for EALs can increase attainment. However, the initial implementation of the intervention may mediate pupil gains while teachers adjust their practice and gain familiarity with the curriculum.

Olson et al. (2017) and Matuchniak et al. (2014) reported on a continued professional development programme called the Pathway Project. Practitioners were given training in cognitive strategies to enhance pupil learning, as well as resources focused on academic writing and coaching support from previous Pathway participants. Olson et al. (2017) reported a positive effect for the intervention when students taught within the Pathway Project were compared with controls. This effect is expressed as an odds ratio of passing the California High School Exit Exam in both years. Matuchniak et al. (2014) reported significant intervention effects at post-test for pupils who had received two years of treatment in comparison to those who had received only one year of the intervention.

Three interventions included an element of continued professional development as a secondary focus of the intervention. August (2014) provided training related to teaching of vocabulary in the science curriculum. Teachers were given mentoring sessions on a weekly basis alongside intervention training sessions (one pre-intervention and four concomitant with the intervention). Greenfader et al. (2015) provided teachers with strategies to enhance oral language development during performing arts. Steiner (2014) carried out a secondary focus as part of their family literacy intervention whereby a teacher learned strategies to recognise and incorporate existing family-based literacy practises into school literacy instruction. Tong et al. provided teachers with knowledge about cross-curricular literacy (implementing literacy strategies in a science curriculum) including strategies for EAL children and biweekly professional development workshops. These interventions showed treatment effects, but with small to medium effect sizes.

Family literacy programme

Two interventions focused on family literacy programmes to enhance language skills of children with English as an additional language. Steiner (2014) reported a medium effect size for outcome measures. However, this study was assessed as having a high risk of bias, so this must be kept in mind when considering the results. O'Brien et al. (2014) was found to have a medium risk of bias (see Table 22).

[Table 22 about here]
[Table 23 about here]

Both of the family literacy interventions in this review targeted children of primary school age and consisted in giving parents effective strategies for engaging children in reading. O 'Brien et al.'s (2014) study reported a family literacy programme (FLP) focused on vocabulary development in children from low income families. The parents were given dialogic reading strategies alongside literacy training. Parents received free English literacy instruction and were provided with strategies and various types of texts to use on their own and with their children. Half of instructional time was dedicated to reading and writing texts of adult interest. The remaining instructional time was spent on texts of importance to child development and learning, including children's books. Each week, teachers introduced a book, modelled read-aloud strategies, and parents then practised reading the book aloud. All children in the Family Literacy Programme

demonstrated language and literacy growth from pre- to post-test, with those with the lowest pre-test vocabulary displaying the largest gains.

Similarly, Steiner (2014) conducted a family literacy programme for lower primary school pupils. Parents and a classroom teacher were taught practices for building a home-school partnership. In the treatment condition, parents showed a significant increase in effective dialogic reading strategies and parental and teacher participation resulted in statistically significant differences in students' scores on the Concepts About Print (CAP) assessment (Clay, 2000), compared to students in the control classroom. The CAP assessment is a standardised measure of children's understanding of printed language.

Family literacy interventions in this review appear to be somewhat effective, but were limited by low sample sizes. Indeed, a key challenge for family literacy interventions is engaging hard-to-reach parents, those with little to no schooling or limited English language proficiency.

Discussion

The present synthesis identified 25 eligible intervention studies, reported in 26 studies (published since 2014): 11 focused on improving language; 14 focused on improving reading comprehension. The language-focused interventions were delivered through vocabulary instruction and adult-led reading. They provide a body of evidence to support the proposition that targeted instruction can lead to significant language gains for EAL students in the short term. Interventions regarding reading comprehension provided less evidence of intervention gains, which is not surprising due to the multifaceted nature of reading comprehension. More interventions taking place over longer time spans are needed to fully investigate how to equip EAL learners with sufficient skills to comprehend texts. With regards to adult dialogic book reading, evidence suggests that gains in vocabulary can be modest. Vocabulary gains through dialogic reading can be enhanced with embedded strategies such as the inclusion of vocabulary definitions, pre-teaching of vocabulary, post-reading reinforcement and spelling and pronunciation activities.

Vocabulary interventions had a tendency towards greater gains for those with the most impoverished vocabularies (Lesaux et al. 2014; Greenfader et al. 2015). When comparing an interactive book reading (IBR) condition with an explicit condition (Vadasy et al. 2015), children in the explicit condition outperformed those in the IBR condition, with gains remaining one year post intervention. On the other hand, no significant benefit was reported in this review for sign-supported vocabulary interventions (Marshall and Hobsbaum 2015). However, the lack of evidence regarding the effectiveness of implicit methods of intervention cannot be interpreted as a lack of effectiveness, as so few of the interventions in this review used implicit methods of teaching.

Four interventions used software to improve reading fluency and vocabulary (Schechter et al. 2015; Trainin et al. 2016; Reeder et al. 2015; Leacox and Jackson 2014). In spite of the lack of information about cost and a possible bias issue (for example, one intervention was funded by Pearson Education, a publisher who sells education based products including language assessment tools), these interventions did show gains with effect sizes ranging from small to large (see Table 11).

Eight interventions in this synthesis included a significant continued professional development component, including four focusing on CPD exclusively. All eight took place in the USA and had small to medium effects on language and literacy development of children.

Only four of the interventions in this review were carried out on upper secondary school children. The majority of interventions (n =17) focused on primary school children. Although it is very important to conduct early interventions so that EAL children do not fall further behind their monolingual peers, the lack of interventions for older children is problematic, especially for children arriving in the country post primary school. This review highlights the paucity of interventions for older children.

Limitations

Limitations include a variability in rigorous intervention methodologies, leading to a high risk of bias for several studies in this report. Furthermore, this review highlights a paucity of interventions within the United Kingdom and interventions for older learners. Most reviews originated from the USA, and results would not necessarily be replicated in the United Kingdom, where a typical classroom may feature many different home languages among EAL pupils. In the USA, classrooms often include a homogenous sample of EAL learners with a first language of Spanish, therefore interventions may be tailored to include Spanish elements, such as translations.

While randomised controlled trials (RTCs) are necessary for the robust evaluation of interventions, they are limited to a particular model of intervention research and typically focus exclusively on literacy, reading skills and vocabulary development, neglecting important factors such as the effect of teachers' perceptions and attitudes (Bailey and Marsden 2017; Cunningham 2017) and ignoring the broad communication competences of EAL children as well as their competences in the home language (Conteh 2006, 2012). Qualitative evaluation should complement quantitative evaluation, so that positive impacts of intervention programmes that cannot be detected through significance tests are not missed out (Andrews 2009). Importantly, limiting our review to RCTs leaves out an important body of literature based on case studies (e.g. Boisvert and Rao 2015; Snow, Eslami and Park 2015) and fails to address the historical approach to EAL children's challenges in terms of special educational needs (SEN) (Safford and Drury 2013).

Implications for the UK

Most of the interventions in this summary could be replicated in the United Kingdom. Teaching of subject-specific vocabulary would be beneficial in the UK for both English-only pupils and those with English as an additional language, and could be incorporated into lessons for children of all ages with relative ease. A notable exception is that the great diversity of home languages featured in the UK EAL population would make the use of L1 bridging strategies (as in Leacox and Jackson 2014) impossible to implement for all EAL pupils. This aspect is however not essential for dialogic book-reading interventions to be beneficial (Crevecoeur et al. 2014, Vadasy and Sanders 2015). Since most schools already implement book reading for younger learners, these would be a low-cost and simple intervention to carry out in the UK context.

Explicit teaching of vocabulary would be recommended especially for the children with the lowest English language vocabularies, both in terms of academic vocabulary and general vocabulary. The use of software to deliver literacy and vocabulary interventions is likely to be beneficial in the UK context, given the lesser demands it places on support staff.

A report commissioned by the Teaching and Development Agency for Schools in conjunction with the National Association for Language Development in the Curriculum (NALDIC 2009) found that continued professional development for teachers of EAL children was inconsistent in the United Kingdom and not accessible on a national scale.

Indeed, specialist support in the UK is lacking in comparison to other countries (Hutchinson 2018: Bell Foundation Report). The Bell Foundation report recommends that the UK should learn from countries in which effective policies exist to establish specialist staffing and programmes for staff development to aid children who do not speak the majority language. Furthermore, teacher training provisions in the UK currently do not regard EAL education as a subject in its own right, and EAL is not a requirement for the training of mainstream teachers (Foley, Sangster and Anderson 2013). Consequently, newly qualified teachers identified EAL pedagogy as one of the areas they felt least prepared for when entering the profession (Pye, Stobart, Lindley and Mori 2016). Replicating the CPD interventions reported in this review could therefore be of great benefit in the UK context.

Conclusions

This review adds to the body of literature on children with English as an additional language. We update the findings of Murphy and Unthiah (2015) using the same methodology and reveal that little has changed since that original review, in spite of great need for UK-based interventions to support these children. Very few controlled language or literacy interventions targeting EAL learners have been carried out to date. Out of the 55 eligible studies identified across Murphy and Unthiah's (2015) review and the present one, only 2 were conducted in the UK (compared with 51 in the USA).

Since the searches for the current review were conducted, little has changed with regards to interventions taking place in the UK. For example, of 94 completed language and literacy projects currently listed by the Education Endowment Foundation (EEF, UK-based charity), only one related to the needs of EAL pupils (Education Endowment Foundation 2018)

As noted above, most of the USA-based interventions could be replicated in the UK – with the exception of those intervention techniques relying on L1 support (such as the use of cognates and L1-L2 translations). Some different intervention methods may need to be investigated in the UK, given the diversity of language backgrounds of EAL children in the UK education system.

The review provides collective evidence that the most effective among existing language-based interventions are those that target word-level skills such as vocabulary acquisition, spelling and morphological awareness. Comprehension-based interventions showed smaller effects, which we suggest is a result of the more demanding task of reading comprehension in comparison to learning vocabulary. This review also identified a lack of provision for older children. Given the continued increase in EAL children entering secondary education, support should be provided beyond primary school. This is especially important when considering the demands of academic vocabulary knowledge and reading comprehension across subjects in secondary education.

It was also found that intervention periods investigated were short, so gains in language or literacy remained relatively limited. Furthermore, none of the interventions reported an independent bias assessment prior to implementation. Longitudinal interventions should thus be carried out with rigorous evaluation at set time points to critically evaluate the effectiveness of the intervention.

All the interventions in this review targeted vocabulary, either directly or indirectly (e.g. as part of a comprehension measure). None targeted specific aspects of grammar such as complex sentences or passives, which are known to be source of difficulties for EAL children (Armon-Lotem, de Jong and Meir 2015). Interventions focusing on continued professional development are also recommended, as they are likely to yield long-lasting impact: by improving teacher knowledge surrounding EAL language and literacy education, several generations of EAL children are likely to benefit.

Declaration of interest statement

The authors declare that they had no conflicts of interest with respect to the authorship or publication of this article.

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Table 1 Search terms used across four databases

Intervention treatment program* Implementation	AND	minority language heritage language additional language community language language minority English language learner ESL diverse language EAL English as a second language English as an additional language	AND	literacy development literacy acquisition literacy skill bilingualism literacy reading development reading skill reading achievement literacy achievement receptive (language/vocabulary) productive (language/vocabulary) expressive (language/vocabulary) writing phonetic decoding phonetic awareness	NOT	case studies disorder autism ethnography

Table 2 Country in which study was undertaken

Study	**Country**
August et al. (2014); August, Artzi and Barr (2016); Barber et al. (2015); Cervetti, Kulikowich and Bravo (2015); Crevecoeur, Coyne and McCoach (2014); Crosson and Moore (2017); Goodwin (2016); Greenfader, Brouillette and Farkas (2015); Hwang et al. (2015); Leacox and Jackson (2014); Lesaux, et al. (2014); Maerten-Rivera et al. (2016); Matuchniak, Olson and Scarcella (2014); O 'Brien et al. (2014); Olson et al. (2017); Park and Warschauer (2016); Schechter et al. (2015); Steiner (2014); Tong et al. (2014); Trainin et al. (2016); Vadasy, Sanders and Nelson (2015); Vadasy and Sanders (2015); Vaughn et al. (2017)	USA
Marshall and Hobsbaum (2015)	UK
Van Staden (2016)	Lesotho
Reeder et al. (2015)	Canada

Table 3 Breakdown by age group

Lower primary 4-6 years	**Upper primary** 7-11 years	**Lower secondary** 12-14 years	**Upper secondary** 15-18 years
Crevecoeur et al. (2014); Greenfader et al. (2015); Leacox and Jackson (2014); Marshall and Hobsbaum (2015); O 'Brien et al. (2014); Reeder et al. (2015); Steiner (2014); Tong et al. (2014); Vadasy and Sanders (2015); Vadasy et al. (2015)	August et al. (2016); Cervetti et al. (2015); Goodwin (2016); Maerten-Rivera et al. (2016); O 'Brien et al. (2014); Park and Warschauer (2016); Reeder et al. (2015); Schechter et al. (2015); Tong et al. (2014); Trainin et al. (2016); Van Staden (2016)	August et al. (2014); Barber et al. (2015); Crosson and Moore (2017); Goodwin (2016); Hwang et al. (2015); Lesaux et al. (2014); Matuchniak et al. (2014); Olson et al. (2017); Vaughn et al. (2017)	Crosson and Moore (2017); Hwang et al. (2015); Matuchniak et al. (2014); Olson et al. (2017)

Table 4 First Language of pupils across 25 interventions (not mutually exclusive)

Language	Number of studies
Spanish	15
Haitian Creole	4
Vietnamese	4
Urdu	3
Arabic	2
French	2
Laotian	2
Somali	2
Tagalog	2
Amharic	1
Bantu	1
Bulgarian	1
Cantonese	1
'Chinese'*	1
Farsi	1
Igbo	1
'Indian'*	1
Italian	1
Khmer	1
Kinyarwanda	1
Kirundi	1
Kiswahili	1
Kurdish	1
'Mymy'*	1
Nepali	1
Polish	1
Romanian	1
Russian	1
Sesotho	1
Tamil	1
Uzbek	1
Yoruba	1
Not reported	6

Note
*As identified in the original studies

Table 5 Focus of Intervention

Focus	Intervention
Language (*n*=11)	August et al. (2016); August et al. (2014); Crevecoeur et al. (2014); Crosson and Moore (2017); Greenfader et al. (2015); Hwang et al. (2015); Leacox and Jackson (2014) ; Lesaux et al. (2014); Marshall and Hobsbaum (2015); Vadasy et al. (2015); Vadasy and Sanders (2015)
Literacy (*n*= 15)	Barber et al. (2015); Cervetti et al. (2015); Goodwin (2016); Maerten-Rivera et al. (2016); Matuchniak et al. (2014); O 'Brien et al. (2014); Olson et al. (2017); Park and Warschauer, (2016); Reeder et al. (2015); Schechter et al. (2015); Steiner, (2014); Tong et al. (2014); Trainin et al. (2016); Van Staden (2016); Vaughn et al. (2017)

Table 6 Primary features targeted by the 'language-focused' interventions

Focus	Paper	Primary features	Intervention method
Academic vocabulary	August et al. (2014)	Quality English and Science Teaching 2 (QuEST2). Two aspects of the intervention: (1) A researcher-designed curriculum of inquiry-based science lessons (2) Professional development to help teachers use the lessons teacher guide/teacher instructional charts; student guide/student instructional charts	Explicit instruction in: (1) vocabulary (students taught 15 new words per week) and (2) word-learning and comprehension strategies. Spanish translations were used
	Crosson and Moore (2017)	An academic vocabulary without morphology (comparison condition) and a morphology-focused academic vocabulary intervention (treatment condition). Instruction about bound Latin roots on academic word learning and morphological problem-solving skill	Explicit instruction in both intervention groups (using Robust Academic Vocabulary Encounters intervention) but Latin roots condition also integrated morphological analysis of the target word's Latin roots in every lesson
	Hwang et al. (2015)	Word Generation (WG) Five general academic vocabulary words presented each week in a topic context. Students were encouraged to read, talk, and write about the weekly topic using the target vocabulary words	Explicit teaching of academic vocabulary for middle school pupils
	Lesaux et al. (2014)	Academic Language Instruction for All Students (ALIAS). The intervention integrated vocabulary, reading comprehension, and writing development.	Explicit teaching of vocabulary found in texts
Taught vocabulary during shared reading	August et al. (2016)	Two methods of vocabulary instruction implemented in interactive shared reading: (1) Extended vocabulary instruction (teacher provides rich, multimodal vocabulary instruction) (2) Embedded vocabulary instruction (definitions embedded in the text)	Explicit teaching of vocabulary
	Crevecoeur et al. (2014)	Storybook intervention with explicit teaching. Children were taught the meanings of 54 target words (3 target words/book) from storybooks	Explicit teaching of vocabulary from storybooks
	Vadasy and Sanders (2015)	Two methods of vocabulary instruction implemented during shared reading: (1) Definitions-only condition Definition of each difficult word given the first time it appeared in each story. (2) Definitions-plus condition. Children were given a definition and then shown a card with the printed target word. Children pronounced the word and said the letters aloud while looking at the printed letters, and pronounced the word again.	Explicit teaching of vocabulary when encountered in texts for both conditions. One condition (definitions plus) also shown the printed words and children were asked to pronounce and spell words aloud.

	Leacox and Jackson (2014)	Technology-enhanced English shared reading with Spanish-bridging vocabulary instruction (TESB) with multiple vocabulary strategies including preview of target vocabulary words and audio-recorded Spanish vocabulary definitions embedded throughout an e-book (treatment condition). Small groups of children listened to adult-read storybook, reading in English with incidental vocabulary exposure (control condition).	Intervention group had technology enhanced reading with software that included explicit vocabulary instruction in the home language
General Vocabulary	Vadasy et al. (2015)	'Connections' group with explicit instruction in high frequency decodable root words (treatment condition) and 'Interactive book reading' (control condition) which taught the same words in storybook context	Explicit teaching of vocabulary encountered in stories.
	Marshall and Hobsbaum (2015)	Sign supported English (SSE) Treatment school had introduced SSE into its reception classes approximately 7 years before the current study took place, as a strategy for supporting vocabulary learning in children with EAL. The control condition was a matched classroom with no use of SSE who underwent business as usual.	Explicit sign-supported English language taught
Oral Language	Greenfader et al. (2015)	Oral language intervention in which children were taught skills of voice projection, vocabulary, dialoguing or narrative discourse, story construction, and story recall.	Explicit teaching of oral language skills through arts curriculum.

Table 7 Risk of bias assessment for studies with a primary focus on academic vocabulary

Intervention	**Risk of bias assessment**
August et al. (2014); Crosson and Moore (2017)	High
Hwang et al. (2015)	Medium
Lesaux et al. (2014)	Low

Table 8 Treatment effect sizes on outcomes measures in interventions with a primary focus on academic vocabulary

Intervention	Effect size reported	Effect	Magnitude of effect
August et al. (2014)	Cohen's *d*	CBM vocabulary ***d* = 0.21** Science ***d* = 0.14** GRADE vocabulary ***d*= 0.05**	Small Small Small
Crosson and Moore (2017)	Cohen's *d*	**Word meaning** *Latin roots condition (pre-post test)* Grades 6-8 ***d* = 0.57** Grades 9-11 ***d* = 1.46** Grades 11-12 ***d* = 2.21** *RAVE condition (pre-post test)** Grades 9-11 ***d* = 1.43** Grades 11-12 ***d* = 1.42** **Facets of word knowledge task** *Latin roots condition (pre-post test)* Grades 11-12 ***d* =1.41** *RAVE condition* Grades 9-11 ***d* = 1.36** **Morphological analysis skill** *Latin roots condition (pre-post test)* Grades 6-8 ***d* = 1.49** Grades 9-10 ***d* = 0.97** *RAVE condition (pre-post test)* Grades 6-8 ***d* = 2.03** Grades 9-11 ***d* = 1.49** Grades 11-12 ***d* = 1.69**	 Small-medium Large Large Large Large Large Large Large Large Large Large Large
Hwang et al. (2015)	None reported (multilevel modelling analysis)	n/a	n/a
Lesaux et al. (2014)	Cohen's *d*	Word mastery (whole group): ***d*=0.41** EAL specific ***d* = 0.49** Monolingual specific ***d* = 0.21** Depth of word knowledge (whole group): ***d*=0.22** EAL specific ***d* = 0.19** Monolingual specific ***d* = 0.26** Academic words in text (whole group): ***d* = 0.17** EAL specific ***d* = 0.18** Monolingual specific ***d* = 0.17** Morphological decomposition (whole group) ***d* =0.40** EAL specific ***d* = 0.43** Monolingual specific ***d* = 0.33** Morphological derivation (whole group) ***d* = 0.21** EAL specific ***d* = 0.18** Monolingual specific ***d* = 0.27** Comprehension of expository text including academic words (whole group) ***d* = 0.15** EAL specific **d = 0.16** Monolingual specific **d = 0.13** Standardized measure of written expression (whole group) ***d* = 0.19** EAL specific ***d* = 0.21** Monolingual specific ***d* = 0.04**	Small Small-Medium Small/no effect

		Standardized measure of reading comprehension (whole group) ***d*=0.04** (non-significant) EAL specific ***d* = 0.04** Monolingual specific ***d* = -0.04**	Small/no effect Small/no effect Small/no effect

Note

* The author reports no significant differences from pre- to post test and therefore gives no effect sizes for the Latin roots condition on the facets of word knowledge task in grades 6-8 and 11-12, as well as the morphological analysis skill task in grades 11-12. In the RAVE condition, no effect sizes are given for pre- to post-test gains for grades 6-8 word meaning task, and grades 6-8 and 11-12 in the facets of word knowledge condition.

Table 9 Risk of bias assessment for studies with a primary focus on taught vocabulary during shared reading

Intervention	Risk of bias assessment
August et al. (2016); Crevecoeur et al. (2014); Leacox and Jackson (2014);	High
Vadasy and Sanders (2015)	Low

Table 10 Treatment effect sizes on outcomes measures in interventions with a primary focus on taught vocabulary during shared reading

Intervention	**Effect size reported**	**Effect**	**Magnitude of effect**
August et al. (2016)	Hedge's *g*	Extended instruction: ***g* = 1.7** Embedded instruction: ***g* = 0.57** Effect of extended instruction gains over embedded instruction: ***g* = 0.71**	Large Medium Medium
Crevecoeur et al. (2014)	Cohen's d	TWKM monolingual group ***d* = 1.91** EAL group ***d* = 1.08** Post-test PPVT treatment effect monolingual group ***d* = 0 .63** EAL group ***d* = 0.29** LCM Monolingual group ***d* =0.61** EAL group **d= –.05**	 Large Large Medium Small Medium Small
Leacox and Jackson (2014)	Cohen's d	English receptive knowledge ***d* =0.78** English expressive naming ***d* = 1.12** Bilingual expressive definition ***d* = 0.61**	Medium-high High Medium
Vadasy and Sanders (2015)	Cohen's *d*	Definitions-plus condition had higher gains than definitions-only condition Spelling gains ***d* = 0.57** Receptive vocabulary gains ***d* =0.30** Definitional vocabulary gains ***d* = 0.41**	 Medium Small Small

Table 11 Risk of bias assessment for studies with a primary focus on general vocabulary

Intervention	**Risk of bias assessment**
Marshall and Hobsbaum (2015)	High
Vadasy et al. (2015)	Low

Table 12 Treatment effect sizes on outcomes measures in interventions with a primary focus on general vocabulary

Intervention	**Effect size reported**	**Effect**	**Magnitude of effect**
Marshall and Hobsbaum (2015)	None reported	n/a	n/a
Vadasy et al. (2015)	Cohen's *d*	Connections students outperformed IBR Reading vocabulary ***d*= 0.64** Decoding ***d* = 0.45** Longer-term gains Connections students ***d*=0.29** IBR ***d* =.027**	 Medium Small Small Small

Table 13 Risk of bias assessment for studies with a primary focus on oral language

Intervention	Risk of bias assessment
Greenfader et al. (2015)	Medium

Table 14 Treatment effect sizes on outcomes measures in interventions with a primary focus on oral language

Intervention	**Effect size reported**	**Effect**	**Magnitude of effect**
Greenfader et al. (2015)	Cohen's *d*	TAP intervention ***d* = 0.06**	Small/no effect

Table 15 Primary features targeted by the literacy-focused interventions

Intervention focus	Paper	Primary features	Intervention method
Technology-based Llteracy	Schechter et al. (2015)	Lexia Reading Core5 software used in English instruction Teacher led instruction Blended learning instruction (i.e. classes both teacher-led and technology-based)	Both technology-based and teacher-led 'blended learning'.
	Trainin et al. (2016)	QuickReads Teachers initially modelled reading, pupils then read a passage silently while listening to the read-aloud and finally the student read the text aloud under timed conditions.	Teacher modelled with independent technology enhanced learning
	Reeder et al. (2015)	The Reading Tutor reading fluency intervention The Reading Tutor listens to oral reading through speech recognition and gives online feedback. Two groups received normal classroom teaching with additional EAL support, however the treatment group had additional feedback via the Reading Tutor.	Teacher led control condition with a treatment condition receiving additional fluency feedback from software
Teacher led-reading comprehension	Tong et al. (2014)	Intervention 1 CPD: Enhancing science teachers' knowledge about content area literacy, including (a) English science vocabulary building and fluency, (b) oral and written academic science language development, (c) integrated science content reading comprehension, (d) imbedded EAL strategies. Content Area Literacy: Supported students' science and reading skills to assist the explanation of science concepts, vocabulary development and morphology, word-reading instruction, and comprehension of science texts. Intervention 2 CPD: biweekly professional development workshop activities including reviewing and practicing upcoming lessons and being instructed on the EAL strategies that were incorporated into the predeveloped lessons. Language/literacy: Phonics, vocabulary, fluency, oral language and writing activities where a chart with preprinted science-embedded questions and science-related visuals	Teachers delivered the content literacy interventions with support of their own CPD strand of the intervention.

	Barber et al. (2015)	USHER intervention Three reading comprehension strategies taught to children: (1) activating background knowledge through the use of text features, (2) generating text-based questions, and (3) organizing information graphically.	Explicit teaching of reading comprehension strategies with teacher modelling and scaffolding of comprehension strategies to help EALs actively process text. Two main classroom activities were involved: whole class and guided reading (or small group instruction).
	Goodwin (2016)	Comprehension instruction (across intervention and control) with prioritisation on instruction, motivation, visuals, use of isolated word instruction and word instruction integrated within text, use of games to reinforce learning and build engagement, and a focus on transfer across subject areas.	Explicit guidance for tutors
	Park and Warschauer (2016)	Reading comprehension (using a specific experimental textbook versus standard English Language Arts textbook) and syntactic enhancement intervention.	Explicit guidance for teachers
	Vaughn et al. 2017	Treatment instructional practices (instructional package: Promoting Adolescents' Comprehension of Text , PACT) that included comprehension canopy, essential words, knowledge acquisition, and team-based learning.	Explicit guidance for teachers
	Van Staden (2016)	Improving EAL learners' reading fluency, word identification, syntactical awareness skills, and decoding of words, vocabulary knowledge and reading comprehension strategies. EAL learners in the comparison group continued with the class readers that were used at the specific sample school	Explicit guidance for teachers
Continued professional development	Cervetti et al. (2015)	Integrated science-literacy curriculum with a step-by-step guide for teachers. Guide provided background information, instructional suggestions, rationales, and strategies for EALs Teachers in the comparison group received the same step-by-step guide, but with limited support material	Explicit guidance for teachers in science content, with or without educational notes aimed at EAL strategies.
	Matuchniak et al. (2014);	Pathway Project Cognitive strategies to enhance pupil learning; resources focused on academic writing and coaching support from previous Pathway participants	Explicit guidance for teachers to support academic writing
	Olson et al. (2017)	Pathway Project	Explicit guidance for teachers to support academic writing

		Cognitive strategies approach to text-based analytical academic writing	
	Maerten-Rivera et al. (2016)	P-SELL (promoting science to English language learners) with the aim of promoting the understanding of science concepts and inquiry and to support English language development	Explicit guidance for teachers about English language and literacy support for all pupils. Support included questioning, differentiation techniques and useful websites. Pupil booklets also provide translations of key vocabulary in the most common home languages (Spanish and Haitian Creole).
Family literacy Programme	O'Brien et al. (2014)	Family Literacy Programme (FLP) Supported parents' development of English biliteracy and taught effective ways to engage their children in literacy. Half of instructional time dedicated to reading and writing texts of adult interest. The other half of the time spent on texts of importance to child development and learning, including children's books.	Each day, teachers provide explicit instruction to help parents improve their own English literacy and to help them support their children's literacy development.
	Steiner (2014)	Eight-week parental intervention with teacher CPD element. The teachers learnt strategies to recognise and incorporate family literacy practices. The parent intervention focused on two literacy events: (a) storybook reading and (b) conversations surrounding storybooks.	During each training session, parents were provided: (a) instruction in using effective read-aloud strategies and ways to engage their children in response to books and (b) a selection of children's books.

Table 16 Risk of bias assessment for studies with a primary focus on technology enhanced literacy

Intervention	Risk of bias assessment
Reeder et al. (2015)	High
Schechter et al. (2015); Trainin et al. (2016)	Medium

Table 17 Treatment effect sizes on outcomes measures in interventions with a primary focus on technology enhanced literacy

Intervention	Effect size reported?	Effect	Magnitude of effect
Reeder et al. (2015)	Cohen's *d*	Two internal measures main effect of time Measure 1 ***d*= 0.13** Measure 2 ***d* =0.68** Standardised measure main effect of time ***d* = 0.41** Effect of group (Group 1 mean gain score slightly superior to Group 2) ***d* =.035** Treatment difference RT group mean gains slightly superior to other group (October-February) ***d* =.043**	 Small Medium Small Small Small
Schechter et al. (2015)	Specific effect size is not reported. Assumed Cohen's *d*	Total test score: treatment group outperformed control ***d* = 0.53** Vocabulary ***d* =.09** Comprehension ***d* =0.52**	 Medium Small/no effect Medium
Trainin et al. (2016)	Hedges's *g*	Reading rate: higher gain than control classrooms ***g* = 0.16** Comprehension: QuickReads in either format performed significantly higher than the control group ***g* = 0.21** Technology main effect ***g* = 0.24**. Vocabulary: Prescore was a significant predictor at the student level ***g* = .06** Vocabulary scores for students using QuickReads were significantly different than control group ***g* = .22**	Small Small Small Small Small

Table 18 Risk of bias assessment for studies with a primary focus on reading comprehension

Intervention	Risk of bias assessment
Barber et al. (2015); Goodwin (2016); Park and Warschauer (2016); Tong et al. (2014)	High
Vaughn et al. (2017); Van Staden (2016)	Medium

Table 19 Treatment effect sizes on outcomes measures in interventions with a primary focus on reading comprehension

Intervention	Effect size reported?	Effect	Magnitude of effect
Barber et al. (2015)	η^2 (language/literacy) Cohen's *d* (self efficacy)	HC $\boldsymbol{\eta^2}$ **= 0.10** MAP $\boldsymbol{\eta^2}$ **= 0.14** Gates MacGinitie $\boldsymbol{\eta^2}$ **= 0.01** USHER reading self-efficacy beliefs Treatment ***d*** **= 0.17** Control ***d*** **= 0.02**	Medium Medium Small Small Small
Goodwin (2016)	Hedge's *g*	multiple choice ***g*** **= 0.41** self-perceived vocabulary knowledge ***g*** **= 0.47** morphological awareness via generation of morphologically related words **per word *g* = 0.51** **total *g* = 0.69**	Small Small-Medium Medium Medium
Park and Warschauer (2016)	η^2	Post-test (controlling for pre-test scores) $\boldsymbol{\eta^2 p}$ **= .051** Beneficial effect of the intervention in the writing portion: written conventions $\boldsymbol{\eta^2 p}$ **= .020** Writing strategies $\boldsymbol{\eta^2 p}$ **= .036** Word analysis $\boldsymbol{\eta^2 p}$ **= .013**	Small Small Small Small
Tong et al. (2014)	Cramers *V*/ η^2	Benchmark assessment in science intervention group outperformed control ***V*** **=.372** TAKS reading test Intervention group outperformed control ***V*** **= .337** DIBELS (English oracy and fluency) Main effect of time $\boldsymbol{\eta^2 p}$ **= .518** significant effect of time pre/post test; WLPB-R significant main effect of time $\boldsymbol{\eta^2 p}$ **= .190** across gender and condition from pretest to posttest. Time x Science intervention $\boldsymbol{\eta^2 p}$ **= .267** Time x literacy intervention $\boldsymbol{\eta^2 p}$ **=.117**	
Van Staden (2016)	Cohen's *d*	Sight word fluency ***d*** **= 0.61** Word recognition ***d*** **= 0.55** Syntactical awareness ***d*** **= 0.65** Vocabulary knowledge ***d*** **= 0.71** Reading comprehension **d= 0.67** showed that learners in the experimental group improved significantly	Medium Medium Medium Medium Medium
Vaughn et al. (2017)	Cohen's *d*	EALs and non EALs in treatment outperformed controls in content knowledge acquisition ***d*** **=0.40** and content-related reading comprehension ***d*** **=0.20**	 Small Small

Table 20 Risk of bias assessment for studies with a primary focus on continued professional development

Intervention	Risk of bias assessment

Cervetti et al. (2015); Maerten-Rivera et al. (2016); Olson et al. (2017)	Medium
Matuchniak et al. (2014)	Low

Table 21 Treatment effect sizes on outcomes measures in interventions with a primary focus on continued professional development

Intervention	**Effect size reported?**	**Effect**	**Magnitude of effect**
Cervetti et al. (2015)	Cohen's *d* (teachers use of strategies) No effect sizes for language outcomes (multilevel models used)	Strategies used by teachers: ***d* = 0.85** Number of unique strategies used ***d* =0.76**	Large Medium-large
Maerten-Rivera et al. (2016)	Odds ratio used as an effect size	READ: **1. 05** GROUP: **1.28**	Small Small
Matuchniak et al. (2014)	Cohen's *d*	ALA (Assessment of Literary Analysis): Y2 Group Commentary ***d* = 0.51**	 Medium
Olson et al. (2017)	Cohen's *d*	Writing outcomes year 1: ***d* = 0.48** Writing outcomes year 2: ***d* = 0.60**	Small-medium Medium

Table 22 Risk of bias assessment for studies with a primary focus on family literacy programmes

Intervention	**Risk of Bias**
Steiner (2014)	High
O 'Brien et al. (2014)	Medium

Table 23 Treatment effect sizes on outcomes measures in interventions with a primary focus on family literacy

Intervention	**Effect size reported?**	**Effect**	**Magnitude of effect**
O 'Brien et al. (2014)	R^2 regression means	*Intervention Group* Vocabulary growth = **0.52** Phonological awareness = **0.18**	n/a
Steiner (2014)	η^2	Post-test comparison of three groups **= 0.17**	Medium