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TEACHING, PEDAGOGY AND PRACTICE IN EARLY YEARS CHILDCARE: AN EVIDENCE REVIEW

ANNEXES TO THE REPORT

AUGUST 2018

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This paper was first published in August 2018. © 2018

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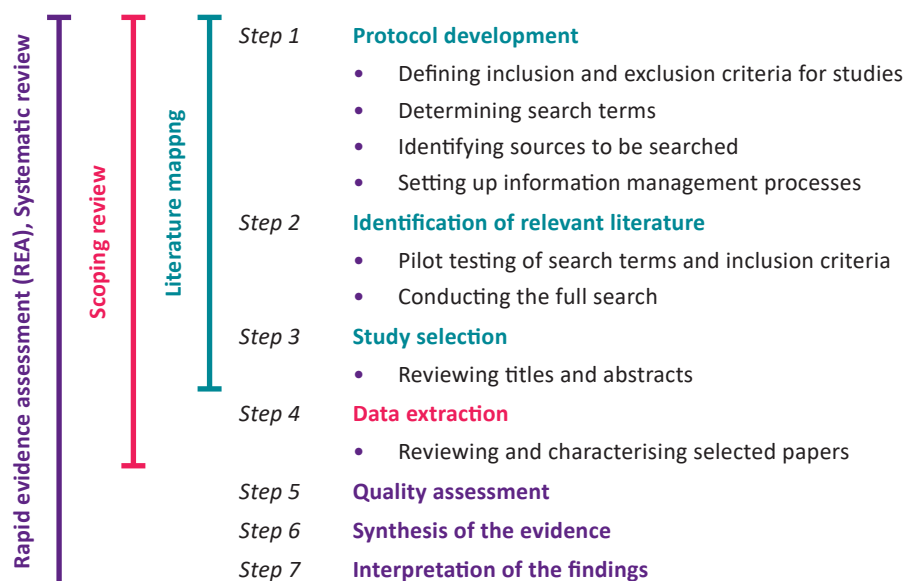
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This document provides the annexes to the EIF report *Teaching, pedagogy and practice in early years childcare: An evidence review*, published in August 2018.¹ These annexes should not be read without reference to the report, which contains key findings, conclusions and recommendations based on the research set out in this document.

Annex A: Research methodology

In order to gather and synthesise the evidence on effective early years practice that improves early education outcomes, we undertook a rapid evidence assessment (REA). REAs provide a systematic assessment of what is known about a policy or practice issue, but the scope of the search and the quality assessment are restricted compared to a systematic review, in order to provide the evidence synthesis in a timely manner. Figure A.1 below illustrates the steps undertaken for a REA (in contrast to other types of reviews).

FIGURE A.1 STEPS FOR CONDUCTING A RAPID EVIDENCE ASSESSMENT



Protocol development and finalisation

Informed by consultation with the EIF project team and the steering group, the research team developed an initial protocol for the review. The initial protocol described the search terms, sources, time period to be covered and inclusion criteria. In addition, the initial protocol set out templates for data extraction from and quality assessment of the studies.

¹ Available from: www.eif.org.uk/publication/teaching-pedagogy-and-practice-in-early-years-childcare-an-evidence-review

Following pilot searches carried out in December 2017 and January 2018, the research team made iterations to the protocol (in particular the search terms) in order to capture papers that were suggested by the steering group. In light of the large number of results that the subsequent search produced, the research team made further changes to the protocol (in particular, changing the sources and inclusion/exclusion criteria) before finalising the protocol as outlined in the sections below.

Search terms

The initial search terms were developed by the research team and informed by discussions with the EIF project team and the steering group. These are listed below in table A.1.

TABLE A.1 INITIAL SEARCH TERMS

Group 1: stage	Group 2: type	Group 3: Process quality	Group 4: outcomes and impact	Group 5: Child background	Group 6: Methodology
early years OR ECEC OR early childhood OR ECE OR ECCE OR early care and education OR early childhood education OR early education	education OR care OR teaching OR provision OR program(me) OR practice OR pedagogy OR services OR childcare OR nursery OR preschool OR pre-school OR crèche OR reception OR foundation stage OR cent(re/er) based OR kindergarten OR daycare OR day care OR sure start OR head start	quality AND indicator* OR high- quality OR high quality OR process quality OR process factors OR pedagogical quality OR cognitive stimulation OR emotional care OR emotional support OR child-adult interactions OR child- teacher interactions OR child-child interactions	outcomes OR child outcomes OR impact OR achiev* OR attain* OR school attain* OR results OR benefits OR school readiness OR cognitive benefits OR social development OR learning process OR effective OR effect(s) OR efficient sustained OR sustainable OR predict OR robust OR equity OR SEAL OR SEL OR social-emotional learning OR executive functions OR inhibitory control OR attention OR self- regulation OR metacognition OR resilience OR literacy OR language development OR communication OR verbal; development OR vocabulary OR numeracy OR spatial skills OR motor skills OR physical health	child(ren) AND access OR equal access OR disadvantaged OR high socio- economic OR low socio- economic OR special educational needs OR special educational needs and disability OR SEND OR SEN OR deprived	quantitative OR evidence OR randomi(s/z) ed control trial OR random* control* trial OR RCT OR empirical evidence OR quasi- experiment OR longitudinal study

Note: The asterisk (*) at the end of certain words is a wildcard used to represent any number of characters after the root word, therefore including variable endings of that root word in the search.

The steering group had recommended that the following studies should be identified by the search:

- Alfieri, Louis; Brooks, Patricia J.; Aldrich, Naomi J.; Tenenbaum, Harriet R. (2011). Does Discovery-Based Instruction Enhance Learning?, *Journal of Educational Psychology*, 103(1), 1–18.
- Becker, Derek R.; Miao, Alicia; Duncan, Robert; McClelland, Megan M. (2014). Behavioral Self-Regulation and Executive Function Both Predict Visuomotor Skills and Early Academic Achievement, *Early Childhood Research Quarterly*, 29(4), 411–424.
- Bornstein, Marc H.; Hahn, Chun-Shin; Putnick, Diane L.; Suwalsky, Joan T. D. (2014). Stability of Core Language Skill from Early Childhood to Adolescence: A Latent Variable Approach, *Child Development*, 85(4), 1346–56.
- Cavanaugh, Dena M.; Clemence, Kimberly J.; Teale, Mikaila M.; Rule, Audrey C.; Montgomery, Sarah E. (2017). Kindergarten Scores, Storytelling, Executive Function, and Motivation Improved through Literacy-Rich Guided Play, *Early Childhood Education Journal*, 45(6), 831–843.
- Center on the Developing Child at Harvard University (2017). *Three Principles to Improve Outcomes for Children and Families, Reports & Working Papers*. As of 25 January 2018, https://46y5eh11fhgw3ve3ytpwxt9r-wpengine.netdna-ssl.com/wp-content/uploads/2017/10/HCDC_3PrinciplesPolicyPractice.pdf
- Denham, Susanne A.; Brown, Chavaughn (2010). ‘Plays Nice with Others’: Social-Emotional Learning and Academic Success, *Early Education and Development*, 21(5), 652–680.
- Goble, Priscilla; Pianta, Robert C. (2017). Teacher–Child Interactions in Free Choice and Teacher-Directed Activity Settings: Prediction to School Readiness, *Early Education and Development*, 28(8), 1035–1051.
- Immordino-Yang, Mary Helen; Demasio, Antonio (2007). We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education, *Mind, Brain, and Education*, 1(1), 3–10.
- Jones, Damon E.; Greenberg, Mark; Crowley, Max (2015). Early Social-Emotional Functioning and Public Health: The Relationship Between Kindergarten Social Competence and Future Wellness, *American Journal of Public Health*, 105(11), 2283–2290.
- Pianta, Robert; Downer, Jason; Hamre, Bridget (2016). Quality in Early Education Classrooms: Definitions, Gaps, and Systems, *The Future of Children*, 26(2), 119–137.
- Pyle, Angela; Danniels, Erica (2017). A Continuum of Play-Based Learning: The Role of the Teacher in Play-Based Pedagogy and the Fear of Hijacking Play, *Early Education and Development*, 28(3), 274–289.
- Pyle, Angela; DeLuca, Christopher; Danniels, Erica (2017). A Scoping Review of Research on Play-Based Pedagogies in Kindergarten Education, *Review of Education*, 5(3), 311–351.
- Siraj-Blatchford, Iram; Muttock, Stella; Sylva, Kathy; Gilden, Rose; Bell, Danny (2002). *Researching effective pedagogy in the early years*, Department for Education and Skills, Research Report RR356. As of 25 January 2018, <http://dera.ioe.ac.uk/4650/1/RR356.pdf>
- Toub, Tamara Spiewak; Repacholi, Betty M.; Meltzoff, Andrew N.; Ruba, Ashley (2016). Infants’ Generalizations about Other People’s Emotions: Foundations for Trait-Like Attributions, *Developmental Psychology*, 52(3), 364–378.
- Weisberg, Deena Skolnick; Hirsh-Pasek, Kathy; Golinkoff, Roberta Michnick (2013). Guided Play: Where Curricular Goals Meet a Playful Pedagogy, *Mind, Brain, and Education*, 7(2), 104–112.

However, the initial search protocol only captured one paper (Pianta et al., 2016).² In order to capture more of the papers that were suggested by the steering group, the research team made numerous iterations to the protocol, in particular changing (adding/removing) search terms and merging groups of terms. The final search terms are listed in table A.2.

TABLE A.2 FINAL SEARCH TERMS

Group 1: Stage and type	Group 2: Process quality	Group 3: Children's outcomes	Group 4: Methodology
(‘early years’ OR ECEC OR ‘early childhood’ OR ECE OR ECCE OR ‘early care’ AND ‘education’) OR ‘early childhood education’ OR ‘early education’ OR ‘preschool education’ OR ‘pre-school education’ OR ‘early academic’ OR childcare OR nursery OR preschool OR ‘pre-school’ OR crèche OR ‘foundation stage’ OR ‘centre-based’ OR ‘center-based’ OR ‘center based’ OR kindergarten OR daycare OR ‘day care’ OR ‘sure start’ OR ‘head start’ OR ‘discovery-based learning’ OR ‘discovery learning’ OR ‘guided play’ OR ‘social emotional learning’ OR ‘social-emotional learning’ OR ‘Literacy-integrated play’ OR ‘self-regulation’ OR ‘play-based’ OR ‘play based’ OR ‘academic achievement’ AND infant)) OR ABS (‘early years’ OR ECEC OR ‘early childhood’ OR ECE OR ECCE OR (‘early care’ AND ‘education’) OR ‘early childhood education’ OR ‘early education’ OR ‘preschool education’ OR ‘pre-school education’ OR ‘early academic’ OR childcare OR nursery OR preschool OR ‘pre-school’ OR crèche OR ‘foundation stage’ OR ‘centre-based’ OR ‘center based’ OR ‘center-based’ OR kindergarten OR daycare OR ‘day care’ OR ‘sure start’ OR ‘head start’ OR ‘discovery-based learning’ OR ‘discovery learning’ OR ‘guided play’ OR ‘social emotional learning’ OR ‘social-emotional learning’ OR ‘Literacy-integrated play’ OR ‘self-regulation’ OR ‘play-based’ OR ‘play based’ OR (‘academic achievement’ AND infant))	((quality AND indicator*) OR ‘high-quality’ OR ‘high quality’ OR ‘process quality’ OR ‘process factors’ OR ‘cognitive stimulation’ OR ‘child-adult interactions’ OR ‘adult-child interactions’ OR ‘child-teacher interactions’ OR ‘teacher-child interactions’ OR ‘child-child interactions’ OR practice* OR pedagog* OR emotion* OR instruct* OR competence OR ‘significant relations’): ti OR ((quality AND indicator*) OR ‘high-quality’ OR ‘high quality’ OR ‘process quality’ OR ‘process factors’ OR ‘cognitive stimulation’ OR ‘child-adult interactions’ OR ‘adult-child interactions’ OR ‘child-teacher interactions’ OR ‘teacher-child interactions’ OR ‘child-child interactions’ OR practice* OR pedagog* OR emotion* OR instruct* OR competence OR ‘significant relations’):	(Outcomes OR ‘impact’ OR achiev* OR attain* OR results OR benefits OR ‘school readiness’ OR ‘cognitive benefits’ OR ‘social development’ OR ‘learning process’ OR effective OR effect OR effects OR efficient OR sustained OR sustainable OR predict OR robust OR equity OR ‘executive functions’ OR ‘inhibitory control’ OR attention OR metacognition OR resilience OR literacy OR ‘language development’ OR communication OR ‘verbal development’ OR vocabulary OR numeracy OR ‘spatial skills’ OR ‘motor skills’ OR ‘physical health’ OR ‘learning goal’ OR ‘academic success’ OR ‘academic demands’): ti OR (Outcomes OR ‘impact’ OR achiev* OR attain* OR results OR benefits OR ‘school readiness’ OR ‘cognitive benefits’ OR ‘social development’ OR ‘learning process’ OR effective OR effect OR effects OR efficient OR sustained OR sustainable OR predict OR robust OR equity OR ‘executive functions’ OR ‘inhibitory control’ OR attention OR metacognition OR resilience OR literacy OR ‘language development’ OR communication OR ‘verbal development’ OR vocabulary OR numeracy OR ‘spatial skills’ OR ‘motor skills’ OR ‘physical health’ OR ‘learning goal’ OR ‘academic success’ OR ‘academic demands’)	((‘empirical study’ OR ‘longitudinal study’ OR ‘systematic review’ OR ‘meta analysis’ OR ‘qualitative study’) OR (‘randomised controlled trial’ OR ‘randomized controlled trial’ OR RCT) OR (‘evidence’ OR ‘findings’)): ti OR ((‘empirical study’ OR ‘longitudinal study’ OR ‘systematic review’ OR ‘meta analysis’ OR ‘qualitative study’) OR (‘randomised controlled trial’ OR ‘randomized controlled trial’ OR RCT) OR (‘evidence’ OR ‘findings’)):

Note: The asterisk (*) at the end of certain words is a wildcard used to represent any number of characters after the root word, therefore including variable endings of that root word in the search.

² The research team also ran a version of the initial search that only included the search terms from groups 1–4. This iteration captured two of the studies recommended by the steering group: Goble and Pianta, 2017 and Pianta et al., 2016.

Sources

The research team initially selected 11 databases as sources to identify relevant academic literature for the search.³ During the protocol development phase the research team reviewed the results with the assistance of three librarians in the RAND Knowledge Services team and decided to exclude six databases (in order to exclude databases that did not support long search strings, journals that were most likely irrelevant or where search hits were duplicated in multiple databases).⁴ The final databases included in the search were: Cochrane Central Register of Controlled Trials (CENTRAL); Educational Resources Information Center (ERIC); PsycINFO; Scopus; Web of Science. In addition, the Campbell Collaboration online library was manually hand-searched with the following limiters ('Education' coordinating group and 'Review'). The research team also included suggested articles from the steering group.

Inclusion and exclusion criteria

The research team developed an initial protocol for the review, including the time period to be covered and other inclusion criteria, informed by consultation with the EIF project team and the steering group. The initial protocol proposed to include studies published after and including January 2000 and those including children in the age group birth to six years old.

As noted above, the research team iterated the search terms in order to capture more of the papers suggested by the steering group. In light of the large number of results that the subsequent searches produced, the research team agreed with EIF to reduce the time period to be covered by the study to the past 10 years (that is, studies published between January 2008 and January 2018 inclusive). This is typical of other systematic reviews, which usually consider research over a 10-year period in order to capture up-to-date, relevant evidence in an efficient manner. The research team then made the final selection of papers on a tiered set of inclusion/exclusion criteria, with criteria 1 and 2 applied during title and abstract screening, and criteria 3 and 4 applied during full text review. The criteria are presented below:

1. **Target population:** Studies had to include children in the age group birth to six years old.
2. **Relevance:** Studies had to be about a practice, programme or intervention, carried out by early education teachers and taking place in an early years setting.
3. **Study quality:** Studies had to be of high quality, which for the purpose of addressing the research questions, the research team defined as: having a clearly defined research question or objective; having a research design that enabled the research question/objective to be addressed; and using a rigorous design (counterfactual study or systematic review).
4. **Counterfactual design quality:** For studies that used a counterfactual design, the research team defined two subsequent criteria of quality:
 - Studies had to use randomised or quasi-experimental matching methods to assign participants to treatment and control groups.
 - The sample sizes in each group had to be at least 50.⁵

3 These were: Academic Search Elite (COMPLETE); Cochrane Central Register of Controlled Trials (CENTRAL); Cochrane Database of Systematic Reviews – CDSR; Dissertation Abstracts; Educational Resources Information Center (ERIC); Education Abstracts; JSTOR; PsycINFO; Scopus; Social Sciences Abstracts; Web of Science.

4 These were: Academic Search Elite (COMPLETE); CDSR; Dissertation Abstracts; Education Abstracts; JSTOR; Social Sciences Abstracts.

5 This is criterion for high-quality evidence used by the European Platform for Investing in Children (EPIC, 2018).

Study selection

To ensure there was a shared understanding of the inclusion/exclusion criteria, 186 of the 7,004 records identified through database searching were selected at random and independently screened (title and abstract screening) by two members of the research team (LH and MS) against inclusion/exclusion criteria 1 and 2. The reviewers compared results and discussed any discrepancies. The remaining records were divided and screened by one of the two reviewers. Records that were unclear were flagged and discussed by the two reviewers to reach a joint decision.

The full records were then reviewed against inclusion/exclusion criteria 3 and 4. Most records were reviewed by one reviewer (LH), although a small number of records were reviewed by other reviewers (SD or MS). Any uncertainties were discussed among the reviewers to reach a consensus decision.

In the Campbell Collaboration online library, papers identified through the search were screened and reviewed by a single reviewer (LH) against the inclusion/exclusion criteria 1 and 2. As systematic reviews, all papers automatically fulfilled inclusion/exclusion criterion 3; criterion 4 did not apply.

Data extraction

Data was extracted by two researchers into an Excel template. The extraction template consisted of six overarching categories: information pertaining to the study (such as methodology, sample); information pertaining to the practice, programme or intervention (such as aims, how often they took place); and information pertaining to each of the four research questions (that is, What, Where, When, Who). Figures A.2 to A.7 present the extraction template.

Summary of search process

Using the final search protocol, the research team identified 7,004 records across the five databases searched.⁶ Two additional papers were identified in the Campbell Collaboration online library and one paper through the steering group's suggestions.⁷ After initial screening of title and abstracts we considered 547 references for full-text review (of which two were identified in the Campbell Collaboration online library and one the paper identified through the steering group). Of these we excluded 439 studies; 161 studies were excluded because they did not target the correct target population or were otherwise irrelevant; 185 and 93 studies were further excluded on the basis of counterfactual design quality because they did not meet the participant assignment criterion and sample size criterion, respectively. Both papers identified in the Campbell Collaboration library and the one from the steering group were included. Data were extracted from 108 studies. Figure A.8 presents the PRISMA diagram depicting the different phases of identifying, screening, and extracting the studies for the REA.

6 The database search took place on 26 January 2018.

7 The hand search of the Campbell Collaboration library took place on 19 April 2018.

FIGURE A.2 DATA EXTRACTION TEMPLATE – INFORMATION ABOUT THE STUDY

Basic information about study			Methodology		Quality assessment			Sample					
Is the study about a programme carried out by teachers in an early years setting?	Does the study report on potential/hypothesised/actual outcomes for children?	Methodology	Listed study limitations	Study limitations not listed in paper	Is the research question clearly defined?	Does research design address research question?	Is the research design rigorous or is it a systematic review?	Study uses a pre-post design only	Is sample randomised?	Are participants matched using quasi-experiment methods?	Intended sample size (treatment)	Intended sample size (control)	Information about any missing data or attrition

FIGURE A.3 DATA EXTRACTION TEMPLATE – INFORMATION ABOUT THE PRACTICE

Basic information about programme/practice					
Name of the programme	Aims of the programme	Brief description of the programme	When and how much	Setting: ISCED 0.1 (targeting under 3), ISCED 0.2 (3–primary), both	Country

FIGURE A.4 DATA EXTRACTION TEMPLATE – ‘WHAT’ RESEARCH QUESTION

What? (Outcomes)						
Type of outcome	Outcome name in paper	How was outcome measured?	When was outcome measured (time point 1)	Direction of impact	Effect size reported?	What is the effect size?

FIGURE A.5 DATA EXTRACTION TEMPLATE – ‘WHERE’ RESEARCH QUESTION

Where? (Level)		
Main level that programme or practice is being implemented: curriculum, setting, teacher	Additional level that programme or practice is being implemented: curriculum, setting, teacher	Additional level that programme or practice is being implemented: curriculum, setting, teacher

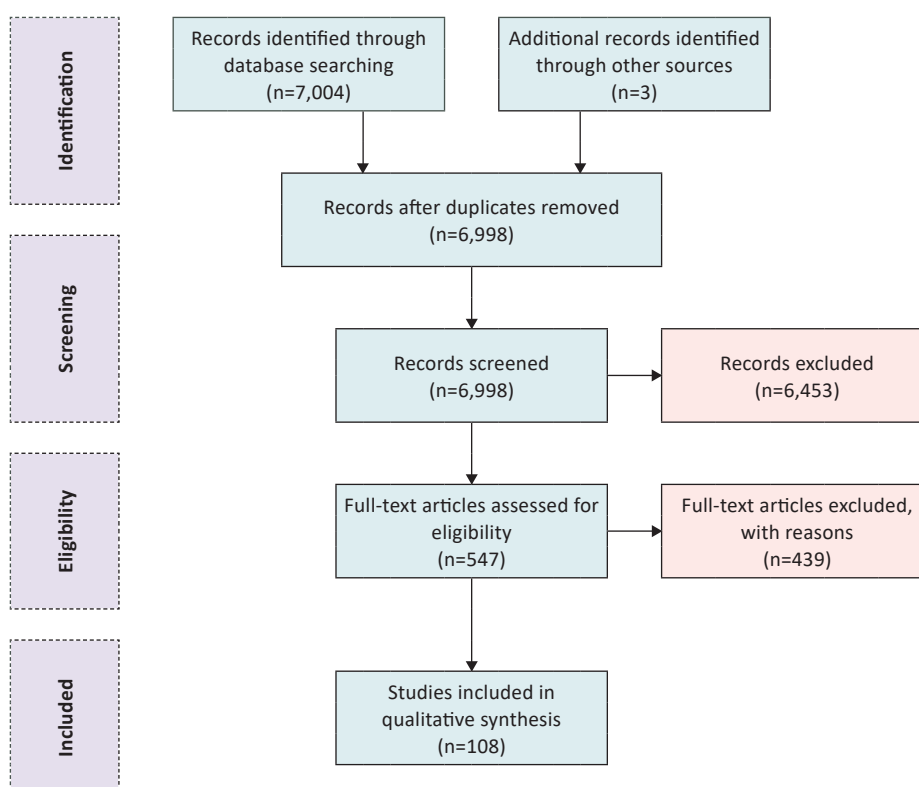
FIGURE A.6 DATA EXTRACTION TEMPLATE – ‘WHEN’ RESEARCH QUESTION

When? (Sustainability)	
Outcome measured at follow-up (time point 2)?	Outcome measured at follow-up (time point 3)? Outcome measured at follow-up (time point 4)?

FIGURE A.7 DATA EXTRACTION TEMPLATE – ‘WHO’ RESEARCH QUESTION

Who?			
Does everybody benefit equally?	Do (and how) outcomes differ across gender?	Do (and how) outcomes differ across children’s backgrounds? (high vs low SES)	Do (and how) outcomes differ across children’s backgrounds? (children with SEN)? Do (and how) outcomes differ across children’s backgrounds? (language spoken at home / English as an Additional Language (EAL))

FIGURE A.8 PRISMA FLOW DIAGRAM



Source: Adapted from Moher et al., 2009

Strengths and limitations of the approach

The rigorous quality inclusion/exclusion criteria applied in this REA means that the studies identified are able to provide robust evidence (based on systematic reviews, meta-analyses or counterfactual studies) on what programmes or interventions make ‘work’ for improving children’s outcomes. However, the constrained scope of the study meant that further evidence of effective teaching may be identified in the wider literature that was not considered for the REA. In particular, we chose to focus the REA on experimental and systematic review studies; this necessitated excluding a large body of literature relying on qualitative, observational evidence on process quality. Overall, a wider search to include more types of studies, different groups of search terms, as well as more databases and studies published in a longer time period may have produced different findings.

Due to the extensive search results, we opted not to conduct grey and unpublished literature searches or to identify further studies through snowballing methods. This means that the findings in this REA may be subject to publication bias (or more specifically, that they might be positively skewed as findings in academic literature tend to be ‘positive’ and ‘statistically-significant’) (Petticrew and Roberts, 2008). To some extent this may be mitigated by the systematic reviews and meta-analyses included in the REA; nevertheless, those studies may also be impacted by publication bias.

Annex B: Brief description of included practices

The 108 studies included in this REA examined the impacts of 83 practices, programmes and/or interventions. These are listed in Table B.1 below in alphabetical order, along with a summary of whether at least one outcome was found to favour the treatment group in the outcome categories examined: language and early literacy (lit); numeracy and mathematics (mat); other cognitive outcomes (cog); socio-emotional outcomes (S/E); and physical outcomes (phys).

TABLE B.1 BRIEF DESCRIPTION OF PRACTICES

Practice/Programme & reference	At least one outcome favouring the treatment group					Description of practice/programme/intervention
	Lit	Mat	Cog	S/E	Phys	
Abbott Preschool Program Frede, E., Barnett, W. S., Jung, K., Esposito Lamy, C., & Figueras, A. (2010).	X					The aim of the project was to provide the necessary knowledge and skills in order to prepare children to enter school by creating a developmentally focused curriculum and the participation of qualified teachers in early childhood.
ABRACADABRA Savage, R., Abrami, P. C., Piquette, N., Wood, E., Deleveau, G., Sanghera-Sidhu, S., & Burgos, G. (2013).	X					ABRACADABRA is free-access internet-based literacy software for beginning readers and includes 32 distinct levelled activities and 17 stories. The project focused on the role of technology, emphasising on the effectiveness of ABRA in the different modules: letters and sounds, reading, comprehension, and writing/spelling in a classroom in Canada.
Active Play educational program Foulkes, J. D., Knowles, Z., Fairclough, S. J., Stratton, G., O'Dwyer, M., Ridgers, N. D., & Fowweather, L. (2017).						The projected aimed at promotion of physical activity in preschool education in order to increase the self-esteem, balance and strength of children. The six-week intervention included 20 activity cards, sample lesson designs, information sources, and a poster that promoted active play.
Adaptive word retrieval intervention Damhuis, C. M. P., Segers, E., Scheltinga, F., & Verhoeven, L. (2016).	X					The 12-week vocabulary-focused intervention involved interactive activities with children in kindergarten including storytelling. The programme was divided into the categories of feelings, spring, and moving and senses through the use of storybooks and narrative books including attractive pictures.
Alphabetic code training, phonological awareness training and Listening comprehension Ecalte, J., Labat, H., Le Cam, M., Rocher, T., Cros, L., & Magnan, A. (2015).	X					The alphabetical code training of the programme included four sessions though the graphical depiction of the letter of the key- word. The phonological awareness activity included 36 activities aiming at the distinction of the elements of syllabus and rhyme. The comprehension training was focused on the representation of inappropriate situations using a story indicating the causes and the impacts of specific actions.
Aprender a Convivir (learning to live together) Alba, G., Fernandez-Cabezas, M., Justicia, F., & Pichardo, M. C. (2015). Benítez, J. L., Fernández, M., Justicia, F., Fernández, E., & Justicia, A. (2011).				X		The ultimate objective of the preventive intervention was to increase the social skills, developing interpersonal relationships, creating a positive environment in the school by preventing risk behaviours. The intervention involved four blocks according to the different topics: Block 1 called 'Rules and rule-following', Block 2, 'Feelings and emotions', Block 3, 'Communication skills' and Block 4 'Help and cooperation'.
BEST in CLASS Sutherland, K. S., Conroy, M. A., Algina, J., Ladwig, C., Jessee, G., & Gyure, M. (2018). Swanson, E., Hairrell, A., Kent, S., Ciullo, S., Wanzek, J. A., & Vaughn, S. (2014). Swanson, E., Vaughn, S., Wanzek, J., Petscher, Y., Heckert, J., Cavanaugh, C., ... Tackett, K. (2011). Therrien, M. C. S., Light, J., & Pope, L. (2016).				X		The programme aimed at improving the interpersonal relationships and the interactions among teachers and children through the implementation of three different interventions: the BEST in CLASS Teacher Manual, the BEST in CLASS Teacher Workshop and the BEST in CLASS Practice-based Coaching.

	Lit	Mat	Cog	S/E	Phys	
Big Math for Little Kids Lewis Presser, A., Clements, M., Ginsburg, H., & Ertle, B. (2015).		X				The intervention was addressed to children aged 4 and 5 years old and aimed towards the development of mathematical learning and related verbal expression through individual and group activities, games as well as storybooks.
Building Blocks Clements, D. H., & Sarama, J. (2008). Clements, D. H., Sarama, J., Farran, D., Lipsey, M., Hofer, K. G., Bilbrey, C., & Society for Research on Educational, E. (2011). Sarama, J., Lange, A. A., Clements, D. H., & Wolfe, C. B. (2012).	X	X				The 30-week programme included group activities that helped children externalise their everyday actions in a mathematical language which helped them improve their mathematical skills through communication and reasoning.
Code-oriented reading intervention Vadasy, P. F., & Sanders, E. A. (2010).	X					In this project the children received individual systematic phonics instruction, including letter-sound correspondences, phonemic decoding, spelling, and assisted oral reading practice in decodable texts in 70 lessons, each session included 7–8 activities.
Conducts secondary analysis of large-scale survey data to evaluate the time-by-grouping Garrett, R., Hong, G., & Society for Research on Educational, E. (2012).						The objective of the intervention was the development of the mathematical skills of minority children in kindergarten classes with English Language and non-English Language students.
Connections (Early Vocabulary Connections: First Words to Know and Decode) Vadasy, P. F., Nelson, J. R., & Sanders, E. A. (2013).						The project focused on the learning of one word each day during the intervention as well as elements including word blending and spelling, word meanings, short reading passages, sentence completion and word meaning match.
Dialogic reading intervention, Standard shared reading intervention, Phonological awareness intervention and Letter knowledge intervention Lonigan, C. J., Purpura, D. J., Wilson, S. B., Walker, P. M., & Clancy-Menchetti, J. (2013).	X					The programme aimed at the improvement of emergency literacy skills through the implementation of the Standard shared reading intervention, the Phonological awareness intervention and the Letter knowledge intervention. The ultimate goal of the project was to help children identify letter names and sounds.
Early Authors Program Bernhard, J. K., Winsler, A., Bleiker, C., Giniewicz, J., & Madigan, A. L. (2008). doi:10.1080/10824660701860458	X					The intervention aimed at the development of the literacy skills for students and their families through the implementation of literacy-focused activities, incorporating both the language of the classroom as well as the home language of the children.
Early Head Start Harden, B. J., Sandstrom, H., & Chazan-Cohen, R. (2012).				X	X	The project aimed to explore the different processes which might influence the learning outcomes in African American 3-year-old children by trying to identify parenting mechanisms. The project used of various methods of data collection such as impact designs including interviews with parents and children's assessments at the end of the project.
Early Reading First Gonzalez, J. E., Goetz, E. T., Hall, R. J., Payne, T., Taylor, A. B., Kim, M., & McCormick, A. S. (2011).	X					The programme focused on the development of language, cognitive, and reading skills. in order to prepare preschool-aged children to enter kindergarten.

	Lit	Mat	Cog	S/E	Phys	
ECHOS: Early Childhood Hands-On Science Brown, J. A., Greenfield, D. B., Bell, E., Juárez, C. L., Myers, T., Nayfeld, I., & Society for Research on Educational, E. (2013).			X			The intervention aimed at the improvement of language and literacy skills. The project included 36 ECHOS lessons focusing on the development of complex science concepts and skills in the fields of language and literacy, mathematics, and creative arts.
ELM curriculum Doabler, C. T., Clarke, B., Kosty, D. B., Baker, S. K., Smolkowski, K., & Fien, H. (2016).		X				The project focused on the design of a math curriculum for kindergarten addressing students with math difficulties and English Language learners with different first language. The daily lessons included four to five math activities such as class and small-group activities, judicious review activities of previously learned material, and worksheet activities based on extended practice with previously taught concepts.
ELM Kindergarten Mathematics Intervention Doabler, C., Baker, S. K., Smolkowski, K., Fien, H., Clarke, B., Cary, M. S., ... Society for Research on Educational, E. (2011).		X				The project included various lessons with 4–5 activities for each lesson in order to promote early mathematical learning and practice. The content of the activities focused on the whole number and operations, measurement, geometry and mathematics vocabulary. On main characteristic of the intervention was the high level of student and teacher interaction through the participation in mathematical activities.
Embedded Instruction Practice- Story Friends Goldstein, H., Kelley, E., Greenwood, C., McCune, L., Carta, J., Atwater, J., Spencer, T. (2016).	X					The project aimed at the development of language and literacy skills especially of the children who were at risk of language disabilities. More specifically, the programme focused on the improvement of oral language, including vocabulary knowledge and language comprehension.
Emotions Course Johnson, S. R., Seidenfeld, A. M., Izard, C. E., & Kobak, R. (2013).						The ultimate goal of the emotions-based preventive project was to explore the impact of Head Start project in the classroom in the improvement of prosocial behaviour in children with caregivers with high rates of depressive symptoms. Emotions Course is a classroom-based curriculum aiming at the facilitation of children's learning and use of emotion recognition, labelling, activation, regulation and utilisation.
English Instructional Intervention Tong, F., Irby, B. J., Lara-Alecio, R., Yoon, M., & Mathes, P. G. (2010). =	X					The project included daily tutorials in the Santillana Intensive English program, Story Retelling and Higher Order Thinking for English Language and Literacy Acquisition, academic oral language (AOL) in a research-based curriculum focused on fields of teaching content such as math and sciences.
Enhancing the intensity of vocabulary instruction for pre-schoolers at risk- WOW curriculum Neuman, S. B., Newman, E. H., & Dwyer, J. (2011).	X					The aim of the programme was to assess the effectiveness of a vocabulary program designed to promote word learning and conceptual development for pre-schoolers living in economically deprived urban communities. More specifically, 12 schools participated in the interventions and the teachers involved received training through workshops in Head Start early learning outcomes and the supplemental curriculum.
Everyday Mathematics Vaden-Kiernan, M., Borman, G., Caverly, S., Bell, N., Ruiz de Castilla, V., Sullivan, K., & Society for Research on Educational, E. (2015). Wang, A. H., Firmender, J. M., Power, J. R., & Byrnes, J. P. (2016).						The project aimed at the prevention of math difficulties in early ages. The learning goals of the curriculum emphasised on real-life problem-solving, manipulatives, concept development, focused use of technology and parental involving.
Head Start Bloom, H. S., Weiland, C., & Society for Research on Educational, E. (2014). Lee, K., & Ludington, B. (2016). Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Westat, I. (2010).	X			X	X	The programme focused on a holistic approach to education aiming at improving school readiness in financially deprived areas. The project emphasised the cognitive, social and emotional development of children as well as on the parental participation.

	Lit	Mat	Cog	S/E	Phys	
HEAD Start CARES Demonstration. The three social-emotional enhancements that Head Start CARES tested were 'The Incredible Years Teacher Training Program,' 'Preschool PATHS' (Promoting Alternative Thinking Strategies), and 'Tools of the Mind-Play.' Morris, P., Mattera, S. K., Castells, N., Bangser, M., Bierman, K., Raver, C., & Mdr. (2014).				X		The project emphasised the training of teachers to create a classroom climate that helps and supports children's ability to control and regulate their behaviour towards the creation of interpersonal relationships among children and teachers. This was achieved through activities which enhance the interactions among students and teachers which enhanced student's emotion knowledge and social problem-solving skills.
Head Start Research-Based, Developmentally Informed (REDI) Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008). Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., & Gill, S. (2014). Bierman, K. L., Heinrichs, B. S., Welsh, J. A., Nix, R. L., & Gest, S. D. (2017). Nix, R. L., Bierman, K. L., Heinrichs, B. S., Gest, S. D., Welsh, J. A., & Domitrovich, C. E. (2016). Pyle, N., Vasquez, A. C., Kraft, B. L., Gillam, S. L., Reutzel, D. R., Olszewski, A., ... Pyle, D. (2017). Sasser, T. R., Bierman, K. L., Heinrichs, B., & Nix, R. L. (2017). Zhai, F., Brooks-Gunn, J., & Waldfogel, J. (2011).	X		X	X	X	The project focused on the development of social and emotional skills as well as the improvement of emergent language skills. The sessions of the intervention involved activities such as puppets, stories, role-playing sessions, sound games and daily alphabet centres, in which children could improve their letter knowledge.
Highly specified content-related book reading intervention Pollard-Durodola, S. D., Gonzalez, J. E., Saenz, L., Soares, D., Resendez, N., Kwok, O., ... Zhu, L. (2016).						The intervention aimed at the exploration of the impact of content-based shared book reading instruction on the vocabulary improvement of Spanish-speaking preschool children who were learning English as a second language and it was implemented in schools of economically deprived areas. The activities included shared book reading content that was organised in 18 constructed instructional units.
INSIGHTS O'Connor, E. E., Cappella, E., McCormick, M. P., & McClowry, S. G. (2014).			X	X		The aim of the project was to increase the academic performance and attention as well as reduce disruptive behaviour problems of financially deprived kindergarten and 1st grade students in 21 schools. The intervention involved children, parents and teachers to support children's ability to self-regulate by enhancing their attention and behavioural management skills.
Integrated comprehensive academic skills-focused curriculum Lonigan, C. J., Phillips, B. M., Clancy, J. L., Landry, S. H., Swank, P. R., Assel, M., ... Barnes, M. (2015).	X		X	X		The ultimate target of the intervention was the development of social, emotional and academic skills of children through the implementation of two types of an experimental curriculum. The social and emotional version of the curriculum focused on the acquisition of behaviour management skills and the social and emotional development through activities which required specific materials such as 80 trade books.

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Interim Assessments Konstantopoulos, S., Miller, S. R., van der Ploeg, A., & Li, W. (2016).						The project focused on the improvement of student's academic performance through the use of evidence of student performance by the teachers towards its maximisation.
Invented spelling programme Martins, M. A., Salvador, L., Albuquerque, A., & Silva, C. (2016).	X		X			The intervention aimed at the development of spelling and writing skills of student using conventional letters. The project implemented in small and heterogeneous spelling groups in which students had to spell four words and reach a consensus. The role of the teacher in this intervention was to write the word that the children decided to the board and then write the same word with alphabetic spelling written by a hypothetical child from another class. At the end the students were asked to compare their spelling with the alphabetic one, and to try to think which one was better and why.
Kindergarten PAVED for Success (K-PAVE) Goodson, B., Wolf, A., Bell, S., Turner, H., Finney, P. B., National Center for Education, E., ... Regional Educational Laboratory, S. (2010).	X		X			The programme aimed at the development of the vocabulary learning of children. The project was created around 240 target words introduced in 24 weekly units of 10 target words per unit. The target words are taught to students and then reinforced through repeated exposure in multiple and different contexts through activities such as storybook reading and classroom discussions.
Language Education Activities for Preschoolers (LEAP)- LEAP-LARGE, LEAP- SMALL and LEAP-OPEN Blases, D., Højen, A., Dale, P. S., Justice, L. M., Dybdal, L., Piasta, S., ... Haghish, E. F. (2018).	X					The intervention focused on the use of play activities towards the acquisition and development of 23 language and literacy objectives. The project was implemented by the educators either in the large groups of the whole class or in small groups which took place twice a week.
Leveled Literacy Intervention system Ransford-Kaldon, C. R., Flynt, E. S., Ross, C. L., Franceschini, L., Zoblotzky, T., Huang, Y., ... Center for Research in Educational, P. (2010).	X					The project aimed to provide intensive help and support to students in order to help them achieve academic competency. The researchers involved in the programme provided on-site orientation to the project and trained school teachers as well as there were on-site researchers in each district to help with the data collection procedure.
Literacy-focused preschool curriculum for language minority children- Literacy Express Preschool Curriculum and LEPC along with professional development workshops and in-class mentoring sessions Goodrich, J. M., Lonigan, C. J., & Farver, J. A. M. (2017).	X					The ultimate goal of the intervention was the improvement of English and Spanish early literacy skills among language minority students through the use of the Literacy Express Preschool Curriculum by the educators, which focused on the promotion of the development of children's early literacy skills and used the instructions of dialogic reading, phonological awareness activities.
Lubo from Outer Space! Schell, A., Albers, L., von Kries, R., Hillenbrand, C., & Hennemann, T. (2015).			X	X		The aim of the intervention was the promotion of expression, regulation of emotions, and development of problem-solving strategies through small-group activities with 9–14 preschool students. The social training program refers to a story about 'extra-terrestrial Lubo' (a hand puppet), who travels to Earth to learn about feelings and friendship, social problems and the children help him to overcome them. The intervention used age-appropriate methods such as cooperative games, role play, discussions, picture cards, creative methods as well as a feedback which supported the learning process in a stimulating way.
Maths curriculum Dillon, M. R., Kannan, H., Dean, J. T., Spelke, E. S., & Duflo, E. (2017).						The programme focused on the improvement of the mathematics learning of the children through the use of books and board games which developed the numerical and geometric skills of the students. More specifically, children played five games that build on numerical and geometric abilities emerged in the first 3 years, related to achievement in school mathematics, and that encouraged children to communicate using the language and symbols of primary school mathematics through social play adults and classmates.

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Mathematics Formative Assessment System – Common Core State Standards: A Randomised Field Trial in Kindergarten and First Grade Lang, L. B., Schoen, R. R., LaVenita, M., Oberlin, M., & Society for Research on Educational, E. (2014).		X				The study was a randomised control trial conducted in three different districts of Florida and aimed to evaluate the impact of the MFAS-CCSS intervention on teachers' knowledge of mathematics and students' mathematics learning in key stage 1.
Midwest Child-Parent Centre Richardson, B. A., Reynolds, A. J., Temple, J. A., & Smerillo, N. E. (2017).						The project focuses on the development of the cognitive skills, literacy and numeracy and non-cognitive skills like socio-emotional learning. The educational programme started in 1960 and it continues until now to be implemented in small groups of 8–9 children focusing also on the element of parental participation.
Montessori Practical Life Activities Bhatia, P., Davis, A., & Shamas-Brandt, E. (2015).					X	The intervention is based on Montessori Schools and emphasises the development of the motor skills using practical life activities which involve the use of a wide range of materials leading to the use of pen and pencil.
Nuffield Early Language Intervention (NELI) Fricke, S., Bowyer-Crane, C., Haley, A. J., Hulme, C., & Snowling, M. (2013).	X		X			The intervention targets oral language abilities for the first 20 weeks, supplemented with training letter-sound knowledge and phoneme awareness in the final 10 weeks. Teaching assistants receive two days training prior to each 10-week block of intervention and attended tutorials every two weeks throughout the programme. The intervention aims to improve children's vocabulary and narrative skills and to promote active listening and confidence in their speaking skills.
Path to Literacy Goldstein, H., Olszewski, A., Haring, C., Greenwood, C. R., McCune, L., Carta, J., ... Kelley, E. S. (2017).	X					The intervention targets children who do not develop early literacy skills, especially phonological awareness and alphabet knowledge prior to kindergarten. The project was a centre-based, small-group, scripted intervention aiming at the development of skills and alphabet knowledge. Additionally, the curriculum was created to be delivered to groups of two to three children for about 10 min/day.
PBS KIDS Transmedia Curriculum Supplement to Support Young Children's Mathematics Learning Llorente, C., Pasnik, S., Moorthy, S., Hupert, N., Rosenfeld, D., Gerard, S., & Society for Research on Educational, E. (2015).		X				The project took place in New York City and San Francisco Bay districts addressing children and families facing financial and social disadvantage. The study aimed to examine the role and the impact of technology and educational transmedia such as video, computer games and activities on the preschool children's mathematics learning. Additionally, the programme allowed the participation of teachers in professional development in math instruction and technology integration in the classroom.
Positive Action Schmitt, S. A., Flay, B. R., & Lewis, K. (2014).				X	X	The ultimate objective of the project was the improvement of social-emotional learning and the promotion of health of the students including six units such as understanding of PA and self-concept, physical health and intellectual health, self-management and self-control, respectful of others, considerate of others, and social bonding, honesty with self and others and self-improvement. The sessions used different strategies according to the age of the children, such as puppets, games, music, stories.
Positive Behaviour Support Procedures Fell, E. G., Walker, H., Severson, H., Golly, A., Seeley, J. R., & Small, J. W. (2009).				X		The aim of the project was to support school readiness through nine monthly classes divided into three sessions. During the three sessions the educators were encouraged to choose three behavioural expectations, such as Be Safe, Be Respectful and Be Responsible and use them in various settings, such as in the hallways, bathrooms and playground. The focus of the second set of the three sessions was classroom management and the effective use of preventive strategies targeted to a small group of children.

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Preschool First Step to Success Feil, E. G., Frey, A., Walker, H. M., Small, J. W., Seeley, J. R., Golly, A., & Forness, S. R. (2014). Floury, V. P., Thompson, J. L., & Wong, C. (2015).				X		The programme was a classroom intervention aimed to support children who were behaviourally at risk to start school through the focus on the development of adaptive behaviour which enhances school progress and friendship making skills for the creation of peer relations and interactions. The intervention provided feedback to the students using a green and red card – green displayed by the coach or teacher for positive classroom behaviour and red for negative behaviour.
Problem based learning (PBL) with cooperative learning (CL) and 'Numbered Heads Together' (NHT) Siew, N. M., Chin, M. K., & Sombuling, A. (2017).			X			The project aimed to support preschool children to work in groups and find solutions to real-world problems by creating a community in the classroom which is based on social interactions through group activities. The findings of the study demonstrated that teachers and students continue to experience difficulties related to working with and in groups. For this reason, the project employed the intervention of Numbered Heads Together (NHT) used as a set of collaborative procedures which have proven to increase students' scientific creativity.
QuarterlyMyTeachingPartner-Math/Science Kinzie, M. B., Whittaker, J. V., Williford, A. P., DeCoster, J., McGuire, P., Lee, Y., & Kilday, C. R. (2014).	X	X				The programme was designed and implemented in order to respond to the need of a preschool mathematics and science curriculum. The curriculum included 66 activities presented in explicit four-step inquiry format, each 15–20 min in length, 'Within Activity' curricular supports, Weekly Centres as well as Mathematics- and Science-related books.
Read Aloud Extension Activities on Vocabulary Silverman, R., Crandell, J. D., & Carlis, L. (2013).	X					The project focused on the exploration of the impact of read aloud plus extension activities intervention relative to an intervention that included read aloud alone. Both conditions were compared to a control group. Children were evaluated knowledge of target vocabulary and general vocabulary knowledge. The read aloud project included activities 24 books and 48 target words. Teachers in the read aloud plus condition were asked to review target words and give opportunities for children to use words. Teachers in the read aloud only condition were asked not to review words at other times of the day.
Read It Again! Lin, T. J., Justice, L. M., Emery, A. A., Mashburn, A. J., & Pentimonti, J. M. (2017).	X			X		The project emphasised the participation of all children in the classroom through collaborating with their peers in groups activities. The use of scaffolding strategies by the teachers was essential as they were designed to support the participation and engagement of children who find the content of a lesson difficult. In this intervention teachers use different strategies with children who find the content of a lesson too easy and for children who find the lesson too difficult.
Read Well Kindergarten Gunn, B., Smolkowski, K., & Vadasy, P. (2010).	X					The intervention aimed at the development of vocabulary, phonological awareness, alphabetic understanding, and decoding of children in kindergarten who start reading and they need instructions in order to improve their reading skills. The project focused on exposure to early literacy concepts with read aloud, songs, and games and small-group elements that are designed to support students with explicit instruction in literacy skills.
Reading and Integrated Literacy Strategies (RAILS) Stevens, R. J., Van Meter, P. N., Garner, J., Warcholak, N., Bochna, C., & Hall, T. (2008).	X					The project focused on the development of word reading, vocabulary development, comprehension, and fluency on children from kindergarten to second grade emphasising on the use of context in which children learned about comprehension processes. The programme started with listening comprehension sessions in kindergarten and moved to reading comprehension by second grade.
Ready to Learn Initiative Peniel, W. R., Pasnik, S., Bates, L., Townsend, E., Gallagher, L. P., Llorente, C., ... International, S. R. I. (2009).	X					The programme's ultimate target was to increase school readiness through video content and teacher-led and hands-on activities which included watched episodes and played online games towards the improvement of literacy skills such as recognition of letter names, identification of letter sounds, and understanding of story and print concepts.

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Ready to Learn Media Supplement Penuel, W. R., Bates, L., Gallagher, L. P., Pasnik, S., Llorente, C., Townsend, E., ... VanderBorght, M. (2012).	X					The project is a theoretical and empirical exploration of the role of media and technology on the social development of social skills, social interaction and literacy skills of children in an early age through the evaluation of a media-rich curriculum supplement developed as part of study. The curriculum supplement involved activities such as video, online games, and hands-on activities to motivate children to gain letter knowledge, knowledge of letter sounds and initial word sounds as well as an understanding of concepts of print.
Recognition & Response Buyse, V., Peisner-Feinberg, E., Soukakou, E., Fetting, A., Schaaf, J., & Burchinal, M. (2016).	X					The project aimed to help and support teachers to be more efficient by providing them with an instructional system consisting of formative assessment, foundational instruction and targeted small-group lessons.
R&R model in the area of language and literacy development Buyse, V., Peisner-Feinberg, E., Burchinal, M., & Society for Research on Educational, E. (2012).	X					The project emphasises the development of the language and literacy skills through the systematic use of universal screening and progress monitoring assessments gathered by classroom educators. The response element is related to the main instruction provided to all children as well as the focused interventions that are provided for some children who require additional instructional supports based on evaluation results.
School Readiness Research Consortium Feil, E. G., Walker, H., Severson, H., Golly, A., Seeley, J. R., & Small, J. W. (2009).				X		The study examines the impact of the project on child care teachers' behaviours and children's social, emotional, skills, early literacy, language and maths outcomes as well as the teacher-child relationship. The ultimate goal of the project was the improvement of the quality of teacher-child interactions to produce greater gains in children's social and emotional competence, language, early literacy, and early mathematical knowledge, as well as positive teacher-child relationships.
Second Step Early Learning Upshur, C. C., Heyman, M., & Wenz-Gross, M. (2017). Virues-Ortega, J., Julio, F. M., & Pastor-Barriuso, R. (2013).				X		The programme focused on the development of social and emotional skills as well as executive functioning. More specifically, the project included eight-weekly different activities for all five days of the week, as well as theme-related songs. Apart from the daily activities, there are also suggested teaching strategies designed to reinforce skills, manage behaviour and help children pay attention, encourage participation and integrate learning the specific skills.
Second Step Preschool/Kindergarten Kit Upshur, C., Wenz-Gross, M., & Reed, G. (2013).				X		The study addressed preschool behavioural problems through the use of 25 lesson cards, posters, puppets, a music CD and small cardboard heart tokens that can be used as reinforcements. The sessions focused on empathy, emotion management and problem-solving. The cards show a large black and white photo of ethnically diverse children and adults in different situations. The back of the card includes scripts and bullet points to support the teacher in delivering the lesson.
Social-Emotional Prevention Program Ştefan, C. A. (2012). Ştefan, C. A., & Miclea, M. (2013).			X	X		The intervention was focused on the development of social and emotional skills through emotional recognition and regulation as well as the reduction of behavioural issues through problem-solving on children, including 37 classroom-based activities.
Special Friends Meyer, L. E., & Ostrosky, M. M. (2016).						The project aimed to explore the Special Friends intervention in the creation of friendships among children with disabilities in the kindergarten towards the increase in the relationships of the children through the cultivation of social skills based on acceptance. The study was focused on the elements of school literacy experiences, mixed-ability, cooperative learning groups (CLGs) and home literacy experiences.

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Stony Brook Emergent Literacy Project Massetti, G. M. (2009).	X					The purpose of the project was to evaluate the package of emergent literacy training and activities for preschool classrooms in order to enhance reading. The participants in the study were children who were financially eligible and enrolled in 10 Head Start classrooms whose teachers volunteered for a research project involving early literacy. The study included 20 developmentally appropriate activities for teachers to engage children in the procedure of acquiring emergent literacy skills.
Storytelling and story-acting practice Nicolopoulou, A., Cortina, K. S., Ilgaz, H., Cates, C. B., & de Sá, A. B. (2015).	X		X	X		The project aimed at the enhancement of the capabilities of preschool children in social and economically disadvantaged areas in the fields of narrative and other oral language skills, skills related more directly to emergent literacy and social competence. During the intervention any child who wishes can dictate a story to a designated teacher who writes down the story as the child tells it. Additionally, each of the stories is read aloud by the teacher to the whole class while the child/author and other children, whom he or she chooses, act out the story.
Success for all Quint, J. C., Balu, R., DeLaurentis, M., Rappaport, S., Smith, T. J., Zhu, P., & Mdr. (2013). Quint, J. C., Balu, R., DeLaurentis, M., Rappaport, S., Smith, T. J., Zhu, P., & Mdr. (2014).	X					The study aims to ensure that all children learn to read in the elementary school levels. The intervention was focused on holistic school improvement elements addressing issues influencing student learning, such as behaviour, attendance and parental participation.
Tennessee Voluntary Prekindergarten Program Lipsey, M. W., Farran, D. C., Hofer, K. G., & Vanderbilt University, P. R. I. (2015). Lipsey, M. W., Hofer, K. G., Dong, N., Farran, D. C., Bilbrey, C., & Vanderbilt University, P. R. I. (2013).						The intervention was addressed to children who are age four on or before 30 September of the respective school year by providing top priority to children who qualify for the Free or Reduced Price Lunch Program.
The Dina Dinosaur Social Skills and Problem Solving Curriculum Webster-Stratton, C., Reid, M. J., & Stoolmiller, M. (2008).			X	X		The purpose of the intervention was the development of the social competence and the emotional self-regulation of children. The programme included seven units: learning school rules, how to be successful in school, emotional literacy, empathy, and perspective taking, interpersonal problem-solving; anger management, social skills; and communication skills. Teachers followed lesson plans that covered each of these content areas at least twice a week, using 15–20-minute large group circle time followed by 20 minutes of small group skill-practice activities.
The effect of four types of instructional organisation grouping on language minority students' math learning Garrett, R., & Hong, G. (2016).						The study examines the impact of four types of instructional organisation grouping on English language learners (children whose parents report a non-English primary language spoken in the household) towards the development of their maths skills.
The K-PAVE vocabulary instruction program Goodson, B., Wolf, A., Bell, S., Turner, H., Finney, P. B., National Center for Education, E., ... Regional Educational Laboratory, S. (2011). Graham, S., & Santangelo, T. (2014). Guo, Y., Wang, S., Hall, A. H., Breit-Smith, A., & Busch, J. (2016).						The purpose of the study was the improvement of the children's vocabulary including a suggested set of teaching techniques including instruction of the target vocabulary words using word-learning strategies, exposure to the vocabulary words in storybooks through repeated reading, and hands-on activities. Additionally, the second element involves teacher participation of children during story reading through questions that promote comprehension and oral language skills. The third element includes teacher discussions with individual or small groups of students to offer an opportunity for the teacher to use new vocabulary and for students to develop their productive use of new vocabulary.

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The Long and Short-Sequence K–8 Spanish Program Boyson, B. A., Semmer, M., Thompson, L. E., & Rosenbusch, M. H. (2013).	X					The project aimed at the improvement of the children's language skills to speak and write Spanish. In this context, the educators created a comprehensible content through scaffolding strategies that included gestures, pictures, objects, stories, music, drama and technology, which enhanced the interactions of children with their peers as well as with the teacher through large-group, small-group and paired activities as well as for individual work.
The Madrasa Early Childhood Development Program Malmberg, L. E., Mwaura, P., & Sylva, K. (2011).		X	X			The study was focused on the development of educational standards by providing more teaching and learning opportunities for Muslim children through active learning and religious integration.
The Opportunity Project Bakken, L., Brown, N., & Downing, B. (2017).	X	X		X		The purpose of the study was to help and support working families who face financial disadvantage by providing high-quality early learning experience to their children towards their emotional, academic and life-long success. The project focused on learning about diversity in the school, in the classroom, in the teaching and learning materials and in the daily social experiences of all children by becoming active learners.
The OWL curriculum and building blocks Weiland, C., & Yoshikawa, H. (2013).	X			X		The aim of the project was the improvement of the early language and literacy skills as well as social skills in which teachers discuss socio-emotional issues with children and integrate emotion-related vocabulary.
The road to mathematics (complete and short version) Toll, S. W. M., & Van Luit, J. E. H. (2014).		X				The intervention aimed towards the reduction of the problems in academic outcomes as well as to identify children with learning disabilities for example dyscalculia. The project included an intensive form of over-rehearsal, small task-focused and clear materials.
The Sunshine Circle Model/Group Theraplay Tucker, C., Schieffer, K., Wills, T. J., Hull, C., & Murphy, Q. (2017).				X		The study aimed at the development of self-regulation and reducing symptoms of trauma in children through group activities which were focused on the rules stick together, no hurts, and have fun. According to the tolerance of the class for group time, the teacher might select three to five different activities for the daily intervention.
Three variations of early literacy curricula implemented in Head Start classrooms (Opening the World of Learning (OWL), OWL combined with Enhanced Milieu Teaching (EMT), and enhanced version of Creative Curriculum- Standard Curriculum. It addresses all curriculum areas, but has a particular focus on language and literacy skills. Kaiser, A., Dickinson, D., Roberts, M., Darrow, C., Freiberg, J., Hofer, K., & Society for Research on Educational, E. (2011).	X					The study addressed problem behaviour in children with low literacy skills, difficulties in reading and peer relationships. The project took place in Head Start preschool classrooms in Birmingham, Alabama and included 52 classrooms.
Tier 2 Kindergarten Mathematics Intervention – replication to the initial ROOTS intervention Doabler, C. T., Clarke, B., Kosty, D. B., Kurtz-Nelson, E., Fien, H., Smolkowski, K., & Baker, S. K. (2016).		X				The project aimed at the evaluation of the efficacy of kindergarten mathematics intervention in the ELM curriculum-core kindergarten maths curriculum. Additionally, the teachers received three days of training related to the program implementation. More specifically, a main characteristic of the intervention was the high levels of teacher–child interactions.

	Lit	Mat	Cog	S/E	Phys	
Tier 2 standard protocol supplemental root word vocabulary and decoding skills intervention Nelson, J. R., Vadasy, P. F., & Sanders, E. A. (2011).	X					The purpose of the study was the development of vocabulary and reinforcement of decoding skills taught in Spanish-speaking English learners in kindergarten. The tutor used a presentation manual to present the lesson to small groups of students. Each landscape-format page included activities for one lesson and was divided into two parts, with the instructional components presented on each side in large print.
Tikichuela: Mathematics in My School- Fostering Early Math Comprehension Naslund-Hadley, E., Parker, S. W., & Hernandez-Agramonte, J. M. (2014). National Center for Education, R. (2008).		X				The study was focused on the enhancement of the academic performance of children in Paraguay and it was designed to close gaps in learning between students in urban and rural areas. More specifically, the lesson and materials were adjusted to Paraguayan conditions and preschool curriculum. Prior to the implementation of the intervention, a lack of knowledge and in pedagogical technique was identified in teachers in Paraguay and for this reason it was decided that the use of audio maths lessons including songs, dances, dramatisation of maths stories, games and other interactive activities could be more effective.
TRIAD-NFT (non-follow through) and TRIAD-FT (follow through) Clements, D. H., & Society for Research on Educational, E. (2011).		X				The aim of the programme was to enhance the mathematic academic achievement especially to those children who were at risk.
Tulsa Public Schools (TPS) pre-K program and Community Action Project (CAP) of Tulsa County Head Start program Gormley, W. T., Jr., Phillips, D. A., Newmark, K., Welti, K., & Adelstein, S. (2011).				X		The purpose of the project was the promotion of the social and emotional development of preschool children.
Words work program Zimmerman, S. S., Rodriguez, M. C., Rewey, K. L., & Heidemann, S. L. (2008).						The project aimed at the education of students aged three to five years old in order to engage them and their families' literacy program based on effective pedagogy through the provision of services that respect cultural differences. During the project students are encouraged to practise literacy skills like rhyming and sounding out words, not only during lessons but also during meals, when the students were washing their hands, or when putting class materials away using equipment and material provided in each classroom.
Young Athletes Program Favazza, P. C., Siperstein, G. N., Zeisel, S. A., Odom, S. L., Sideris, J. H., & Moskowitz, A. L. (2013).					X	The ultimate objective of the intervention was the development of the motor skills in children with disabilities using visual tracking and motor imitation, walking, running, balance and jumping, trapping and catching, throwing, striking and kicking to help children acquire new knowledge and skills through the interaction with their environment and the task.

Source: RAND Europe

Annex C: Detailed findings on language and literacy outcomes

This annex presents the detailed findings from the REA on language and literacy outcomes. First, the narrative findings are presented, organised by outcome categories, namely general language and literacy, oral language, listening skills, reading, vocabulary and writing. The strengths and limitations of the evidence are then presented. The narrative is followed by tables providing an overview of the systematic reviews (table C.1) and studies (table C.2) that are included in the REA.

General language and literacy

Overview of studies

Fourteen studies measured general language and literacy skills in children. We also found one meta-analysis of the impact of the Tools of the Mind curriculum (see box C.1 below for more details).

Types of programmes

Five studies explored the outcomes of Head Start (one study) and Head Start REDI (four studies). Head Start REDI supports teachers to integrate research-based programmes into the classroom, primarily for improving social-emotional functioning and language-emergent literacy skills. Both Head Start and Head Start REDI involve curriculum-level changes, with the latter also implementing teacher-level changes. Two studies investigated programmes aimed at improving children's mathematics attainment (Building Blocks and another mathematics curriculum). The rest of the studies investigated different programmes. We also found one meta-analysis of the Tools of the Mind curriculum.

All the interventions included an aspect of teacher-led activities and sessions, including working with children in smaller groups (Bleses et al., 2018; Buyse et al., 2016; Clements et al., 2011a; Landry et al., 2014) and using books or storytelling (Bernhard et al., 2008; Bierman et al., 2017; Bierman et al., 2014; Buyesse et al., 2016; Landry et al., 2014; Nicolopoulou et al., 2015). However, in general, interventions were relatively different to each other, including aspects such as parental involvement, the introduction of specialists to support teachers, the use of technology and children self-authoring stories. One of the interventions – the storytelling and story-acting practice – also included an aspect of child-led activities (Nicolopoulou et al., 2015).

Head Start and Head Start REDI involve year-long curricula, with shorter activity sessions (under 30 minutes) conducted daily or multiple times per week. Not all the other studies reported details on programme length and intensity of sessions, but those that did varied considerably. One programme was a year-long programme (Bernhard et al., 2008). Five others were full-time Head Start curricula (Bierman et al., 2008; Bierman et al., 2014; Bierman et al., 2017; Sasser et al., 2017; Zhai et al., 2011) while four were shorter (Bleses et al., 2018; Lin et al., 2017; Dillon et al., 2017; O'Connor et al., 2014). Six programmes included sessions implemented multiple times a week (Bierman et al., 2008; Bierman et al., 2014; Bleses et al., 2018; Dillon et al., 2017; Nicolopoulou et al., 2015; Sasser et al., 2017), one comprised daily sessions (Buyse et al., 2016). Session length also varied, with four programmes having sessions lasting 30 minutes or less (Bierman et al., 2008; Bleses et al., 2018; Buyse et al., 2016; Sasser et al., 2017) while two others had longer sessions (Dillon et al., 2017; O'Connor et al., 2014).

Outcomes examined

The 14 papers measured 15 general language and literacy outcomes. In three studies, only general literacy outcomes were assessed (Bernhard et al., 2008; Bleses et al., 2018; Buysse et al., 2016). The remaining studies assessed general language and literacy skills as part of a battery of other outcome measures (such as social skills, emotional understanding, mathematics ability and behaviour). In addition, one further study measured a composite school readiness outcome, which comprised literacy, numeracy, socio-emotional and physical health (Richardson et al., 2017).

Target population

Most of the studies examined children aged at least three years. One study focused on children aged below three while two studies included both age groups. One study was conducted in Denmark and another study was conducted in India. The remaining studies took place in the US.

Impact of programmes

In general, studies reported favourable results on general language and literacy skills. None of the findings favoured the control group, although four measurements did not find differences between the control and treatment groups. These were emergent literacy skills as a result of Head Start REDI-C (Bierman et al., 2017), literacy achievement as a result of Building Blocks (Clements et al., 2011a), mastery of language as a result of a maths curriculum (Dillon et al., 2017) and child literacy academic performance from the School Readiness Research Consortium (Landry et al., 2014). The mathematics-focused programmes had no impact on children's literacy and language mastery immediately following the intervention and at follow-up (Clements et al., 2011a; Dillon et al., 2017), suggesting that any improvements seen through mathematics interventions may not generalise to general language and literacy gains (though note that Sarama et al. (2012) found that the mathematics-focused Building Blocks programme had a positive impact on children's oral language).

Although outcomes were generally favourable, effect sizes that were reported were more modest (none were assessed as being large impacts). Bierman et al. (2008), investigating Head Start REDI, and Zhai et al. (2011), studying Head Start, both reported small effects (-0.7–0.15 and 0.19 respectively). Zhai et al. (2011) also found that improvements to children's language skills persisted even at age five, several years after the Head Start intervention.

The meta-analysis of the Tools of the Mind curriculum reported small but not statistically significant effects of the programme on children's literacy (see box C.1).

What works for whom

Only two studies examined differences between subgroups of children. Sasser et al. (2017) found that children in Head Start REDI classes who had lower executive function skills benefited more from the programme. Zhai et al. (2011) identified that Head Start outcomes did not differ by gender. In addition, the study that measured a composite school readiness score found that children whose home language was Spanish experienced similar benefits to other children from attending the Midwest Child-Parent Centre, a comprehensive intervention which includes an intensive parental involvement component (Richardson et al., 2017).

BOX C.1 FINDINGS FROM A META-ANALYSIS ON THE TOOLS OF THE MIND CURRICULUM ON LITERACY OUTCOMES

In a meta-analysis of six studies, Baron et al. (2017) found that the Tools of the Mind curriculum, which aims to improve children's self-regulation and academic skills through structured make-believe play scenarios and other curricular activities, had a positive effect on literacy, but it was not statistically significant. The effect on self-regulation was also not statistically significant. However, the Tools curriculum had a small but significant effect on children's mathematics skills. However, given the small number of studies and the methodological limitations and potential bias of those studies, the authors cautioned that the findings should not be seen as conclusive.

Source: RAND Europe

Oral language

Overview of studies

The REA identified 18 studies that reported on a range of oral language skills.

Types of programmes

Two of the studies focused on Head Start; a further two studies examined the K-PAVE programme. The rest of the studies investigated different programmes.

Five of the studies examined programmes implemented at the curriculum-level; five studies examined curriculum- and teacher-level programmes; two studies examined curriculum- and setting-level programmes; five interventions were implemented at the curriculum, setting and teacher level. Examination of the included studies suggests that the level or levels at which interventions were implemented did not have differential impacts on children's oral language outcomes.

Thirteen studies investigated programmes that were based on teacher-led methods, such as the type of instruction given or use of additional resources (Boyson et al., 2013; Buyse et al., 2012; Damhuis et al., 2016; Ecalle et al., 2015; Goodrich et al., 2017; Goodson et al., 2010; Goodson et al., 2011; Lonigan et al., 2015; Lonigan et al., 2013; Neuman et al., 2011; Pollard-Durodola et al., 2016; Ransford-Kaldon et al., 2010; Tong et al., 2010). Three papers implemented programmes that were child-led or included greater amounts of discussions between children and/or teachers (Nicolopoulou et al., 2015; Pollard-Durodola et al., 2016; Sarama et al., 2012). Nine papers investigated programmes using small group activities (Boyson et al., 2013; Buyse et al., 2012; Fricke et al., 2013; Goodrich et al., 2017; Goodson et al., 2010; Goodson et al., 2011; Lonigan et al., 2015; Lonigan et al., 2013; Ransford-Kaldon et al., 2010) and three programmes included technology or multi-media activities (Boyson et al., 2013; Nueman et al., 2011; Sarama et al., 2010). Two programmes focused on a whole-child approach (Bloom et al., 2014; Puma et al., 2010). There were mixed results for programmes that implemented a whole-child approach (Bloom et al., 2014; Puma et al., 2010), and interventions that used technology (Boyson et al., 2013; Nueman et al., 2011; Sarama et al., 2010).

For the studies that provided information on the dosage of the programme, seven included short sessions with children (under 30 minutes) and only one programme included longer sessions. There was a roughly equal split between the interventions that were implemented daily compared to multiple times per week and those that took place across a year compared to shorter time periods. Where

studies provided more details about the implemented programme, they appear to be fairly similar.

However, as noted earlier, many papers often did not provide an in-depth description of the programmes being assessed. This limited our ability to draw conclusions about what aspects of programmes may be more effective.

Outcomes examined

The outcomes examined included grammar, narrative skills, expressive vocabulary, oral comprehension, word decoding abilities and general oral language abilities.

Target population

All but one of the studies focused on children aged three years and above. Except for three studies (which were conducted in France, the UK and the Netherlands), the remaining studies took place in the US.

Impact of programmes

Overall, the studies reported that programmes had a beneficial effect on oral language outcomes in children. None of the studies reported findings favouring the control group. Three studies found no effects; specifically, Goodson et al. (2011) found that the K-PAVE programme had no effect on expressive vocabulary; and Pollard-Durodola et al. (2016) found that a content-related shared book reading intervention also had no effect on expressive vocabulary. Bloom et al. (2014) found that Head Start had no effect on oral comprehension.

The majority of studies reporting effect sizes reported medium effects (that is, between 0.20 and 0.79). One study reported a large effect size of 0.83–1.08 and 0.92–1.10 after exploring the effects of the Nuffield Early Language Intervention on taught expressive vocabulary and grammar respectively after assessments immediately after intervention and five months later (Fricke et al., 2013). Goodrich et al. (2017) examined the impact of the Literacy Express Preschool Curriculum on Spanish-speaking children's oral language skills and found small effects ($g = -0.04$ – 0.13). The K-PAVE programme also had small effects on children's expressive vocabulary (0.14).

Seven studies conducted follow-up assessments of children (Buysse et al., 2012; Damhuis et al., 2016; Fricke et al., 2013; Goodson et al., 2010; Neuman et al., 2011; Puma et al., 2010; Tong et al., 2010). Of these, three examined children's outcomes after at least one year and when children were in primary school (Fricke et al. 2013; Puma et al., 2010; Tong et al., 2010). Specifically, Puma et al. (2010) conducted measurements when children were aged four, when they were in kindergarten and in first grade; and Tong et al. (2010) measured children in kindergarten, first and second grade. Fricke et al. (2013) assessed children at the end of nursery, and four times throughout the first two school years. All three of these studies found that Head Start, the English Instructional Intervention and the Nuffield Early Language Intervention had sustained impacts on children's oral language outcomes.

What works for whom

Eight studies examined whether oral language outcomes varied between different groups of children. Three studies examined gender differences: Samara

et al. (2012) and Tong et al. (2010) found that Building Blocks and the English Instructional Intervention, respectively, had a more positive impact for boys' than girls' oral language skills; Goodson et al. (2011) found no differential impacts of K-PAVE on expressive vocabulary between genders. Three studies investigating effects for children who did not speak the majority language found that these children benefited equally or more than other children (Pollard-Durodola et al., 2016; Puma et al., 2010; Ransford-Kaldon et al., 2010). However, Goodrich et al. (2017) found that monolingual English-speaking children scored higher on measures for oral language than language minority children. Ransford-Kaldon et al. (2010) found that the Leveled Literacy Intervention System benefited the fluency of children with special educational needs. The impact of the Leveled Literacy Intervention System on oral language skills did not differ between children from a lower socio-economic background and other children. Similarly, the effect of the Recognition and Response model on children's expressive vocabulary did not differ depending on children's socio-economic background. In contrast, Sarama et al. (2012) found that the Building Blocks maths achievement programme had a greater effect on oral language for children from a higher socio-economic background.

Listening skills

Overview of studies

The REA included seven studies that examined the impact of programmes on children's listening skills.

Types of programmes

Two studies examined the Ready to Learn initiative and the Ready to Learn media supplement (Penuel et al., 2009; 2012 respectively). The remaining studies investigated ABRACADABRA (Savage et al., 2013)⁸, K-PAVE (Goodson et al., 2010), the Long and Short-Sequence K–8 Spanish Program (Boyson et al., 2013), Nuffield Early Language Intervention (Fricke et al., 2013) and Read Well Kindergarten (Gunn et al., 2010). It should be noted that none of these programmes were specifically aimed at impacting children's listening skills.

Four of the studied interventions were implemented at a curriculum and teacher level (Gunn et al., 2010; Fricke et al., 2013; Goodson et al., 2010; Savage et al., 2013), two at the curriculum level (Boyson et al., 2013; Penuel et al., 2012) and one across curriculum, setting and teacher level (Penuel et al., 2009). All seven programmes used teacher-led activities. In addition, four programmes used small group activities (Boyson et al., 2013; Fricke et al., 2013; Goodson et al., 2010; Gunn et al., 2010) and four used technology (Boyson et al., 2013; Penuel et al., 2009; Penuel et al., 2012; Savage et al., 2013). The studies largely did not include detailed information on the dosage of the interventions. The information provided suggests that the majority of interventions were implemented across a specific time frame, rather than throughout the school year, although the Nuffield Early Language Intervention was implemented across 30 weeks (Fricke et al., 2013), and in short sessions (30 minutes or less). The small number of studies and the differences in aspects of programmes meant no conclusions could be drawn as to whether these affected the outcome of the intervention.

⁸ The Education Endowment Foundation has also funded an evaluation of Abracadabra on 1,884 children in Year 1 in England. The evaluation found a programme effect for children's literacy (Abracadabra).

Outcomes examined

The outcomes examined across the studies included listening comprehension, knowledge of sounds, including letter sounds, sound awareness and the ability to blend words.

Target population

All the studies targeted children aged three and above. One study was conducted in Canada and one in the UK; the remaining studies were conducted in the US.

Impact of programmes

Nine listening outcomes (listed above) were assessed across the six papers. Five of these outcomes were favourably impacted by the intervention; Penuel et al. (2009; 2012) reported that the Ready to Learn initiative and the Ready to Learn media supplement had medium effects on children's knowledge of letter sounds and beginning sound awareness respectively and Fricke et al. (2013) reported that the Nuffield Early Language Intervention had a medium effect on letter-sound knowledge (the remaining studies did not report effect sizes). However, Penuel et al. found that there was no impact on other measures of awareness of sounds (Penuel et al., 2009; 2012). Gunn et al. (2010) also reported no impact of Read Well Kindergarten on children's sound awareness. Follow-up assessments when children were at the start and end of first grade also found no impacts for letter and name sounds.

Listening comprehension was assessed in three studies. Boyson et al. (2013) reported that the Long and Short-Sequence K–8 Spanish Program had positive impacts for children in the programme. Fricke et al. (2013) reported that the Nuffield Early Language Intervention had a medium effect on listening comprehension. Goodson et al. (2010) found that K-PAVE did not have listening comprehension effects for children, immediately and one month post-intervention.

What works for whom

None of the papers investigating listening skills explored if effects varied across different groups of children.

Reading

Overview of studies

We found one systematic review (narrative synthesis and meta-analysis) on the impact of read aloud interventions (box C.2). In addition, we found 36 studies included assessments of children's reading outcomes.

BOX C.2 FINDINGS FROM A SYSTEMATIC REVIEW ON THE IMPACT OF READ-ALoud INTERVENTIONS

Swanson et al. (2011) conducted a narrative synthesis of 11 studies and a meta-analysis of 18 studies that examined the effect of read-aloud interventions (for example, dialogic reading, repeated reading of stories, story reading with extended vocabulary activities) on early reading outcomes. The ages of children in the studies included in the review ranged from 3–8, and were aged 6 and under in many of the studies. Overall, the authors report that read-aloud interventions had significant, positive effects on children's language, phonological awareness, print concepts, comprehension and vocabulary outcomes.

Source: RAND Europe

Types of programmes

Of the included studies, four investigated the impact of the Head Start programmes; two studied examined the OWL programme and a further two studies reported on the Success for All model. The remaining studies investigated interventions that were different from one another.

All the studies investigated programmes implemented curricular-level changes. Most also included teacher- and/or setting-level changes. About half the studies examined programmes that incorporated traditional teacher-led instruction with the use of additional resources and activities (for instance, graphics, songs, games). In addition, several interventions involved the adoption of smaller class sizes or implementing the intervention with small groups of children. Other types of interventions included the use of technology, adopting a child-centred approach, and additional teacher support.

The frequency and duration of sessions varied across programmes. There were about equal numbers of interventions that were conducted daily compared to 1–4 times per week, as well as taking place throughout the entire school year compared to a shorter time frame. The majority of intervention sessions lasted less than half an hour, with most taking 10–20 minutes. However, the information provided by studies on the duration and frequency of interventions was limited.

Outcomes examined

Among the 36 included studies, the children's reading outcomes assessed included general reading skills, alphabet knowledge, word knowledge, phonological awareness and comprehension.

Target population

Most of the studies focused on children aged three and above. Only two studies (Bakken and Downing, 2011; Bernhard et al., 2008) additionally included children aged below three. All but five studies were conducted in the US (the five studies were conducted in the UK, Canada, France, Portugal and the Netherlands).

Impact of programmes

The 36 studies measured 70 reading outcomes. In 11 studies, the respective interventions had no effect on the treatment group as compared to the control group on some assessed reading outcomes (Buysse et al., 2012; Ecalle et al., 2015; Frede et al., 2010; Goodson et al., 2011; Gunn et al., 2010; Puma et al., 2010; Quint et al., 2014; Sarama et al., 2012; Savage et al., 2013; Vadasy et al., 2010; Zimmerman et al., 2008). In two studies, the findings favoured the control group: Konstantopoulos, et al. (2016) using teacher assessment interventions to impact children's reading achievement, and Quint et al. (2013) assessing word identification skills in the Success for All programme. However, in general, when measuring reading outcomes the majority of studies reported that the programmes had a positive impact. Programmes that used small groups for teaching generally demonstrated a positive impact on reading outcomes in children.

Ten studies did not report effect sizes for outcomes. In studies that did report effect sizes, most reported medium effects (that is, ranging between 0.20 and 0.79) on reading outcomes. Assessing the impact of the Stony Brook Emergent Literacy Project, Massetti (2009) reported large effects for phonological awareness and print awareness (each was assessed with two different measures) (effect sizes $d=1.72-1.94$). Vadasy and Sanders (2010) examined the impact of classroom phonics instruction and supplemental phonics-based instruction and also reported

large effects for alphabetic knowledge, phonological awareness, word reading and passage reading fluency (effect sizes $d=0.91-1.27$). Early Reading First also had a large effect on alphabet knowledge (effect size $\delta T=1.19$) (Gonzalez et al., 2011).

Fifteen studies included follow-up assessments of children after the end of the respective programmes being examined (Bakken and Downing, 2017; Buysse et al., 2012; Damhuis et al., 2016; Frede et al., 2010; Fricke et al., 2013; Goldstein et al., 2017; Gunn et al., 2010; Neuman et al., 2011; Puma et al., 2010; Quint et al., 2013; Quint et al., 2014; Sasser et al., 2017; Tong et al., 2010; Zhai et al., 2011; Zimmerman et al., 2008). Of these, eight examined children's outcomes after at least one year and when children were in primary school (Bakken and Downing, 2017; Fricke et al., 2013; Gunn et al., 2010; Puma et al., 2010; Quint et al., 2014; Sasser et al., 2017; Tong et al., 2010; Zimmerman et al., 2008). Specifically, Bakken and Downing (2017) examined children when they were in third, fourth and fifth grade; Fricke et al. (2013) measured children five times throughout nursery and their first two school years; Gunn et al. (2010) assessed children at the start of kindergarten and the start and end of first grade; Puma et al. (2010) assessed children from when they were four until they were in the first grade; Quint et al. (2014) assessed children in kindergarten and then from third to fifth grade; Tong et al. (2010) conducted measurements with children in kindergarten, first and second grade; and Zimmerman et al. (2008) assessed children yearly between second and fifth grade.

Follow-up assessments of children showed mixed impacts on reading outcomes. Quint et al. (2013) assessed the Success for All programme and found the control group benefited more with word identification than the experimental group.⁹ Fricke et al. (2013) identified that the Nuffield Early Language Intervention had a sustained impact on reading comprehension ($d=0.52$) although less of an effect on early word reading ($d=0.16$) and text reading accuracy ($d=0.05$). Fricke et al. (2013) also identified that the effect size for phoneme awareness was small at follow-up ($d=0.13-0.21$) but the phonological awareness showed a medium effect size ($d=0.52$). Gunn et al. (2010) found that Read Well Kindergarten only has a positive impact on sight words and decodable words; reading ability, reading competence and phonological processing were not affected. Zimmerman et al. (2008) measured reading skills through to fifth grade and found no effect from the Words work program. Frede et al. (2010) found no impact on print awareness after two years of the Abbott Preschool Program. Quint et al. (2014) and Buysse et al. (2012) assessed multiple reading outcomes at multiple follow-up assessments; some were not affected while others showed a benefit. Buysse et al. (2012) found that letter knowledge, phonological awareness and print knowledge were positively affected by the Recognition and Response model whereas phonological awareness showed no effect compared to the control group. Head Start was found to not have an effect on the reading outcomes assessed (phonetic awareness and pre-reading/reading) (Puma et al., 2010). The other assessed reading outcomes all showed a positive effect after the follow-up assessments (Bakken et al., 2017; Zhai et al., 2011; Damhuis et al., 2016; Goldstein et al., 2017; Neuman et al., 2011; Tong et al., 2010; Fricke et al., 2013).

⁹ The randomised control trial exploring the effects of Success for All in the UK also found that it provides a benefit. The authors found that children in the experimental group (exposed to the success for all programme) made an additional one month's progress in their literacy ability compared to the control group and children from low socio-economic backgrounds (defined as children receiving free school meals) made an additional two months progress compared to the control group (Miller, Biggart, Sloan & O'Hare, 2017).

What works for whom

Nine studies investigated whether reading outcomes differed between different groups of children. Three studies examined whether girls and boys benefited differently; two found no gender differences (Quint et al., 2013; Zhai et al., 2011) while one found that girls benefited from the English Instructional Intervention more than boys when measuring phonological awareness (Tong et al., 2010). Four studies reported findings for children who did not speak the majority language. In two studies examining the impact of Head Start, minority language children benefited equally or more than other children (Puma et al., 2010; Zhai et al., 2011). In the other two studies, minority language children did not benefit as much as other children (Goodrich et al., 2017, assessing the Literacy Express Preschool Curriculum; Sarama et al., 2012, examining the Building Blocks maths achievement programme). These findings indicate that Head Start may be a promising intervention for improving the reading ability of children who do not speak the majority language (see also box 4.1 in chapter 4 of the main report¹⁰). The Recognition and Response model was not found to have differential impacts on children with and without additional educational needs (Buysse et al., 2012).

Vocabulary

Overview of studies

The REA identified two meta-analyses (see box C.3 below) and 14 studies reporting findings of interventions on children's vocabulary outcomes.

Types of programmes

The interventions assessed were varied, although two studies evaluated Head Start. The majority of studies implemented interventions which were teacher-led (or had aspects of teacher-led activities) and five included teaching children in small groups (Buysse et al., 2012; Frede et al., 2010; Fricke et al., 2013; Kaiser et al., 2011; Pollard-Durodola et al., 2016; Ransford-Kaldon et al., 2010). Four included the use of books or stories (Damhuis et al., 2016; Goldstein et al., 2016; Pollard-Durodola et al., 2016; Silverman et al., 2013). One study mentioned the introduction of technology (Damhuis et al., 2016) and one the implementation of teaching assistants (Frede et al., 2010).

Both Head Start (Bloom et al., 2014; Puma et al., 2010) and Abbott Preschool Programme (Frede et al., 2010) are full-year programmes. Story Friends was also implemented over the course of a school year (Goldstein et al., 2016) and the Nuffield Early Language Intervention was implemented over 30 weeks (Fricke et al., 2013). The remaining interventions were took place over shorter periods.

The majority of the programmes involved multiple sessions a week lasting 30 minutes or less; however, the Leveled Literacy Intervention system was implemented daily (Ransford-Kaldon et al., 2010) and the Story Friends programme (Goldstein et al., 2016) and the Abbott Preschool Program (Frede et al., 2010) involved sessions lasting longer than 30 minutes.

10 See: www.eif.org.uk/publication/teaching-pedagogy-and-practice-in-early-years-childcare-an-evidence-review

BOX C.3 FINDINGS FROM META-ANALYSES ON VOCABULARY OUTCOMES

In a meta-analysis of 67 studies, Marulis and Neuman (2010) found that vocabulary interventions had a positive and large impact on prekindergarten and kindergarten children's word learning, with moderate effects persisting over time. Studies included in the meta-analysis examined a wide range of interventions, though storybook reading and dialogic reading were the most common. The authors also found that at-risk children who were middle- or upper-income were significantly more likely to benefit from vocabulary interventions than at-risk, low-income children, suggesting that such interventions are not sufficient for closing income gaps, even in the early years.

Guo et al. (2016) conducted a meta-analysis of seven articles that examined the impact of science instruction on the vocabulary outcomes of typically developing children in kindergarten or prekindergarten. The authors identified two types of science instruction: primarily science interventions, and vocabulary interventions with a focus on science. Overall, science instruction increased young children's vocabulary outcomes (medium effect size), though the science interventions had larger effects on vocabulary outcomes than the vocabulary interventions.

Source: RAND Europe

Outcomes examined

The 14 studies examined a variety of children's vocabulary outcomes, including receptive vocabulary, vocabulary learning and vocabulary knowledge (expressive vocabulary outcomes are reported under oral language).

Target population

All the studies examining vocabulary outcomes involved children aged over three years. The majority of the studies were conducted in the US; one study each was conducted in France, the UK and the Netherlands.

Impact of programmes

Of the 14 vocabulary outcomes examined, nine favoured the treatment groups (Bloom et al., 2014; Buysse et al., 2012; Frede et al., 2010; Fricke et al., 2013; Goldstein et al., 2016; Gonzalez et al., 2011; Puma et al., 2010; Ransford-Kaldon et al., 2010; Weiland & Yoshikawa, 2013), while five showed no difference between treatment and control groups (Damhuis et al., 2016; Ecalle et al., 2015; Kaiser et al., 2011; Pollard-Durodola et al., 2016; Silverman et al., 2013). The majority of teacher-led interventions and all interventions with heavy inclusion of books/storytelling and introduction of technology show no effect on children's vocabulary abilities, suggesting that such activities and/or resource may not be sufficient for vocabulary improvements. Out of the studies which found a positive effect of intervention on vocabulary outcomes, the majority were classed as medium effect sizes (no studies reported large effects). Both Head Start studies reported small effect sizes (0.15, Bloom et al., 2014; 0.09–0.16, Puma et al., 2010).

Six studies conducted more than one follow up assessment of children (Buysse et al., 2012; Damhuis et al., 2016; Frede et al., 2010; Fricke et al., 2013; Goldstein et al., 2016; Puma et al., 2010), of these, three studies assessed children more than one year after the intervention ended and after children were already in primary school (Fricke et al., 2013; Kaiser et al., 2011; Puma et al., 2010). Puma et al. (2011) and Fricke et al. (2013) reported that vocabulary outcomes were maintained;

as well as at post-intervention, Kaiser et al. (2011) found no effect at first grade follow-up.

What works for whom

Five studies investigated the effects of interventions on different subgroups of children (Bloom et al., 2014; Buysse et al., 2012; Puma et al., 2010; Ransford-Kaldon et al., 2010; Silverman et al., 2013). None of the studies suggested less of a positive impact for low socio-economic status, special educational needs or language minority children. Three studies reported that children who did not speak the majority language benefited equally or more than other children (Bloom et al., 2014; Puma et al., 2010; Ransford-Kaldon et al., 2010). Other studies found that children from lower socio-economic background (Buysse et al., 2012; Ransford-Kaldon et al., 2010) or special education needs (Ransford-Kaldon et al., 2010) were also able to benefit.

Writing

Overview of studies

We found one meta-analysis of the impact of spelling instruction (see box C.4 for more details). Only six studies investigated children's writing-related outcomes.

Types of programmes

There was one study each examining Head Start (Puma et al., 2010), the Stony Brook Emergent Literacy Project (Masseti, 2009) and the Leveled Literacy Intervention System (Ransford-Kaldon et al., 2010). Vadasy and Sanders (2010) assessed the impact of supplemental phonics-based instruction for low-skilled kindergarteners and classroom phonics instruction. Martins et al. (2016) examined a spelling programme and Fricke et al. (2013) examined the Nuffield Early Language Intervention. It should be noted that none of these programmes specifically aimed at improving children's writing ability. Two of these programmes were implemented only at the curriculum-level (Ransford-Kaldon et al., 2010; Vadasy et al., 2010), two implemented curriculum- and teacher-level changes (Fricke et al., 2013; Massetti, 2009), one implemented curriculum- and setting-level changes (Martins et al., 2016), and one implemented changes at all three levels (Puma et al., 2010).

Three programmes were more focused on teacher-led activities (Fricke et al., 2013; Massetti, 2009; Ransford-Kaldon et al., 2010; Vadasy et al., 2010); the invented spelling programme included a more child-led approach (Martins et al., 2016); and Head Start uses a whole-child approach (Puma et al., 2010). Except for Head Start, the remaining programmes lasted less than a year, although the Nuffield Early Language Intervention lasted for 30 weeks (Fricke et al., 2013). The lack of complete details about the frequency and intensity of sessions, and the small number of studies assessing writing outcomes, limit the ability to identify any specific aspects of interventions may have most benefited children's writing and spelling outcomes.

Outcomes examined

The five studies examined children's spelling and pre-writing, emergent and writing skills.

BOX C.4 FINDINGS FROM A META-ANALYSIS ON THE IMPACT OF SPELLING INSTRUCTION

Graham et al. (2014) conducted a meta-analysis of 58 studies (across 53 articles) that examined the impact of spelling instruction on children's spelling, phonological awareness, reading and writing. Children in the included studies ranged from kindergarten to grade 12. Regardless of children's grade level and literacy skills, the authors found generally positive effects of spelling instruction on spelling, spelling when writing, phonological awareness and reading skills.

Source: RAND Europe

Target population

All the studies examining writing outcomes involved children aged over three years. Four of the studies were conducted in the US, one study took place in Portugal and one in the UK.

Impact of programmes

While Puma et al. (2010) reported that Head Start initially benefited children's pre-writing ability, follow-up measurements found that effects had faded. This effect was also seen with the Nuffield Early Language Intervention which had a strong effect size post-intervention on spelling ($d=0.82$) which had dropped roughly five months later ($d=0.35$). The remaining four programmes did not conduct follow-ups, but all were reported to have large post-intervention effects on children's general writing skills (Masseti, 2009; Ransford-Kaldon et al., 2010) and spelling (Martins et al., 2016; Vadasy & Sanders, 2010).

What works for whom

Vadasy and Sanders (2010) reported that a reading intervention had better impacts on English-speaking children's spelling, than the spelling of minority language children. Ransford-Kaldon et al. (2010) examined the impacts of the Leveled Literacy Intervention System on minority language children and found that they did not benefit more or less than other children. The Leveled Literacy Intervention System also did not have differential effects for children from varying socio-economic backgrounds and with or without special educational needs.

Strengths and limitations of the evidence

This REA found that in general, most of the interventions targeting a range of language and literacy outcomes had favourable effects on children who received the programme – although it may be that this reflects a publication bias for positive findings (Petticrew and Roberts, 2008). However, for listening and vocabulary outcomes, only just over half of the assessed outcomes were favourably impacted by the programmes. In terms of vocabulary outcomes, programmes that focused on books, story-telling and the use of technology tended not to impact children's vocabulary abilities. It may be that incorporating such activities and/or resource are helpful but not be sufficient for vocabulary improvements, though further research is needed to confirm this.

The strongest body of evidence was on the Head Start programme and its variants in the US, examined by seven studies included in this review. These studies found that participating in Head Start classrooms favourable impacted children's general

literacy skills (Bierman et al., 2008; Zhai et al., 2011), reading skills (Puma et al., 2010; Zhai et al., 2011), vocabulary skills (Bloom et al., 2014; Puma et al., 2010) and writing skills (Puma et al., 2010). Zhai et al. (2011) found that improvements to children's language skills persisted even at age five, several years after the Head Start intervention. Vocabulary effects, though small, were also maintained (Bloom et al., 2014; Puma et al., 2010). Sasser et al. (2017) found that children in Head Start REDI classes who had lower executive function skills had greater benefits to their general language skills than other children. A systematic review found that widely available and well-regulated programmes, including Head Start, had a positive impact on improving the language and literacy skills of dual-language learners (Buysse et al., 2014). However, Head Start had only a limited and short-term impact on children's pre-writing ability (Puma et al., 2010). In addition, the findings from studies on Head Start, all of which were conducted in the US, may not be generalisable to a UK context.

Overall, the variety of the programmes studied (in terms of length, frequency and intensity of programme) and the lack of clear and complete descriptions of these programmes means it is difficult to draw conclusions about whether there are particular aspects of programmes that are more effective for children's language and literacy outcomes.

Children's reading-related outcomes were the most frequently examined by studies; in comparison, there were fewer studies focusing on other language outcomes such as oral language and listening. Other studies have raised the dearth of research on, for instance, oral language (Law, Roulstone, & Lindsay, 2015).

In the future, more research should examine in more detail whether impacts differ between children with different backgrounds, whether effects persist in the longer term, and on the effect of programmes for children aged below three years.

TABLE C.1 SUMMARY OF SYSTEMATIC REVIEWS ON LANGUAGE AND LITERACY OUTCOMES

Reference	Review focus	Time period covered	Number of studies included	Brief summary of the study and findings
Buyse, V., Peisner-Feinberg, E., Pérez, M., Hammer, C. S., & Knowles, M. (2014). Effects of early education programs and practices on the development and learning of dual language learners: A review of the literature. <i>Early Childhood Research Quarterly</i> , 29(4), 765–785. doi:10.1016/j.ecresq.2013.08.004	Effects of early care and education practices on the developmental outcomes of dual-language learners from birth to 5 years	2000–2011	Narrative synthesis: 25	The authors conducted a narrative synthesis of the effect of early care and education practices on dual-language learners. The search identified 25 articles that met the inclusion criteria. Almost all of the studies included focused on Latino or Spanish-speaking children aged between 3–5 years. Only one study focused on children aged under 3. Across the studies, most participants were enrolled in centre-based settings including Head Start, Even Start, Montessori and public pre-kindergarten. Based on a few large-scale high quality studies, the review found some evidence that widely available and well-regulated programmes, such as Head Start, had a positive impact on improving the language and literacy skills of dual-language learners. However, the heterogeneity of intervention types and study methods mean it was not possible for the researchers to distinguish between the separate contributing effects of language instruction and type of intervention.
Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2011). Pedagogical Strategies for Teaching Literacy to ESL Immigrant Students: A Meta-Analysis. <i>British Journal of Educational Psychology</i> , 81(4), 629–653.	Reading and writing outcomes of interventions to teach English literacy to immigrant children	Not stated	Meta-analysis: 26	The authors conducted a meta-analysis of experimental and quasi-experimental studies that examined strategies for teaching English literacy to immigrant children. The search identified 20 articles, comprising 26 effect sizes, which met the inclusion criteria (3,150 participants). There was a range of interventions, which the authors categorised into four types: collaborative reading, systematic phonics instruction and guided reading, multimedia assisted reading, and structured or diary writing. Interventions were targeted at children from kindergarten to grade 6. Except for multimedia assisted reading, the remaining intervention types had positive and statistically significant effects on children's reading and writing. Collaborative reading studies had the largest effect, while structured and diary writing interventions had a moderate effect. Shorter studies (3 months or less) had larger effects than studies conducted over a longer period.
Swanson, E., Vaughn, S., Wanzek, J., Petscher, Y., Heckert, J., Cavanaugh, C., ... Tackett, K. (2011). A Synthesis of Read-Aloud Interventions on Early Reading Outcomes among Preschool through Third Graders at Risk for Reading Difficulties. <i>Journal of Learning Disabilities</i> , 44(3), 258–275.	Effects of read-aloud interventions on early reading outcomes for children from aged 3 to 8	1984–2008	Narrative synthesis: 11; Meta-analysis: 18	The authors aimed to examine the effect of read-aloud interventions (for example, dialogic reading, repeated reading of stories, story reading with extended vocabulary activities) on early reading outcomes. The authors conducted a search of the literature using three steps: first, a database search of studies published between 1984 and 2008; second, a hand search of 9 journals from 2004 to 2008; third, snowballing by reviewing the reference lists of identified studies. The search identified 27 articles, comprising 29 studies, which met the inclusion criteria. A meta-analysis was conducted of a sub-set of 18 articles that provided sufficient data. A narrative synthesis was conducted for the remaining studies. The sample of children in the review ranged in age from 3–8, and were aged 6 and under in many of the studies. Overall, the authors report that read-aloud interventions had significant, positive effects on children's language, phonological awareness, print concepts, comprehension and vocabulary outcomes.
Graham, S., & Santangelo, T. (2014). Does Spelling Instruction Make Students Better Spellers, Readers, and Writers? A Meta-Analytic Review. <i>An Interdisciplinary Journal</i> , 27(9), 1703–1743.	Effect of spelling instruction on children's spelling, phonological awareness, reading and writing outcomes	Prior to October 2012	Meta-analysis: 58	The authors conducted a meta-analysis of experimental and quasi-experimental studies that examined the impact of spelling instruction on children's spelling, phonological awareness, reading and writing. The search identified 53 articles, comprising 58 effect sizes, which met the inclusion criteria (6,037 participants from kindergarten to grade 12). Regardless of children's grade level and literacy skills, the authors found generally positive effects of spelling instruction on spelling, spelling when writing, phonological awareness and reading skills.

Guo, Y., Wang, S., Hall, A. H., Breit-Smith, A., & Busch, J. (2016). The Effects of Science Instruction on Young Children's Vocabulary Learning: A Research Synthesis. <i>Early Childhood Education Journal</i> , 44(4), 359–367.	Effect of science instruction on children's vocabulary	1990 to October 2014	Meta-analysis: 7	The authors conducted a meta-analysis of experimental and quasi-experimental studies that examined the impact of science instruction on the vocabulary outcomes of typically developing children (without mental, physical or sensory disabilities) in kindergarten or prekindergarten. Seven articles met the inclusion criteria and were included in the meta-analysis. The frequency, length and intensity of science instruction in the included studies varied widely, with interventions ranging from 2 to 220 sessions (median of 16 sessions) across a period of 1 day to 44 weeks (median of 5 weeks). Sessions lasted between 14 and 23 minutes (median of 20 minutes). Overall, science instruction increased young children's vocabulary outcomes (medium effect size). The authors categorised two types of science instruction: primarily science interventions, and vocabulary interventions with a focus on science. The science interventions (3 studies) had medium to large effect sizes for vocabulary outcomes. The vocabulary interventions (4 studies) had effect sizes ranging from small to large.
Marulis, L. M., & Neuman, S. B. (2010). The Effects of Vocabulary Intervention on Young Children's Word Learning: A Meta-Analysis. <i>Review of Educational Research</i> , 80(3), 300–335.	Effects of vocabulary interventions on the oral development of children in prekindergarten and kindergarten	Prior to September 2008	Meta-analysis: 67	The authors conducted a meta-analysis of experimental and quasi-experimental studies that analysed the impact of vocabulary interventions on prekindergarten and kindergarten children's word learning. The search identified 64 articles that met the inclusion criteria, yielding 67 studies and 216 effect sizes (5,929 participants). There was a wide range of interventions, though storybook reading and dialogic reading were the most common. Overall, vocabulary interventions had a positive and large effect on word learning. The 11 studies that included a post-test (2–180 days following intervention) found that moderate effects persist over time. The effects were greater when trained adults carried out the intervention, when the intervention included explicit and implicit instruction, and when outcomes were measured using author-created measures as opposed to standardised measures. Of particular interest for this evidence review, at-risk children who were middle- or upper-income were significantly more likely to benefit from vocabulary interventions than at-risk, low-income children. The authors therefore state that vocabulary interventions are unlikely to be powerful enough to close income gaps, even in the early years.
Baron, A., Evangelou, M., Malmberg, L. E., Melendez-Torres, G. J. (2017) The Tools of the Mind curriculum for improving self-regulation in early childhood. Campbell Systematic Reviews. doi: 10.4073/csr.2017.10	Effect of the Tools of the Mind curriculum on the self-regulation, maths and literacy skills of children in preschool and kindergarten	Prior to December 2016	Meta-analysis: 6	The authors conducted a meta-analysis of studies using an experimental or quasi-experimental design, to examine the impact of the Tools of the Mind curriculum on children's self-regulation and academic skills. The search identified 6 eligible studies, comprising 14 records 13 of which met the inclusion criteria for the meta-analysis. Overall, the authors found that the Tools of the Mind curriculum had a positive and small effect on children's math skills. The effect size for self-regulation and literacy were positive but not statistically significant. However, given the small number of studies included in the meta-analysis, the methodological limitations and the potential bias of those studies, the authors cautioned against considering the findings as conclusive. Note: This systematic review is also reported under mathematics and socio-emotional outcomes.

Source: RAND Europe

TABLE C.2 SUMMARY OF STUDIES ON LANGUAGE AND LITERACY OUTCOMES

Reference	Programme name	Country of programme	Main level	Outcome measure	Favours treatment	Favours control	No effect
Bakken, L., Brown, N., & Downing, B. (2017).	The Opportunity Project	US	Curriculum	Maths test score Reading test scores Social interactions Attitudes to school	X X X X		
Bernhard, J. K., Winsler, A., Bleiker, C., Gimieniewicz, J., & Madigan, A. L. (2008).	Early Authors Program	US	Teacher	Language, literacy and print knowledge	X		
Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008).	Head Start REDI	US	Curriculum	Language skills Literacy skills Emotional understanding and socio-cognitive skills Social behaviours Learning engagement at school Learning engagement at home	X X X X X X		
Bierman, K. L., Heinrichs, B. S., Welsh, J. A., Nix, R. L., & Gest, S. D. (2017).	Head Start REDI-C	US	Curriculum	Social-emotional adjustment Emergent literacy skills	X		X
Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., & Gill, S. (2014).	Head Start REDI	US	Curriculum	Language and emerging literacy skills Learning engagement Social competence Aggressive behaviour	X X X X		
Bloom, H. S., Weiland, C., & Society for Research on Educational, E. (2014).	Head Start	US	Curriculum	Receptive vocabulary Early reading Oral comprehension Early math Externalising behaviour problems Self-regulation	X X X X		X X
Blases, D., Højlen, A., Dale, P. S., Justice, L. M., Dybdal, L., Piasta, S., ... Haghish, E. F. (2018).	Language Education Activities for Preschoolers (LEAP)- LEAP-LARGE, LEAP-SMALL and LEAP-OPEN	Denmark	Curriculum	Language and literacy skills	X		

Boyson, B. A., Semmer, M., Thompson, L. E., & Rosenbusch, M. H. (2013).	The Long and Short-Sequence K-8 Spanish Program	US	Curriculum	Speaking performance Listening comprehension	X X
Buyse, V., Peisner-Feinberg, E., Burchinal, M., & Society for Research on Educational, E. (2012).	Recognition and Response model in the area of language and literacy development	US	Setting	Letter knowledge Vocabulary Phonological awareness Receptive language Expressive vocabulary Print knowledge Phonological awareness	X X X X X X X
Buyse, V., Peisner-Feinberg, E., Soukakou, E., Fetting, A., Schaaf, J., & Burchinal, M. (2016).	Recognition & Response	US	Setting	Language and literacy skills	X
Clements, D. H., Sarama, J., Farran, D., Lipsey, M., Hofer, K. G., Bilbrey, C., & Society for Research on Educational, E. (2011).	Building Blocks	US	Curriculum	Thinking and learning within maths Narrative recall Maths achievement Literacy achievement	X X X X
Damhuis, C. M. P., Segers, E., Scheltinga, F., & Verhoeven, L. (2016).	Adaptive word retrieval intervention	The Netherlands	Curriculum	Knowledge of target words General receptive vocabulary General expressive vocabulary	X X X
Dillon, M. R., Kannan, H., Dean, J. T., Spelke, E. S., & Duflo, E. (2017).	Maths curriculum	India	Curriculum	Maths concepts and skills Social skills Mastery of language Executive function Motivation to tackle challenging problems	X X X X X
Ecalte, J., Labat, H., Le Cam, M., Rocher, T., Cros, L., & Magnan, A. (2015).	Alphabetic code training, phonological awareness training and listening comprehension	France	Curriculum	Letter knowledge Phonological skills Vocabulary Oral comprehension Reading	X X X X X

Fricke, S., Bowyer-Crane, C., Haley, A. J., Hulme, C., & Snowling, M. (2013).	Nuffield Early Language Intervention (NELI)	UK	Curriculum	Grammar Vocabulary Listening comprehension Narrative skill Taught vocabulary Letter-sounds knowledge Phonological awareness Phoneme awareness Reading Spelling	X X X X X X X X X X
Frede, E., Barnett, W. S., Jung, K., Esposito Lamy, C., & Figueras, A. (2010).	Abbott Preschool Program	US	Setting	Receptive vocabulary Mathematical skills Print awareness	X X X
Goldstein, H., Kelley, E., Greenwood, C., McCune, L., Carta, J., Atwater, J., Spencer, T. (2016).	Embedded Instruction Practice- Story Friends	US (Ohio and Kansas)	Curriculum	Measure of vocabulary learning Children's ability to comprehend stories	X X
Goldstein, H., Olszewski, A., Haring, C., Greenwood, C. R., McCune, L., Carta, J., ... Kelley, E. S. (2017).	Path to Literacy	US – 3 sites: Ohio, Kansas and Florida	Curriculum	Phonemic awareness Phonemic awareness	X X
Gonzalez, J. E., Goetz, E. T., Hall, R. J., Payne, T., Taylor, A. B., Kim, M., & McCormick, A. S. (2011).	Early Reading First	US	Teacher	Print knowledge Alphabet knowledge Receptive vocabulary and general language development	X X X
Goodrich, J. M., Lonigan, C. J., & Farver, J. A. M. (2017).	Literacy-focused preschool curriculum for language minority children – Literacy Express Preschool Curriculum and LEPC along with professional development workshops and in-class mentoring sessions	US	Teacher	Oral language Phonological awareness Print knowledge	X X X
Goodson, B., Wolf, A., Bell, S., Turner, H., Finney, P. B., National Center for Education, E., ... Regional Educational Laboratory, S. (2010).	Kindergarten PAVED for Success (K-PAVE)	US	Curriculum	Expressive vocabulary Academic knowledge Listening comprehension	X X X

Goodson, B., Wolf, A., Bell, S., Turner, H., Finney, P. B., National Center for Education, E., ... Regional Educational Laboratory, S. (2011).	The K-Pave Vocabulary Instruction Program	US	Curriculum	Expressive vocabulary Academic knowledge Passage comprehension	X X X
Gunn, B., Smolkowski, K., & Vadasy, P. (2010).	Read Well Kindergarten	US	Curriculum	Rapid atomized naming Letter and name sounds Sight words and decodable words Reading ability Reading competence Phonological processing Receptive language	X X X X X X
Kaiser, A., Dickinson, D., Roberts, M., Darrow, C., Freiberg, J., Hofer, K., & Society for Research on Educational, E. (2011).	Three variations of early literacy curricula implemented in Head Start classrooms (Opening the World of Learning (OWL), OWL combined with Enhanced Milieu Teaching (EMT), and enhanced version of Creative Curriculum – Standard Curriculum. It addresses all curriculum areas, but has a particular focus on language and literacy skills.	US – Birmingham AL urban area	Curriculum	Composite measure of vocabulary Composite measure of grammatical sophistication Composite measure of complex language Composite measure of print knowledge	 X X X
Konstantopoulos, S., Miller, S. R., van der Ploeg, A., & Li, W. (2016).	Interim assessments	US	Curriculum	Mathematics achievement (grade) Reading achievement (grade)	 X X
Landry, S. H., Zucker, T. A., Taylor, H. B., Swank, P. R., Williams, J. M., Assel, M., ... Klein, A. (2014).	School Readiness Research Consortium	US	Teacher	Child social-emotional functioning Teacher-child relationship quality Child academic performance Child academic performance	 X X X X
Lin, T. J., Justice, L. M., Emery, A. A., Mashburn, A. J., & Pentimonti, J. M. (2017).	Read It Again!	US	Curriculum	Social depth Language skills Social competence	 X X X

Lonigan, C. J., Phillips, B. M., Clancy, J. L., Landry, S. H., Swank, P. R., Assel, M., ... Barnes, M. (2015).	Integrated comprehensive academic skills-focused curriculum	US	Curriculum	Non-verbal cognitive ability Oral language skills Code related skills Maths skills Socio-emotional awareness Oral language	X X X X X X
Lonigan, C. J., Purpura, D. J., Wilson, S. B., Walker, P. M., & Clancy-Menchetti, J. (2013). -130.	Dialogic reading intervention, Standard shared reading intervention, Phonological awareness intervention and Letter knowledge intervention	US	Curriculum	Oral language Phonological awareness Print knowledge	X X X
Martins, M. A., Salvador, L., Albuquerque, A., & Silva, C. (2016).	Invented spelling programme	Portugal	Curriculum	Letters known Cognitive ability Phonological awareness Spelling Reading	X X X X X
Massetti, G. M. (2009).	Stony Brook Emergent Literacy Project	US	Teacher	Phonological awareness Print awareness Emergent writing Phonological awareness Print awareness Emergent writing	X X X X X X
Nelson, J. R., Vadasy, P. F., & Sanders, E. A. (2011).	Tier 2 standard protocol supplemental root word vocabulary and decoding skills intervention	US	Curriculum	Proximal Root word vocabulary Distal Reading vocabulary Word reading	X X
Neuman, S. B., Newman, E. H., & Dwyer, J. (2011).	Enhancing the intensity of vocabulary instruction for pre-schoolers at risk – WOW curriculum	US	Curriculum	Word knowledge Students' expressive vocabulary Categories and properties knowledge Ability to make inferences and generalisations	X X X
Nicolopoulou, A., Cortina, K. S., Ilgaz, H., Cates, C. B., & de Sá, A. B. (2015).	Storytelling and story-acting practice	US	Curriculum	Oral language development Emergent literacy skills Pretend abilities Social competence	X X X X

O'Connor, E. E., Cappella, E., McCormick, M. P., & McClowry, S. G. (2014).	INSIGHTS	US	Setting	Child temperament Child sustained attention Child behaviour problems Child academic achievement	X X X X
Penuel, W. R., Pashnik, S., Bates, L., Townsend, E., Gallagher, L. P., Llorente, C., ... International, S. R. I. (2009).	Ready to Learn Initiative	US	Curriculum	Children's knowledge of letter names Children's knowledge of letter sounds Children's knowledge of common initial sounds. Knowledge of story and print concepts. Knowledge of letters in own name	X X X X
Penuel, W. R., Bates, L., Gallagher, L. P., Pashnik, S., Llorente, C., Townsend, E., ... VanderBorght, M. (2012).	Ready to Learn Media Supplement	US, preschool classrooms in California and New York	Curriculum	Letter name knowledge Letter sounds Beginning sound awareness Story and print concepts	X X X
Pollard-Durodola, S. D., Gonzalez, J. E., Saenz, L., Soares, D., Resendez, N., Kwok, O., ... Zhu, L. (2016).	Highly specified content-related book reading intervention	US		Vocabulary measure	X
Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Westat, I. (2010).	Head Start	US	Curriculum	Vocabulary Oral comprehension Phonetic awareness Pre-writing Pre-reading/reading Maths School performance Social skills and positive approach to learning Social competence Problem behaviour Health status	X X X X X X X
Quint, J. C., Balu, R., DeLaurentis, M., Rappaport, S., Smith, T. J., Zhu, P., & Mdrc. (2013).	Success for All	US	Curriculum	Word identification skills and reading decoding 'apply phonic/decoding skills to unfamiliar words'	X X

Quint, J. C., Balu, R., DeLaurentis, M., Rappaport, S., Smith, T. J., Zhu, P., & Mdr. (2014).	Success for All	US	Curriculum	Word identification Phonetic awareness Passage comprehension Word reading	X X X X
Ransford-Kaldon, C. R., Flynt, E. S., Ross, C. L., Franceschini, L., Zoblotsky, T., Huang, Y., ... Center for Research in Educational, P. (2010).	Leveled Literacy Intervention system	US		Phonemic awareness Letter-sound relationships Vocabulary Comprehension Fluency Writing	X X X X X X
Sarama, J., Lange, A. A., Clements, D. H., & Wolfe, C. B. (2012).	Building Blocks	US	Curriculum	Letter recognition Oral language Early mathematics	X X X
Sasser, T. R., Bierman, K. L., Heinrichs, B., & Nix, R. L. (2017).	Head Start Research-Based, Developmentally Informed (REDI)	US	Curriculum	Working memory Inhibitory control Attention shifting Reading fluency Language arts Mathematics Reading ability Need for/use of special education services	X X X X X X X X
Savage, R., Abrami, P. C., Piquette, N., Wood, E., Deleveaux, G., Sanghera-Sidhu, S., & Burgos, G. (2013).	ABRACADABRA	Canada	Curriculum	Letter sound knowledge Blending words measure Word reading skills Group Reading Assessment and Diagnostic Evaluation Understanding of spoken language Ability to fluently break three- or four-phoneme words	X X X X X X
Silverman, R., Crandell, J. D., & Carlis, L. (2013).	Read Aloud Extension Activities on Vocabulary	North-eastern US	Setting	Targeted vocabulary knowledge General vocabulary knowledge	X X
Stevens, R. J., Van Meter, P. N., Garner, J., Warcholak, N., Bochna, C., & Hall, T. (2008).	Reading and Integrated Literacy Strategies (RAILS)	US	Curriculum	Reading achievement Phonemic awareness Reading fluency	X X X

Tong, F., Irby, B. J., Lara-Alecio, R., Yoon, M., & Mathes, P. G. (2010).	English Instructional Intervention	US	curriculum	Phonological awareness Oral language skills Reading related skills	X X X
Vadasy, P. F., & Sanders, E. A. (2010).	Code-oriented reading intervention	US	Curriculum	Alphabetic knowledge Phonological awareness Word reading Spelling Passage reading fluency Comprehension	X X X X X
Vadasy, P. F., Nelson, J. R., & Sanders, E. A. (2013).	Connections (Early Vocabulary Connections: First Words to Know and Decode)	US	Curriculum	Reading vocabulary Word reading	X X
Weiland, C., & Yoshikawa, H. (2013).	The OWL curriculum and Building Blocks	US	Curriculum	Receptive vocabulary Pre-reading and reading skills Numeracy and early maths Working memory Attention shifting Cognitive inhibitory control Emotion identification Positive emotion Impulse control	X X X X X X X X X X
Zhai, F., Brooks-Gunn, J., & Waldfogel, J. (2011).	Head Start	US	Curriculum	Language skills Reading identification skills Social competence Attention Behavioural problems	X X X X X
Zimmerman, S. S., Rodriguez, M. C., Rewey, K. L., & Heidemann, S. L. (2008).	Words Work program	US	Curriculum	Reading skills	X

Source: RAND Europe

Annex D: Detailed findings on numeracy or mathematics outcomes

This annex presents the detailed findings from the REA on numeracy and mathematics outcomes. First, the narrative findings are presented, followed by the strengths and limitations of the evidence, then by tables providing an overview of the systematic reviews (table D.1) and studies (table D.2) that are included in the REA.

Overview of studies

Twenty-one papers that examined numeracy or mathematics outcomes were identified in this REA. In addition, we identified two meta-analyses: one of the impact of early mathematics programmes in pre-kindergarten and kindergarten, and one on the Tools of the Mind curriculum (box 5.1 in chapter 5 of the main report¹¹).

Types of programmes

Three of the included studies examined the impact of Early Learning in Mathematics, while two studies examined Building Blocks. Early Learning in Mathematics is a curriculum with content on number operations, geometry and measurement, which is designed to support a wide range of children and enhance mathematical knowledge. Building Blocks is a programme, implemented at the curriculum and teacher level, to improve children's overall mathematical attainment. The other studies focused on different programmes.

All the studies investigated programmes that implemented curricular-level changes. Sixteen of the 21 programmes were implemented more than one level. This was either at the curriculum and teacher levels (n=8), the curriculum and setting levels (n=5), or at all three levels (n=3).

The frequency and duration of sessions varied across programmes. There were some interventions that included daily sessions (Lewis Presser et al., 2015; Sarama et al., 2012), while other interventions included activities 1–4 times per week (Clements and Sarama, 2008). Some interventions involved shorter sessions lasting 10–20 minutes (Clements and Sarama, 2008; Kinzie et al., 2014), while others lasted about an hour (45–60 minutes) (Dillon et al., 2017; Doabler et al., 2016; Doabler et al., 2011) or even two hours (O'Connor et al., 2014). Interventions could last for one year (30–33 weeks) (Bakken et al., 2017; Kinzie et al., 2014) but several interventions were shorter, being implemented for between 10 weeks and 4 months (O'Connor et al., 2014; Clements and Sarama, 2008; Dillon et al., 2017).

Outcomes examined

Across the 21 studies, outcomes examined included counting, number recognition, mathematical ability, simple arithmetic and problem-solving.

Target population

The majority of studies examined children aged three and older. None of the studies examined children aged under 3, while 3 studies focused on children of

11 See: www.eif.org.uk/publication/teaching-pedagogy-and-practice-in-early-years-childcare-an-evidence-review

both age groups (Dillon et al., 2017; Bakken et al., 2017; Lonigan et al., 2015). The majority of the studies were conducted in the US (n=18). The remaining studies were conducted in the Netherlands (n=1), India (n=1) and Paraguay (n=1).

Impact of programmes

The meta-analyses of early mathematics programmes, such as Building Blocks and Early Learning in Mathematics (Wang et al., 2016), and Tools of the Mind (Baron et al., 2017), both found that these programmes favourably impacted children's mathematics skills (see box 5.1 in chapter 5 of the main report¹²).

Across the outcomes being assessed, the majority were favourably impacted by the programmes being examined (23 out of 32 outcomes). Given the findings of Wang et al.'s (2016) meta-analysis, this was unsurprisingly also true for the individual studies examining the impact of Building Blocks and Early Learning in Mathematics. In eight studies, no differences were found between the treatment and control groups. However, the evaluation of mCLASS, an interim assessment product that aims to maximise children's learning in mathematics by providing teachers immediate insight into children's progress, found that children that received the mCLASS performed worse than the control group, and that it did not close the gap between high and low achievers (Konstantopoulos et al., 2016).

The 16 studies that reported effect sizes mostly found medium effects (that is, between 0.20 and 0.79). The three programmes reporting the strongest effects were the Building Blocks programme, MyTeachingPartner-MathScience, and the TRIAD programme. Clements et al. (2011a) reported that the 30-week Building Blocks programme, which incorporated small-group mathematics sessions into everyday activities, had a moderate effect (effect size $g=0.71$). MyTeachingPartner-MathScience is a curriculum- and teacher-level intervention, implemented over 33 weeks, that aims to stimulate children to relate mathematics to relevant everyday problems. Children in the programme outperformed those in a control condition on a test measuring geometry, measurement skills, and numbers sense ($g=0.52$), but not in science or in a test measuring early mathematics ability (Kinzie et al., 2014). Clements et al. (2011b) found that participating in the TRIAD programme (Technology-enhanced, Research-based, Instruction, Assessment and professional) contributed to high mathematics scores for children ($g=0.51$). Seven studies did not report effect sizes.

Seven studies conducted a follow-up assessment of children's outcomes. Five of the seven studies continued finding positive effects of the following programmes on children's mathematics outcomes: one of the studies on Building Blocks (Clements and Sarama, 2008); Head Start REDI (Sasser et al., 2017); the Opportunity Project (Bakken et al., 2017); the Road to Mathematics programme (Toll and van Luit, 2014); and TRIAD (Clements et al., 2011a). There were no programme impacts at follow-up reported for the Math Curricula (Dillon et al., 2017) and the other study on Building Blocks (Clements et al., 2011b).

In one study Building Blocks was implemented early in the fall. The follow up measurements later in the spring of the same school year show that the programme was effective in enhancing mathematical knowledge of children in the experimental group (Clements and Sarama, 2008). The effect of Head Start REDI was measured at first, second and third grade and there were sustained gains in mathematical knowledge (Sasser et al., 2017). The Opportunity Project

12 See: www.eif.org.uk/publication/teaching-pedagogy-and-practice-in-early-years-childcare-an-evidence-review

followed one cohort of children from kindergarten through fourth grade and found sustained impact on mathematical ability (Bakken et al., 2017). The Road to Mathematics had small long-lasting impacts on early numeracy over three years for children who were classified as 'medium-achievers', but the reverse was true for children classified as 'low achievers' (Toll and van Luit, 2014). Favourable effects for the experimental group were found for the TRIAD programme one year after the programme ended (Clements and Society for Research on Educational, 2011).

What works for whom

Four studies investigated whether mathematics outcomes varied between different groups of children – all of which found that children who might be considered 'at-risk' benefited more from interventions than other children. The Road of Mathematics is a remedial programme designed to support low-performing children in the Netherlands and at the same time help in identifying children with learning disabilities. Results revealed that low-performing children benefited more from the programme (Toll and van Luit, 2014). Children who were considered at-risk based on their comparatively lower mathematics scores, benefited the most from the Early Learning in Mathematics programme (Doabler et al. 2011). There were significant positive effects for Spanish-speaking English learners in Early Learning in Mathematics classrooms (Doabler et al., 2016). Finally, Bloom et al. (2014) found that children who performed worse at the start of the REDI intervention during Head Start showed more favourable development over time, as well as significantly higher mathematical knowledge at third grade. However, it is important to note that while promising, these individual benefits are seen for different programmes and have not been replicated. More research needs to be done, focusing on each programme, to establish that they are able to offer greater benefits to at-risk than other children.

Strengths and limitations of the evidence

The majority of studies reviewed found that interventions yielded small to large impacts on numeracy or mathematics outcomes, though as mentioned in a previous section, it may be that this reflects a publication bias for positive findings (Petticrew and Roberts, 2008). Furthermore, the majority of the programmes evaluated were implemented at multiple levels and contained multiple components, making it difficult to determine which component, which level of the programme (or combination thereof) were key to these positive outcomes.

The studies reviewed focused on children's numeracy or mathematics learning in kindergarten and in the first year of school, indicating that there is a need for more research on the impact of interventions targeting process quality for younger children for this category of outcomes – especially with regards to potentially sustained gains that could result as these younger children grow. Sustained impact is often a question left unanswered: only seven of the 21 studies measured mathematical ability at a later point in time. Out of these seven, five reported programme effects at follow-up (Bakken et al., 2017; Clements, et al., 2011a; Clements and Sarama, 2008; Sasser et al., 2017; Toll and van Luit, 2014).

One of the general limitations of the studies reviewed is the lack of information on the fidelity of treatment implementation. Indeed, low fidelity of implementation can be a cause of weaker impacts – however, the studies reviewed rarely provided information in this regard. It is thus possible that higher effort to monitor the fidelity would have led to higher programme effects (Kinzi et al., 2014; Clements and Society for Research on Educational, 2011; Doabler, 2016).

Furthermore, there are limitations related to the outcome measures used to test the impact of the programmes. Some of the studies did not use standardised measure to evaluate mathematical knowledge (Bakken et al., 2017; Lonigan et al., 2015; Llorente et al., 2015) or used measures created by the programme developers, calling into question the impartiality of the measure (Clements et al. 2008). Furthermore, some tests used may not have been specifically designed for use with children whose primary language is different from that of the test (Doabler, 2016). These limitations surrounding measurements are worth highlighting because they can result in a lack of sensitivity or bias in detecting effects. Also, it might be reasonable to expect that improvements driven by curriculum changes or targeted at changing teacher practice may take longer to have an impact and thus the timing of the measurement of outcomes may not have been optimal in all studies.

Also as noted previously, the generalisability of the findings can be problematic, especially in cases where the programme was administered to selected groups of children or in specific settings (such as in publicly subsidised child care centres) (Lewis Presser et al., 2015).

Future research on the sustained impact of interventions targeting process quality for mathematical ability in the early years is needed, but also on how these interventions might impact different groups of children and in different contexts differently.

TABLE D.1 SUMMARY OF SYSTEMATIC REVIEWS ON MATHEMATICS OUTCOMES

Reference	Review focus	Time period covered	Number of studies included	Brief summary of the study and findings
Wang, A. H., Firmender, J. M., Power, J. R., & Byrnes, J. P. (2016). Understanding the Program Effectiveness of Early Mathematics Interventions for Prekindergarten and Kindergarten Environments: A Meta-Analytic Review. <i>Early Education and Development</i> , 27(5), 692–713.	Effects of early mathematics intervention programmes implemented in prekindergarten and kindergarten settings	2000–present (study published in 2016)	Meta-analysis: 31	The authors conducted a meta-analysis of experimental and quasi-experimental studies that examined the effect of early mathematics programmes in prekindergarten and kindergarten. Altogether, 29 articles were included in the review, comprising 31 effect sizes. The mathematics curriculum programmes identified were Building Blocks, Early Learning in Mathematics, Experimental Mathematics Curriculum, Pre-K Mathematics Curriculum (10 studies); the remaining 19 studies examined miscellaneous math-related activities. Overall, the interventions had a moderate to large effect size. They tended to have greater effects when they (1) targeted a single content strand of the National Council of Teachers of Mathematics, as opposed to multiple strands, (2) lasted 120 to 150 minutes each week, compared to shorter programmes, (3) were designed for prekindergarten settings as opposed to kindergartens, (4) presented content individually to children as opposed to small and whole groups, and (5) were tested using researcher-created mathematics assessments as opposed to standardised tests.
Baron, A., Evangelou, M., Malmberg, L. E., Melendez-Torres, G. J. (2017) The Tools of the Mind curriculum for improving self-regulation in early childhood. Campbell Systematic Reviews. doi: 10.4073/csr.2017.10	Effect of the Tools of the Mind curriculum on the self-regulation, maths and literacy skills of children in preschool and kindergarten	Prior to December 2016	Meta-analysis: 6	The authors conducted a meta-analysis of studies using an experimental or quasi-experimental design, to examine the impact of the Tools of the Mind curriculum on children's self-regulation and academic skills. The search identified 6 eligible studies, comprising 14 records 13 of which met the inclusion criteria for the meta-analysis. Overall, the authors found that the Tools of the Mind curriculum had a positive and small effect on children's math skills. The effect size for self-regulation and literacy were positive but not statistically significant. However, given the small number of studies included in the meta-analysis, the methodological limitations and the potential bias of those studies, the authors cautioned against considering the findings as conclusive.

Source: RAND Europe

TABLE D.2 SUMMARY OF STUDIES ON MATHEMATICS OUTCOMES

Reference	Programme name	Country of programme	Main level	Outcome measure	Favours treatment	Favours control	No effect
Bakken, L., Brown, N., & Downing, B. (2017).	The Opportunity Project	US	Curriculum	Maths test score Mathematical knowledge	X X		
Clements, D. H., & Sarama, J. (2008).	Building Blocks	US	Curriculum	Mathematical knowledge	X		
Clements, D. H., Sarama, J., Farran, D., Lipsey, M., Hofer, K. G., Bilbrey, C., & Society for Research on Educational, E. (2011).	Building Blocks	US	Curriculum	Thinking and learning within maths			X
Clements, D. H., & Society for Research on Educational, E. (2011).	TRIAD-NFT (non-follow through) and TRIAD-FT (follow through)	US	Curriculum	Understanding of maths	X		
Dillon, M. R., Kannan, H., Dean, J. T., Spelke, E. S., & Duflo, E. (2017).	Maths curriculum	India	Curriculum	Maths concepts and skills		.	X
Doabler, C., Baker, S. K., Smolkowski, K., Fien, H., Clarke, B., Cary, M. S., ... Society for Research on Educational, E. (2011).	ELM Kindergarten Mathematics Intervention	US	Curriculum	Mathematics performance	X	.	
Doabler, C. T., Clarke, B., Kosty, D. B., Baker, S. K., Smolkowski, K., & Fien, H. (2016a).	ELM curriculum	US	Curriculum	Beginning of mathematical ability	X		
Doabler, C. T., Clarke, B., Kosty, D. B., Kurtz-Nelson, E., Fien, H., Smolkowski, K., & Baker, S. K. (2016b).	Tier 2 Kindergarten Mathematics Intervention – replication to the initial ROOTS intervention	US – urban and suburban schools from the metropolitan area of Boston, Massachusetts	Curriculum	NSB – Number Sense Brief (Jordan et al., 2008) TEMA-3 – Tests of Early Mathematics Ability Oral counting RAENS=ROOTS Assessment of Early Numeracy Skills ASPENS (Clarke et al., 2012) The SAT-10 SESAT	X X X X X		X

Author(s)	Study Title	Country	Setting	Outcome	Findings
Garrett, R., & Hong, G. (2016).	The effect of four types of instructional organisation grouping on language minority students' maths learning	US	Setting	Child academic performance	X
Garrett, R., Hong, G., & Society for Research on Educational, E. (2012).	Conducts secondary analysis of large-scale survey data to evaluate the time-by-grouping	US	Setting	Child academic performance	X
Kinzie, M. B., Whittaker, J. V., Williford, A. P., DeCoster, J., McGuire, P., Lee, Y., & Kilday, C. R. (2014).	QuarterlyMyTeachingPartner-Math/Science	US	Curriculum	Oral language development Emergent literacy skills Pretend abilities Social competence	X X X X
Konstantopoulos, S., Miller, S. R., van der Ploeg, A., & Li, W. (2016).	Interim Assessments	US	Curriculum	Mathematics achievement (grade)	X
Lang, L. B., Schoen, R. R., LaVenia, M., Oberlin, M., & Society for Research on Educational, E. (2014).	Mathematics Formative Assessment System – Common Core State Standards: A Randomised Field Trial in Kindergarten and First Grade	US – Florida	Teacher	FCR-STEM CCSS Student Mathematics Assessments for Kindergarten and Grade 1	X
Lewis Presser, A., Clements, M., Ginsburg, H., & Ertle, B. (2015).	Big Math for Little Kids	US	Curriculum	Mathematical knowledge Mathematics Language Measure: Identification Mathematics Language Measure: Identification Mathematics Language Measure: Justification Mathematics Language Measure: Justification	X X X X X
Llorente, C., Pasnik, S., Moorthy, S., Hupert, N., Rosenfeld, D., Gerard, S., & Society for Research on Educational, E. (2015).	PBS KIDS Transmedia Curriculum Supplement to Support Young Children's Mathematics Learning	US – New York City and San Francisco	Curriculum	Standardised assessment of children's maths skills in preschool and kindergarten Children's understanding of counting; number recognition and subitising; shapes	X X
Malmberg, L. E., Mwaura, P., & Sylva, K. (2011).	The Madrasa Early Childhood Development Program	Zanzibar, Kenya and Uganda	Teacher	Cognitive skills Cognitive ability Early mathematics Mathematics	X X X X

Naslund-Hadley, E., Parker, S. W., & Hernandez-Agramonte, J. M. (2014).	Tikichuela: Mathematics in My School- Fostering Early Math Comprehension	Paraguay	Curriculum	Mathematics test scores Child academic achievement Maths	X X X	X
Toll, S. W. M., & Van Luit, J. E. H. (2014).	The road to mathematics (complete and short version)	The Netherlands	Curriculum	Early numeracy Simple arithmetic skills Complex mathematical ability Numeracy and early maths Maths skills Early maths	X X X X X X	X
Vaden-Kiernan, M., Borman, G., Caverly, S., Bell, N., Ruiz de Castilla, V., Sullivan, K., & Society for Research on Educational, E. (2015).	Everyday Mathematics	US	Curriculum	Maths ability Mathematical skills		X
Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Westat, I. (2010).	Head start		US	Math school performance		X
Sarama, J., Lange, A. A., Clements, D. H., & Wolfe, C. B. (2012).	Building Blocks	US	Curriculum	Early mathematics	X	

Source: RAND Europe

Annex E: Detailed findings on other cognitive outcomes

This annex presents the detailed findings from the REA on other cognitive outcomes. We first present the narrative findings, followed by the strengths and limitations of the evidence, then a table providing an overview of the studies (table E.1) included in the REA.

Overview of studies

In total, the REA included 20 studies that investigated cognitive outcomes, other than language, literacy and mathematics, in children.

Types of programmes

Seven studies explored the outcomes of Head Start (n=3) or Head Start REDI (n=4). Head Start REDI supports teachers to integrate research-based programmes into the classroom, primarily for improving social-emotional functioning and language-emergent literacy skills. Both Head Start and Head Start REDI involve curriculum-level changes, with the latter also implementing teacher-level changes. The rest of the studies each investigated different programmes.

The interventions typically included some teacher-led activities and sessions, including working with children in smaller groups (Fricke et al., 2013; Kinzie et al., 2014; Clements et al., 2011a; Landry et al., 2014; Martins et al., 2016; Goodson et al., 2010) and using books or storytelling (Nicolopoulou et al., 2015). However, in general, interventions were relatively different to each other. The key focus differed between studies from joint teacher and parent engagements (O'Connor et al., 2014), active learning by using locally available low-cost materials (Malmberg et al., 2011), or the use of story-telling (Goodson et al., 2010; Nicolopoulou et al., 2015).

Head Start and Head Start REDI involve year-long curricula, with shorter activity sessions (under 30 minutes) conducted daily or multiple times per week. Not all the other studies reported details on programme length and intensity of sessions, but those that did varied considerably. One programme was a year-long programme (Kinzie et al., 2014; Dillon et al., 2017), seven others were full time Head Start curricula (Puma et al., 2010; Harden et al., 2012; Zhai et al., 2011; Bierman et al., 2008; Bierman et al., 2014; Nix, 2016; Sasser, 2017), while four were shorter lasting less than five weeks (Blesses et al., 2018; Lin et al., 2017; ; O'Connor et al., 2014), between five to six weeks (Martins et al., 2016, Siew et al., 2016), or several months (10–30 weeks) (Fricke et al., 2013; O'Connor et al., 2014; Schell et al., 2015).

The frequency and duration of sessions varied across programmes. Some programmes included sessions implemented multiple times a week (Bierman et al., 2008; Bierman et al., 2014; Dillon et al., 2017; Fricke et al., 2013; Nicolopoulou et al., 2015; Sasser et al., 2017; Schell, A. et al., 2015), one comprised daily sessions (Buysse et al., 2016). Session length also varied, with some programmes having sessions lasting 30 minutes or less (Bierman et al., 2008; Fricke et al., 2013; Sasser et al., 2017; Webster-Stratton et al., 2008) while others had longer (one hour) sessions (Dillon et al., 2017; O'Connor et al., 2014; Siew, et al., 2017).

All the studies investigated programmes that implemented curricular-level changes. Sixteen of the 19 programmes were implemented at more than one level. This was either at the curriculum and teacher levels (n=11), or at all three levels (n=5).

Outcomes examined

Across the 20 studies outcomes examined included cognitive skills, cognitive flexibility, problem-solving, attention control or science learning.

Target population

Most of the studies (n=18) targeted children aged three and above. Only one study examined children aged under three (Harden et al., 2012) and one focused on both age groups (Dillon et al., 2017).

Impact of programmes

Overall, studies reported a favourable impact on a number of other cognitive outcomes for children receiving the programmes. Twelve of the 20 studies reported small to moderate effects, while five studies reported that programmes had no impact on children (three studies found positive effects but did not report the effect size). Programmes with large effects included Head Start REDI (Nix et al., 2016; Sasser et al., 2017), Lubo from Outer Space! (Schell et al., 2015), the Madrasa Early Childhood Development Program (Malmberg et al., 2011), the Problem Based Learning with Cooperative Learning and 'Numbered Heads Together' Programme – PBL-CL 'NHT' (Siew et al., 2017), and the Social-Emotional Prevention Program (Ştefan and Miclea, 2013). The largest effects were evident for the PBL-CL 'NHT' method, a programme with the main purpose of developing children's problem-solving abilities. Children in the programme showed improved cognitive skills and outperformed their peers in the control group on five measures of scientific creativity (fluency, originality, elaboration, abstractness of title, and resistance to premature closure) developed by the authors of the study.

One of the two studies on science knowledge found positive programme effects, while the second one did not. The Early Childhood Hands-On Science (ECHOS) programme is implemented at the curriculum and teacher and setting levels, and aims to enhance science processing skills and deepen the understanding of science content. Preliminary results of the programme suggests positive treatment effect on children's science skills (Brown, J. A. et al., 2013). A second programme, QuarterlyMyTeachingPartner, is a Math and Science programme designed at the curriculum and teacher levels. No programme effects were identified on science outcomes (Kinzie, M. B., 2014).

Six of the 19 studies measured programme effects at follow-ups. Two of them were on Head Start (Zhai et al., 2011; Puma et al., 2010) and another two on Head Start REDI (Nix et al., 2016; Sasser, 2017), measuring programme effect at first, second and third grade. These studies found that Head Start REDI had favourable effects on children's learning engagement, and attention and the follow-up results showed that participation in REDI led to higher learning engagement and lower attention problems. At the 4-year follow-up, children from the intervention group showed more positive trajectories for both learning engagement and attention control. Thus, the body of evidence reviewed suggests that the positive impacts of this intervention are both immediate in preschool and kindergarten and sustained into elementary school. Similarly, cognitive flexibility was re-assessed in the Head Start programme at the end of kindergarten and by end of the first year in school, showing a long-term benefit of participating in the programme.

Additionally, the study on the Madrasa Early Childhood Development Program also found improvements in children's cognitive ability, up to two years after the programme ended. Cognitive ability was measured at two different times, showing positive gains at both time points, though slightly weaker at the second time point

(Malmberg, 2011). The efficacy of the 4-month long Math Curriculum was tested at the end of the first year of schooling as well as 6–9 month and 12–15 months after the intervention ended, but the study found no benefits in cognitive flexibility or motivation skills (Dillon et al, 2017).

Finally, findings showed that children in ‘Lubo aus dem All! – Vorschulalter’, a programme designed to target social-cognitive problem-solving strategies saw positive impacts five months after the intervention ended, though the randomisation procedures led to imbalanced groups so these findings should be interpreted with caution (Schell et al., 2015).

Some studies did not find any sustained impact of the programmes examined. The Incredible Years Teacher Classroom Management (IY-TCM) programme, aimed at improving teacher competencies in supporting children in the classroom, and developing children’s social, emotional and problem-solving skills did not lead to sustained effect on children’s executive function but had small positive effect on child’s motivation, which was evaluated with teacher’s reports (Morris et al., 2014).

Although the main goal of the Math Curricula programme was to develop learning in mathematics for children who have minimal access to books or do not have educated parents, it also tested for possible gains in other cognitive skills. However, findings showed no benefits in cognitive flexibility or motivation skills for children in the experimental group (Dillon et al, 2017).

What works for whom

Head Start’s primary goal was to improve school readiness of children from low-income families through the provision of comprehensive and high-quality services, including early education and development, parental involvement, and medical, dental, mental health and nutritional programmes as well as other social services. One study found that the REDI intervention had higher impact for children who scored low on problem-solving compared to children with high scores (Sasser et al., 2017). Another of the Head Start studies found that dual-language learners in the programme have benefited more than other groups (Puma et al., 2010). Lastly, a Head Start study was exploring programme impact on children’s school readiness and did not find any gender differences (Zhai et al., 2011). However, no other studies examined subgroups of children.

The comprehensive INSIGHTS intervention, aiming to enhance students’ attention control skills was evaluated with children from low-income families. Results suggest that children in the programme demonstrated faster growth in sustained attention compared with children in a supplemental reading programme, although no comparisons were provided with children in higher income groups (O’Connor et al., 2014).

Strengths and limitations of the evidence

The majority of studies reviewed found that interventions yielded small to large impacts on cognitive ability, flexibility or science outcomes. Furthermore, the majority of the programmes evaluated were implemented at multiple levels and contained multiple components, making it difficult to determine which component, which level of the programme (or combination thereof) were key to these positive outcomes.

The studies reviewed focused on children’s cognitive skills (different from numeracy, mathematical skills or language ability) in kindergarten and in the first year of school, indicating that there is a need for more research on the impact

of interventions targeting process quality for younger children for this category of outcomes – especially with regards to potentially sustained gains that could result as these younger children grow. We are unable to conclude if the effect of the interventions is sustainable since there were only six of the 19 studies that re-evaluated programme efficacy at a later point in time. Out of these six, five reported programme effects at follow-ups (Zhai, 2011; Puma, 2010; Nix et al., 2016; Sasser, 2017; Malmberg, 2011).

One of the general limitations of the studies reviewed is the lack of information on the fidelity of treatment implementation. Indeed, low fidelity of implementation can be a cause of impacts different from the true programme effect. Some of the children in the studies may not have experienced the programme implemented in the way it was intended to be. For example, children may not have attended Head Start as their parents reported – some evidence suggests that parents over-report attendance (Puma et al., 2010). Although it is important to know at what time children started the programme and for how long, this could not always be tracked (Zhai et al., 2011).

Another problematic element in these studies can be attrition (children or schools dropping out of the study), if it is systematic. There was large variation in the attrition rates across the studies examined (varying from 4–6% up to 30%). In some instances, those most likely to drop out were systematically different from those who might not; such as children with higher or lower scores at baseline could be less likely to be at follow-up (Malmberg, 2011), or the proportion of those dropping out could be higher in one of the groups (Kinzie et al., 2014).

Furthermore, there are limitations related to the data available or the outcome measures used to test the impact of the programmes. For instance, some studies reported that they did not have detailed information for the control group or they did not collect important information at baseline (see Malmberg, 2011). Similarly, in the study evaluating the REDI programme, due to lack of data it was not possible to control on socio-demographic characteristics when assigning children in the experimental or control groups (Bierman et al., 2008; Nix et al., 2016).

There were only three programmes for which measured of sustained impact were available: Head Start, Madrasa Early Childhood Development Program and Math Curricula. All except the Math Curricula had reported programme effects at the follow-up.

Finally, children who were involved in many of the interventions cannot be assumed to be representative of the entire population. The sample in many papers represent a population of low-achieving students, students from language or ethnic minority group or represents a population prioritised for early intervention – with high proportions of low-income students. Therefore, for many studies the generalisability of the findings is not possible.

TABLE E.1 SUMMARY OF STUDIES ON OTHER COGNITIVE OUTCOMES

Reference	Programme name	Country of programme	Main level	Outcome measure	Favours treatment	Favours control	No effect
Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008).	Head Start REDI	US	Curriculum	Language skills Literacy skills Emotional understanding and socio-cognitive skills Social behaviours Learning engagement at school Learning engagement at home	X X X X X X		
Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., & Gill, S. (2014).	Head Start REDI	US	Curriculum	Language and emerging literacy skills Learning engagement Social competence Aggressive behaviour	X X X X		
Brown, J. A., Greenfield, D. B., Bell, E., Juárez, C. L., Myers, T., Nayfield, I., & Society for Research on Educational, E. (2013).	ECHOS: Early Childhood Hands-On Science	US	Curriculum	Science knowledge	X		
Dillon, M. R., Kannan, H., Dean, J. T., Spelke, E. S., & Duflo, E. (2017).	Maths curriculum	India	Curriculum	Maths concepts and skills Social skills Mastery of language Executive function Motivation to tackle challenging problems			X X X X X
Fricke, S., Bowyer-Crane, C., Haley, A. J., Hulme, C., & Snowling, M. (2013).	Nuffield Early Language Intervention (NELI)	UK	Curriculum	General cognitive	X		
Goodson, B., Wolf, A., Bell, S., Turner, H., Finney, P. B., National Center for Education, E., ... Regional Educational Laboratory, S. (2010).	Kindergarten PAVED for Success (K-PAVE)	US	Curriculum	Expressive vocabulary Academic knowledge Listening comprehension	X X		X

Harden, B. J., Sandstrom, H., & Chazan-Cohen, R. (2012).	Early Head Start	US – targeted group: African American children	Curriculum	Language skills Cognitive development Social-emotional development Negativity towards parent Engaged with parents during play Injury or hospitalisation	X X X X X	X X
Kinzie, M. B., Whittaker, J. V., Williford, A. P., DeCoster, J., McGuire, P., Lee, Y., & Kilday, C. R. (2014).	QuarterlyMyTeachingPartner-Math/Science	US	Curriculum	Number sense and operation Geometry and measurement Number sense and place value Science learning	 X X X	X X
Malmberg, L. E., Mwaura, P., & Sylva, K. (2011).	The Madrasa Early Childhood Development Program	Zanzibar, Kenya and Uganda	Teacher	Cognitive skills	X	
Martins, M. A., Salvador, L., Albuquerque, A., & Silva, C. (2016).	Invented spelling programme	Portugal	Curriculum	Letters known Cognitive ability Phonological awareness Spelling Reading	X X X X X	
Nicolopoulou, A., Cortina, K. S., Ilgaz, H., Cates, C. B., & de Sá, A. B. (2015).	Storytelling and story-acting practice	US	Curriculum	Oral language development Emergent literacy skills Pretend abilities Social competence	X X X X	
Nix, R. L., Bierman, K. L., Heinrichs, B. S., Gest, S. D., Welsh, J. A., & Domitrovich, C. E. (2016).	Head Start REDI	US	Curriculum	Social competence Aggressive-oppositional behaviour Learning engagement Attention problems Peer rejection	X X X X X	
O'Connor, E. E., Cappella, E., McCormick, M. P., & McClowry, S. G. (2014).	INSIGHTS	US	Setting	Child temperament Child sustained attention Child behaviour problems Child academic achievement	X X X X	

Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Westat, I. (2010).	Head start	US	Curriculum	Vocabulary	X	
				Oral comprehension	X	
				Phonetic awareness		X
				Pre-writing		X
				Pre-reading/reading		X
				Maths		X
Sasser, T. R., Bierman, K. L., Heinrichs, B., & Nix, R. L. (2017).	Head Start Research- Based, Developmentally Informed (REDI)	US	Curriculum	School performance		X
				Social skills and positive approach to learning	X	
				Social competence	X	
				Problem behaviour	X	
				Health status	X	
				Working memory	X	
				Inhibitory control	X	
				Attention shifting	X	
				Reading fluency	X	
				Language arts	X	
Schell, A., Albers, L., von Kries, R., Hillenbrand, C., & Hennemann, T. (2015).	Lubo from Outer Space!	Germany	Curriculum	Mathematics	X	
				Reading ability	X	
				Need for/use of special education services	X	
				Problem-solving	X	
				Everyday behaviour	X	
Siew, N. M., Chin, M. K., & Sombuling, A. (2017).	Problem based learning (PBL) with cooperative learning (CL) and 'Numbered Heads Together' (NHT)	Malaysia	Curriculum	Fluency	X	
				Originality	X	
				Elaboration	X	
				Abstractness of title	X	
				Resistance to premature closure	X	
Ștefan, C. A., & Miclea, M. (2013).	Social-Emotional Prevention Program	Romania	Curriculum	Emotion recognition	X	
				Problem-solving	X	
				Social and emotional competence	X	
				Externalising problems	X	
				Internalising problems	X	
				Social skills	X	

Webster-Stratton, C., Reid, M. J., & Stoolmiller, M. (2008).	The Dina Dinosaur Social Skills and Problem Solving Curriculum	US	Curriculum	Problem behaviour	X
				School readiness	X
				Problem-solving	X
				Feelings language	X
Zhai, F., Brooks-Gunn, J., & Waldfogel, J. (2011).	Head Start	US	Curriculum	Language skills	X
				Reading identification skills	X
				Social competence	X
				Attention	X
				Behavioural problems	X
Source: RAND Europe					

Annex F: Detailed findings on socio-emotional outcomes

This annex presents the detailed findings from the REA on children's socio-emotional outcomes. First, the narrative findings are presented, organised by social skills, emotional skills, socio-emotional skills and behaviour. We then present the strengths and limitations of the evidence, followed by tables providing an overview of the systematic reviews (table F.1) and studies (table F.2) that are included in the REA.

Social skills

Overview of studies

In total, the REA included 25 papers and one meta-analysis measuring social skills outcomes in children.

Types of programmes

Two studies explored the Aprender a Convivir programme. Seven studies explored the social outcomes of three types of Head Start programmes: Head Start, Early Head Start and Head Start REDI. One paper examined the Head Start CARES demonstration which tested three social-emotional enhancements: The Incredible Years Teacher Training Program, Preschool PATHS (Promoting Alternative Thinking Strategies), and Tools of the Mind – Play. The REA also identified a meta-analysis on Tools of the Mind, described in box F.1 below. The remaining studies investigated different programmes.

While all programmes studied implemented changes at the curriculum level, most were led by teachers and included aspects such as the teaching of emotions and the use of resources (such as toys, games). Five of the studies included teachers providing rewards to children (Alba et al., 2015; Benítez et al., 2011; Feil et al., 2014; Stefan, 2012; Upshur et al., 2013). Nine programmes included an aspect of book/story reading, by either the teacher or child (Bakken et al., 2017; Bierman et al., 2014; Dillon et al., 2017; Feil et al., 2009; Landry et al., 2014; Meyer et al., 2016; Nicolopoulou et al., 2015; Schmitt et al., 2014; Stefan, 2012). Four involved a wider positive classroom culture change to create a more child-centred approach, for instance, by implementing routines and boundaries and encouraging respect, autonomy and active learning (Bakken et al., 2017; Nicolopoulou et al., 2015; Bloom et al., 2014; Puma et al., 2010). Finally, four included parent involvement.

About half the studies examined year-long programmes while the remaining studies examined programmes with a shorter time frame. The number of year-long interventions is slightly skewed due to the greater number of Head Start-related interventions, which are whole, school year curricula. The majority of programmes included activities that were implemented multiple times a week rather than daily. Five studies implemented programmes with relatively short sessions (less than 30 minutes), while four involved longer sessions; the other studies did not report details on programme length.

The included studies examined a range of social skills and abilities, including social competence, prosocial and socio-cognitive skills, social interactions and behaviours (including interactions with peers, parents and teachers), social depth, and social problem-solving skills.

Target population

The majority of studies included children at least three years of age. Two studies examined children aged under three (Harden et al., 2012; Landry et al., 2014) and two studies were conducted with children from both age groups (Bakken et al., 2017; Dillon et al., 2017). Two studies each were carried out in Romania and Spain. One study was conducted in India. The remaining studies took place in the US.

Impact of programmes

The 25 studies measured 34 social skills outcomes. Of these, 31 of the measured outcomes were showed to be positively impacted by the interventions. In one case, children in the control group had better outcomes than those receiving the programme (Meyer and Ostrosky, 2016, exploring the impact of the Special Friends intervention on children's friend nominations). The other three outcomes measured were not differentiated between treatment and control groups (Dillon et al., 2017; Johnson et al., 2013; Upshur et al., 2013). In particular, one study examining the impact of a mathematics curriculum did not find generalised impacts on children's social skills (Dillon et al., 2017). The other two studies both found no effect on prosocial skills as a result of the Emotions Course (Johnson et al., 2013) and Head Start (Upshur et al., 2013).

Four studies did not report effect sizes for outcomes (Bakken et al., 2017; Dillon et al., 2017; Feil et al., 2009; Lin et al., 2017). In studies that did report effect sizes, most were medium effects (that is, between 0.20 and 0.79). The largest effect sizes were found for the Aprender a Convivir programme (Alba et al., 2015), which found that the programme had a positive impact on children's social competence ($d=0.21-0.86$); the PATHS preschool curriculum, implemented within Head Start REDI (Nix et al., 2016), which was found to improve children's social competence and reduce peer rejection (0.57–1.80 for social competence and 0.60–1.66 for peer rejection)); and the Social-Emotional Prevention Program (Ştefan and Miclea, 2013), which improved children's social problem-solving ($d=0.80$). Overall, the heterogeneity of programme foci, activities, lengths and dosages makes it difficult to draw conclusions about what aspects of the programmes may have the most impact on children's social outcomes. However, the REA did identify one meta-analysis on Tools of the Mind, described in box F.1 below, which found that the curriculum had a positive but not statistically significant effect on children's self-regulation.

Seven studies conducted follow-up assessments of children after the end of the respective programmes being examined (Alba et al., 2015; Bakken and Downing, 2017; Dillon et al., 2017; Nix et al., 2016; Puma et al., 2010; Ştefan and Miclea, 2013; Zhai et al., 2011). Of these, four examined children's outcomes after at least one year and when children were in primary school (Bakken and Downing, 2017; Dillon et al., 2017; Nix et al., 2016; Puma et al., 2010). Specifically, Bakken and Downing (2017) examined children when they were in third, fourth and fifth grade; Dillon et al. (2017) assessed children's outcomes 6–9 and 12–15 months after the mathematics curriculum intervention; Nix et al. (2016) examined children's social competence every year between kindergarten and third grade; and Puma et al. (2010) assessed children's social skills and social competence when children were aged four, when they were in kindergarten and in first grade. Follow-up assessments in all studies except Dillon et al. (2017) (which examined a mathematics curriculum that did not find impacts on children's social skills even immediately after the intervention) showed that gains in social skills were maintained. In particular, Head Start (Puma et al., 2010), Head Start REDI (Nix et al., 2016) and the Opportunity Project (Bakken and Downing, 2017) may be

effective for improving children's social skills, including when and after they transition into primary school.

BOX F.1 FINDINGS FROM A META-ANALYSIS ON THE IMPACT OF THE TOOLS OF THE MIND CURRICULUM ON CHILDREN'S SELF-REGULATION

In a meta-analysis of six studies, Baron et al. (2017) found that the Tools of the Mind curriculum, which aims to improve children's self-regulation and academic skills through structured make-believe play scenarios and other curricular activities, had a positive effect on self-regulation, but it was not statistically significant. The effect on literacy was also not statistically significant. However, the Tools curriculum had a small but significant effect on children's mathematics skills. The authors cautioned against considering the findings as conclusive, because of the small number of included studies and their methodological limitations.

Source: RAND Europe

What works for whom

Only four studies examined whether social skills outcomes differed between different groups of children. Alba et al. (2015) found that the Aprender a Convivir programme had a greater effect on girls' social competence than boys. However, Zhai et al. (2011) did not find that the effect of Head Start on children's prosocial skills or social competence varied by gender. Upshur et al. (2013) also found no effect on prosocial skills between gender or socio-economic status, as a result of the Second Step Preschool/Kindergarten Kit. Puma et al. (2010) found that improvements in the social skills and competence, of children speaking a minority language, were sustained into first grade after attending Head Start.

Emotional skills

Overview of studies

The REA included 10 studies that investigated children's emotional skills.

Types of programmes

Four studies examined the impacts of Head Start and related programmes (that is, Head Start, Head Start REDI, Early Head Start and the Head Start CARES demonstration). The majority of programmes were teacher-led; two focused on creating a positive classroom environment to support a whole-child approach to learning (Bakken et al., 2017; Bloom et al., 2014). Studies reported limited information on the frequency and dosage of programmes. Where information was provided, about half of programmes lasted one school year; about half of programmes were implemented daily and the rest were implemented multiple times per week; and about half involved relatively longer sessions as opposed to shorter sessions.

Outcomes examined

Across 10 studies, a variety of emotional skills was examined, including emotional understanding, knowledge and competence, externalising or internalising problems and negativity towards parents.

Target population

Of the 10 studies, nine examined children aged three and above while one focused on children aged below three (Harden et al., 2012). One study involved children in both age groups (Bakken et al., 2017). Two studies were conducted in Romania; the remaining studies took place in the US.

Impact of programmes

The 10 studies measured 19 emotional skills outcomes. Of these, 17 of the assessed outcomes were positively affected by the intervention. In the remaining two cases, outcomes did not differ between the treatment and control groups (Ştefan & Miclea, 2013; Weiland & Yoshikawa, 2013). Ştefan and Miclea assessed the impact of the Social–Emotional Prevention Program on emotion knowledge, while Weiland and Yoshikawa assessed the impact of the OWL curriculum and Building Blocks on positive emotion. Most of the nine studies that reported effect sizes reported medium effects. However, Ştefan (2012) reported that the Social-Emotional Prevention Program had a large effect on children’s emotional competence skills ($d = 0.85$). Bloom et al. (2014) reported that Head Start had a small effect on children’s externalising skills (-0.05), while Weiland and Yoshikawa (2013) reported that the OWL curriculum and Building Blocks also had a small effect on emotion identification (0.18).

Two studies conducted follow-up assessments of children’s emotional skills. Specifically, Bakken and Downing (2017) examined children following the Opportunity Project intervention, when they were in third, fourth and fifth grade, and Ştefan and Miclea (2013) assessed the impact of the Social-Emotional Prevention Program on emotional competence, externalising/internalising behaviour and emotional recognition three months after the intervention. Both studies found that positive effects were maintained at follow-up.

What works for whom

Very few studies examined whether emotional skills outcomes differed between different groups of children, and those that did generally found no differences. There were two exceptions: Ştefan and Miclea (2013) found that girls’ emotion recognition and externalising/internalising behaviours benefited more from the Social-Emotional Prevention Program. Examining the Dina Dinosaur Social Skills and Problem Solving Curriculum, Webster-Stratton et al. (2008) found that children most at risk of being assessed as having special education needs benefited more from the programme.

Socio-emotional skills

Overview of studies

Seven studies assessed children’s outcomes related to general socio-emotional functioning.

Types of programmes

Two studies examined Head Start and Head Start REDI (Bierman et al., 2017; Lee and Ludington, 2016), and the remaining studies examined different programmes.

All the programmes studied implemented changes at the curriculum level; additionally, four implemented teacher-level activities. The Head Start programmes were year-long programmes; one study reported a shorter programme (Schmitt et al., 2014). The Positive Action programme (Schmitt et al., 2017) used sessions with

children that were under 30 minutes. However, in general, studies did not provide much information on the frequency or length of the interventions they were reporting on.

Outcomes examined

The studies examined general socio-emotional skills (Bierman et al., 2017; Gormley et al., 2011; Landry et al., 2014; Lee and Ludington, 2016; Lonigan et al., 2015; Schmitt et al., 2014; Webster-Stratton et al., 2008), operationalised across studies as socio-emotional adjustment, development, awareness, functioning, outcomes and understanding of positive behaviour. Webster-Stratton et al. (2008) framed these social outcomes as school readiness in children.

Target population

Six studies included children aged at least three; one study examined children aged below three (Landry et al., 2014); and one study included children in both age groups (Lonigan et al., 2015). All seven included studies were conducted in the US.

Impact of programmes

All seven studies reported positive effects on the general socio-emotional skills they were examining. Of the five studies that reported an effect size, the majority were of a medium size. The Dina Dinosaur Social Skills and Problem Solving Curriculum were found to have a large effect on school readiness (including measurement of children's emotional self-regulation, social skills and conduct problems, effect size -2.87) (Webster-Stratton et al., 2008). The Tulsa Public Schools pre-K programme and Community Action Project of Tulsa County Head Start programme had a small effect on social-emotional development (-0.2–0.13) (Gormley et al., 2011).

None of these studies conducted follow-up assessments.

What works for whom

Three studies examined if more vulnerable children benefited differently from the respective interventions. Gormley et al. (2011) found that the Tulsa Public Schools pre-K programme and Community Action Project, part of the Tulsa County Head Start programme, improved the social-emotional development of children from lower and higher socio-economic backgrounds equally. Examining Head Start, Lee and Ludington (2016) found that children who had experienced violence in their neighbourhood experienced greater improvement in their socio-emotional outcomes than those who did not have these experiences. Webster-Stratton et al. (2008) found that the Dina Dinosaur Social Skills and Problem Solving Curriculum had a greater positive impact on children with a lower school readiness score, than children assessed as initially being more prepared for school.

Behaviour

Overview of studies

The REA included 20 studies and one meta-analysis that examined behaviour outcomes.

Types of programmes

Many of these studies investigated the effect of Head Start programmes: four studies assessed the regular Head Start programme, two Head Start REDI, one

Early Head Start and one the Head Start CARES demonstration. Additionally, two investigated the Aprender a Convivir programme and two Second Step programmes (Second Step Early Learning and Second Step Preschool/Kindergarten Kit).

All the programmes studied implemented changes at the curriculum level; in addition, eight implemented teacher-level changes and five implemented teacher- and setting- level changes. Many of the studies involved teacher-led aspects (n=13); programmes in three studies took a whole-child approach and creating a positive atmosphere in the classroom; the Aprender a Convivir programme included elements of providing rewards for children (Alba et al., 2015; Benítez et al., 2011).

The frequency and length of the interventions varied across the studies. Six examined year-long programmes (primarily due to the large number of Head Start interventions) and five were implemented over a shorter period. Six interventions include activities implemented multiple times a week and three included daily activities. Six programmes included sessions which were less than 30 minutes and four which had longer sessions between 35–50 minutes. Overall, the amount of information, provided by studies on the lengths of programmes and how often and long sessions were, was variable.

Outcomes examined

The 20 studies that examined behavioural outcomes measured outcomes ranging from everyday behaviours to problem, antisocial or aggressive behaviour in children. The meta-analysis investigated the impact of universal classroom management programmes on children's disruptive or aggressive behaviour (see box F.2).

BOX F.2 FINDINGS FROM A META-ANALYSIS ON THE IMPACT OF CURRICULUM AND MANAGEMENT PROGRAMMES ON CHILDREN'S BEHAVIOUR

Oliver et al. (2011) conducted a meta-analysis of 12 studies on the impact of universal classroom management programmes on disruptive or aggressive behaviour of children from kindergarten to grade 12. Overall, there was a large and positive effect of programmes on classroom-level behaviour. The authors were unable to examine effects specifically for children in kindergarten as studies did not report data by grade level.

Source: RAND Europe

Target population

Most of the studies were conducted in the US; of the remaining studies, two were conducted in Spain and one in Germany.

Impact of programmes

The meta-analysis found that universal classroom management programmes had a large and positive effect of programmes on classroom-level behaviour (see box F.2). Across the 20 individual studies, 28 behaviour outcomes were measured. The majority of the studies found that the programmes implemented had positive impacts, although six studies found no differences in some behaviour outcomes

between children who had received the intervention and children who had not. None of the studies reported that children in the control condition had more positive outcomes than children receiving the programmes.

Two studies did not report effect sizes for outcomes (Lee and Ludington, 2016; Feil et al., 2009). Most studies that did reported medium effects. Four studies reported large effect sizes. Specifically, both Bierman et al. (2014) and Nix et al. (2016) found that Head Start REDI reduced the number of aggressive behaviours shown by children, Upshur et al. (2013) found that the Second Step Preschool/Kindergarten Kit had an impact on reducing children's disruptive behaviour ($d=-1.22$). Tucker et al. (2017) reported that the Sunshine Circle Model/Group Theraplay also had a positive impact on behaviour ($r=0.24-0.80$). A further three studies reported small effect sizes; these were: Webster-Stratton et al. (2008), assessing the impacts of the OWL curriculum/building blocks on problem behaviour ($-0.14-0.03$); O'Connor et al. (2014), assessing child temperament after INSIGHTS implementation ($0.05-0.07$); and Puma et al. (2010), assessing the impact of Head Start on problem behaviour (-0.14).

Six studies conducted follow-up assessments with children (Alba et al., 2015; Nix et al., 2016; Puma et al., 2010; Schell et al., 2015; Tucker et al., 2017; Zhai et al., 2011). Of these, two examined children's outcomes after at least one year and when children were in primary school (Nix et al., 2016; Puma et al., 2010). Nix et al. (2016) assessed children's aggressive-oppositional behaviour every year between kindergarten and third grade, following implementation of Head Start REDI, while Puma et al. (2010) assessed children's problem behaviour after Head Start, when children were aged four, when they were in kindergarten and in first grade. Both studies reported that positive behaviour effects were maintained. In contrast, Zhai et al. (2011), examining children's behaviour problems at age five, found no effect of Head Start. Alba et al. (2015) also found that the Aprender a Convivir programme had no effect on children's problem behaviour a year and two years after the programme (when children were aged four and five).

What works for whom

Five studies examined whether behaviour outcomes differed across different groups of children. Alba et al., (2015) found that the Aprender a Convivir programme had a greater effect on reducing behavioural problems in girls than boys. Upshur et al. (2017) found that the Second Step Early Learning programme did not have differing effects on girls versus boys or on children from different socio-emotional backgrounds on children's inhibitory control. Examining the Dina Dinosaur Social Skills and Problem Solving Curriculum, Webster-Stratton et al. (2008) did not find differential impacts on gender, although children most at risk of being assessed with special educational needs benefited to a greater extent. Exploring the impact of Head Start on children's behavioural problems, Zhai et al. (2011) did not find differences by gender, though Puma et al. (2010) found that effects for language minority children were maintained at first grade.

Strengths and limitations of the evidence

Our REA found that a variety of programmes and interventions that had been implemented had positive impacts on a range of children's socio-emotional outcomes. The largest body of evidence was around Head Start (and variations of the programme) in the US, which was found to improve children's social competence (Nix et al., 2016), social skills (Puma et al., 2010) and reduce children's externalising skills (Bloom et al., 2014), aggressive behaviours (Nix et al., 2016) and behavioural problems (Morris et al., 2014; Puma et al., 2010). Most of the

studies examining Head Start also found that effects were maintained over a longer period. However, the heterogeneity of the programmes found (in terms of length, frequency and intensity of programme) – and in several studies, the lack of clear descriptions of these programmes – makes it difficult to draw conclusions about whether there are particular aspects of programmes that are more effective. In other cases, the similarities across programmes (for instance, that all implemented curricular changes) also precludes comparisons to programmes implemented at other levels.

In addition, most of the studies identified were conducted in the US and not replicated in other countries, making it difficult to assess how generalisable the findings may be.

Almost all of the studies reported positive outcomes. It is not possible to assess in this REA if this reflects a publication bias for positive results (Petticrew and Roberts, 2008), or whether programmes are generally effective at improving children's socio-emotional outcomes. Only a subset of the studies conducted follow-ups, and of those, only a small number conducted follow-ups of children when they reached primary school. It was thus difficult to assess whether programmes and practices differ in terms of longer-lasting effects. In addition, few studies compared programme impacts across different groups of children, so there is limited evidence to determine which practices might work better for children at greatest risk of falling behind.

TABLE F.1 SUMMARY OF SYSTEMATIC REVIEWS ON SOCIO-EMOTIONAL OUTCOMES

Reference	Review focus	Time period covered	Number of studies included	Brief summary of the study and findings
Therrien, M. C. S., Light, J., & Pope, L. (2016). Systematic review of the effects of interventions to promote peer interactions for children who use aided AAC. AAC: Augmentative and Alternative Communication, 32(2), 81–93. doi:10.3109/07434618.2016.1146331	Effects of interventions to promote peer interactions for children who use aided augmentative and alternative communication (AAC)	Prior to January 2015	Narrative synthesis: 19	The authors included studies published in a peer-reviewed journal prior to January 2015, which examined children aged between 3 and 21 years, with developmental disabilities, who used aided AAC. Altogether, 19 studies were included in the review, comprising 56 participants. The majority of studies focused on primary or secondary school-aged children; only 8 participants were in preschool. All studies reported that interventions improved peer interactions for children, although both the degree of impact and the quality of the evidence varied across studies.
Virues-Ortega, J., Julio, F. M., & Pastor-Barriuso, R. (2013). The TEACCH programme for children and adults with autism: A meta-analysis of intervention studies. Clinical Psychology Review, 33(8), 940–953. doi:10.1016/j.cpr.2013.07.005	Effect of the intervention programme TEACCH (Treatment and Education of Autistic and Related Communication Handicapped Children) on children with autism	Prior to December 2012	Meta-analysis: 13	The authors conducted a search for studies reporting a TEACCH intervention trial for individuals with autism spectrum disorder, where the intervention group consisted of at least 5 participants. All relevant studies published prior to the search date (1 December 2012) were included. The search identified 13 studies (including 172 participants) for inclusion in the meta-analysis. Five studies included participants with a mean age of under 5; the remaining studies included participants with mean ages ranging from 8.7 to 23.7 years. Overall, the meta-analysis found that TEACCH had moderate to large gains for participants' social and maladaptive behaviour, and small or negligible effects on communication, activities of daily living, and motor functioning. Note: This systematic review is also reported under physical outcomes.
Oliver, Reschley & Wehby. 2011. The effects of teachers' classroom management practices on disruptive or aggressive student behaviour	Effect of universal classroom management programmes on disruptive, aggressive, and inappropriate behaviour in children from kindergarten to grade 12	1950–2009	Meta-analysis: 12	The authors conducted a meta-analysis of studies using an experimental or quasi-experimental design, to examine the degree of impact of universal classroom management programmes on disruptive or aggressive behaviour of children from kindergarten to grade 12. The search identified 12 studies that met the inclusion criteria. Seven of the studies examined the effect of the Classroom Organization and Management Program (COMP), three examined the 'Good Behavior Game'. Overall, the authors found a large and positive effect of programmes on classroom-level behaviour. It was not possible to examine effects specifically for children in kindergarten as studies did not report data by grade level.

Baron, A., Evangelou, M., Malmberg, L. E., Melendez-Torres, G. J. (2017) The Tools of the Mind curriculum for improving self-regulation in early childhood. Campbell Systematic Reviews. doi: 10.4073/csr.2017.10	Effect of the Tools of the Mind curriculum on the self-regulation, maths and literacy skills of children in preschool and kindergarten	Prior to December 2016	Meta-analysis: 6	The authors conducted a meta-analysis of studies using an experimental or quasi-experimental design, to examine the impact of the Tools of the Mind curriculum on children's self-regulation and academic skills. The search identified 6 eligible studies, comprising 14 records 13 of which met the inclusion criteria for the meta-analysis. Overall, the authors found that the Tools of the Mind curriculum had a positive and small effect on children's maths skills. The effect size for self-regulation and literacy were positive but not statistically significant. However, given the small number of studies included in the meta-analysis, the methodological limitations and the potential bias of those studies, the authors cautioned against considering the findings as conclusive. Note: This systematic review is also reported under language/literacy and mathematics outcomes.
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Source: RAND Europe

TABLE F.2 SUMMARY OF STUDIES ON SOCIO-EMOTIONAL OUTCOMES

Reference	Programme name	Country of programme	Main level	Outcome measure	Favours treatment	Favours control	No effect
Alba, G., Fernandez-Cabezas, M., Justicia, F., & Pichardo, M. C. (2015).	Aprender a Convivir (learning to live together)	Spain	Curriculum	Social competence Behavioural problems	X		X
Bakken, L., Brown, N., & Downing, B. (2017).	The Opportunity Project	US	Curriculum	Maths test score Reading test scores Social interactions Attitudes to school	X X X X		
Benítez, J. L., Fernández, M., Justicia, F., Fernández, E., & Justicia, A. (2011).	Aprender a Convivir (learning to live together)	Spain	Curriculum	Social competence Antisocial behaviour	X X		
Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008).	Head Start REDI	US	Curriculum	Language skills Literacy skills Emotional understanding and socio-cognitive skills Social behaviours Learning engagement at school Learning engagement at home	X X X X X X		
Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., & Gill, S. (2014).	Head Start REDI	US	Curriculum	Language and emerging literacy skills Learning engagement Social competence Aggressive behaviour	X X X X		
Bierman, K. L., Heinrichs, B. S., Welsh, J. A., Nix, R. L., & Gest, S. D. (2017).	Head Start REDI-C	US	Curriculum	Social-emotional adjustment Emergent literacy skills	X X		
Bloom, H. S., Weiland, C., & Society for Research on Educational, E. (2014).	Head Start	US	Curriculum	Receptive vocabulary Early reading Oral comprehension Early math Externalising behaviour problems Self-regulation	X X X X		X X

Dillon, M. R., Kannan, H., Dean, J. T., Spelke, E. S., & Duflo, E. (2017).	Maths curriculum	India	Curriculum	Maths concepts and skills Social skills Mastery of language Executive function Motivation to tackle challenging problems	X X X X X
	Positive Behaviour Support Procedures	US	Curriculum	Aggressive behaviour Maladaptive behaviour Adaptive behaviour Social interactions	X X X X
	Preschool First Step to Success	US	Setting	Social skills Problem behaviour Aggressive behaviour Social competence	X X X X
	Tulsa Public Schools (TPS) pre-K programme and Community Action Project (CAP) of Tulsa County Head Start program	US		Social-emotional development	X
	Early Head Start	US – targeted group: African American children	Curriculum	Language skills Cognitive development Aggression Negativity towards parent Sustained attention with objects Engaged with parents during play Injury or hospitalisation	X X X X X X
Johnson, S. R., Seidenfeld, A. M., Iizard, C. E., & Kobak, R. (2013).	Emotions Course	US	Teacher	Children's prosocial behaviour	X
	School Readiness Research Consortium	US	Teacher	Child social-emotional functioning Teacher- child relationship quality Child academic performance Child academic performance	 X X X X
Lee, K., & Ludington, B. (2016).					
	Head Start	US	Curriculum	Socio-emotional outcomes Negative/problem behaviour	X X

Lin, T. J., Justice, L. M., Emery, A. A., Mashburn, A. J., & Pentimonti, J. M. (2017).	Read It Again!	US	Curriculum	Social depth Language skills Social competence	X X X	
Llorente, C., Pasnik, S., Moorthy, S., Hupert, N., Rosenfeld, D., Gerard, S., & Society for Research on Educational, E. (2015).	PBS KIDS Transmedia Curriculum Supplement to Support Young Children's Mathematics Learning	US – New York City and San Francisco	Curriculum	Standardised assessment of children's maths skills in preschool and kindergarten Children's understanding of counting; number recognition and subitising; shapes; and patterns measure of young children's behavioral self-regulation	X X X	X
Lonigan, C. J., Phillips, B. M., Clancy, J. L., Landry, S. H., Swank, P. R., Assel, M., ... Barnes, M. (2015).	Integrated comprehensive academic skills-focused curriculum	US	Curriculum	Nonverbal cognitive ability Oral language skills Code-related skills Maths skills Socio-emotional awareness	X X X X X	
Meyer, L. E., & Ostrosky, M. M. (2016).	Special Friends	US	Curriculum	Children's three best friends and one very best friend from their classroom		X
Morris, P., Mattera, S. K., Castells, N., Bangser, M., Bierman, K., Raver, C., & Mdrc. (2014).	HEAD Start CARES Demonstration. The three social-emotional enhancements that Head Start CARES tested were 'The Incredible Years Teacher Training Program,' 'Preschool PATHS' (Promoting Alternative Thinking Strategies), and 'Tools of the Mind – Play.'	US	Teacher	Executive function Behavioural problems Emotion knowledge Social problem-solving skills Learning behaviours Social behaviours		X X
Nicolopoulou, A., Cortina, K. S., Ilgaz, H., Cates, C. B., & de Sá, A. B. (2015).	Storytelling and story-acting practice	US	Curriculum	Oral language development Emergent literacy skills Pretend abilities Social competence Learning engagement Attention problems Peer rejection	X X X X X X X	

Nix, R. L., Bierman, K. L., Heinrichs, B. S., Gest, S. D., Welsh, J. A., & Domitrovich, C. E. (2016).	Head Start REDI	US	Curriculum	Social Competence Aggressive-oppositional behaviour Learning engagement Attention problems Peer rejection	X X X X X
O'Connor, E. E., Cappella, E., McCormick, M. P., & McClowry, S. G. (2014).	INSIGHTS	US	Setting	Child temperament. Child sustained attention Child behaviour problems Child academic achievement	X X X X
Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Westat, I. (2010).	Head start	US	Curriculum	Vocabulary Oral comprehension Phonetic awareness Pre-writing Pre-reading/reading Maths School performance Social skills and positive approach to learning Social competence Problem behaviour Health status	X X X X X X X X X X
Schell, A., Albers, L., von Kries, R., Hillenbrand, C., & Hennemann, T. (2015).	Lubo from Outer Space!	Germany	Curriculum	Problem-solving Everyday behaviour	X X
Schmitt, S. A., Flay, B. R., & Lewis, K. (2014).	Positive Action	US	Curriculum	Understanding of positive action Self-concept Physical health Intellectual health Self-management Self-control Respect Considerate Social bonding Honesty Self-improvement	X X X X X X X X X X X

Ștefan, C. A. (2012).	Social Emotional Prevention Program	Romania	Curriculum	Emotional competence Externalising problems Internalising problems Emotion recognition Social problem-solving	X X X X X
Ștefan, C. A., & Miclea, M. (2013).	Social-Emotional Prevention Program	Romania	Curriculum	Emotion recognition Problem solving Social and emotional competence Externalising problems Internalising problems Social skills	X X X X X X
Sutherland, K. S., Conroy, M. A., Algina, J., Ladwig, C., Jessee, G., & Gyure, M. (2018).	BEST in CLASS	US	Curriculum	Problem behaviour Social skills Children's interactions	X X X
Tucker, C., Schieffer, K., Wills, T. J., Hull, C., & Murphy, Q. (2017).	The Sunshine Circle Model/ Group Therapy	US	Curriculum	Behaviour	X
Upshur, C., Wenz-Gross, M., & Reed, G. (2013).	Second Step Preschool/ Kindergarten Kit	US	Curriculum	Disruptive behaviour Disruptiveness of classroom Behaviour problems Prosocial skills	X X X X
Upshur, C. C., Heyman, M., & Wenz-Gross, M. (2017).	Second Step Early Learning	US	Curriculum	Inhibitory control Attention control Working memory Emotion knowledge Social problem-solving skills	X X X X X
Webster-Stratton, C., Reid, M. J., & Stoolmiller, M. (2008).	The Dina Dinosaur Social Skills and Problem Solving Curriculum	US	Curriculum	Problem behaviour School readiness Problem solving Feelings language	X X X X

Weiland, C., & Yoshikawa, H. (2013).	The OWL curriculum and building blocks	US	Curriculum	Receptive vocabulary	X	
				Pre-reading and reading skills	X	
				Numeracy and early maths	X	
				Working memory	X	
				Attention shifting	X	
				Cognitive inhibitory control	X	
				Emotion identification	X	
				Positive emotion		X
				Impulse control		X
Zhai, F., Brooks-Gunn, J., & Waldfogel, J. (2011).	Head Start	US	Curriculum	Language skills	X	
				Reading identification skills	X	
				Social competence	X	
				Attention	X	
				Behavioural problems		X
Source: RAND Europe						

Annex G: Detailed findings on physical outcomes

This annex presents the detailed findings and the strengths and limitations of the evidence from the REA on children's physical outcomes. The narrative findings are followed by tables providing an overview of the systematic reviews (table G.1) and studies (table G.2) that are included in the REA.

Overview of studies

In comparison to the greater number of studies identified in other outcome areas, we identified only seven studies and one meta-analysis that examined physical outcomes.

Types of programmes

The meta-analysis examined the effect of the TEACCH intervention programme (Treatment and Education of Autistic and Related Communication Handicapped Children).

Three studies explored the outcomes of Early Head Start, Head Start and Head Start REDI respectively (Harden et al., 2012; Puma et al., 2010; Sasser et al., 2017). All three programmes involve curriculum-level changes, with Head Start REDI also implementing teacher-level changes.

One study examined Positive Action, a 10-week curriculum aimed both at improving children's socio-emotional and health outcomes. The Positive Action curriculum included different units, among which one promoted physical and intellectual health through utilising a variety of age-appropriate strategies (Schmitt et al., 2014). Active Play was a six-week programme, implemented at the curriculum, teacher and setting levels, with the main aim of increasing children's physical activity (Foulkes et al., 2017). The Montessori Practical Life Activities programme was a curriculum aimed at boosting the development of children's fine motor skills through the use of practical life activities (Bhatia et al., 2015). Finally, the Young Athletes programme, a curriculum consisting of comprehensive lessons over an eight-week period, aimed to promote the motor skill development of children with disabilities (Favazza et al., 2013).

Outcomes examined

The meta-analysis on the TEACCH programme examined a battery of outcomes for children with autism, including daily activities and motor functioning. The studies examined outcomes ranging from fine motor skills to fundamental movement skills, anthropometry, numbers of injury and hospitalisation, and general physical health.

Target population

There was a wide range in the number of children participating in these studies, from 100 (Bhatia et al., 2015) to 1,884 (Puma et al., 2010). The majority of studies included children at least three years of age. One study examined children aged under three and one was conducted with children from both age groups. One study was conducted in the UK. The remaining studies took place in the US.

Impact of programmes

The meta-analysis on the TEACCH programme found the children with autism experienced benefits to their daily activities and motor functioning (see box G.1).

Across the seven studies, the nine outcomes measured showed that the various interventions had largely favourable effects for participants. However, the Active Play programme was found not to have an effect on children's fundamental movement skills or anthropometry (Foulkes et al., 2017).

Five studies reported effect sizes for outcomes, most of which were small to medium effects. Children who received Head Start ($g=0.33$, Puma et al., 2010) and the Positive Action curriculum ($g=0.57$, Schmitt et al., 2014) had moderate improvements in their health. The Montessori Practical Life Activities programme had a moderately positive impact on children's accuracy and speed ($g=0.53$ and $g=0.37$ respectively, Bhatia et al., 2015), while the Young Athletes programme improved the motor skill development of children with disabilities ($g=0.21$, Favazza et al., 2013). Children who attended Early Head Start were less likely to be hospitalised or be injured ($g=-.15$, Harden et al., 2012).

BOX G.1 FINDINGS FROM A META-ANALYSIS ON THE IMPACT OF THE TEACCH INTERVENTION PROGRAMME

In a meta-analysis of 13 studies on the effect of the TEACCH intervention programme (Treatment and Education of Autistic and Related Communication Handicapped Children) on children with autism, Virues-Ortega et al. (2016) found that TEACCH had moderate to large gains for participants' social and maladaptive behaviour, and small or negligible effects on communication, activities of daily living, and motor functioning. (Note that only five studies included participants with a mean age of under 5.)

Source: RAND Europe

What works for whom

Only two studies examined whether impacts differed across groups of children; in both cases studies examined gender differences. Foulkes et al. (2017) found that the Active Play programme did not significantly affect children's fundamental movement skills, although girls' locomotor skills did improve slightly more than boys'. The Montessori Practical Life Activities programme was not found to benefit either girls or boys more (Bhatia et al., 2015).

As noted above, the Young Athletes and the TEACCH intervention programmes focused only on children with disabilities and children with autism respectively.

Strengths and limitations of the evidence

Our REA found that a variety of programmes and interventions that had been implemented had positive impacts on a range of children's physical outcomes including motor skills and general physical health – however, the body of evidence is small, especially in comparison to the other outcomes reported in this REA, and it would be premature to draw any conclusions about which programmes may be more effective and for whom. The overall positive results may also reflect a publication bias (Petticrew and Roberts, 2008), which was not assessed in this REA.

The majority of the studies identified were conducted in the US and not replicated in other countries, making it difficult to assess how generalisable the findings may be. Most of the studies were also conducted with children aged three and above.

Very few studies conducted follow-up measurements or assessments of how impacts might vary across different groups of children. It was thus difficult to assess which programmes might have longer-lasting effects or might work better for different groups of children.

TABLE G.1 SUMMARY OF SYSTEMATIC REVIEWS ON PHYSICAL OUTCOMES

Reference	Review focus	Time period covered	Number of studies included	Brief summary of the study and findings
Virues-Ortega, J., Julio, F. M., & Pastor-Barriuso, R. (2013). The TEACCH programme for children and adults with autism: A meta-analysis of intervention studies. Clinical Psychology Review, 33(8), 940–953. doi:10.1016/j.cpr.2013.07.005	Effect of the intervention programme TEACCH (Treatment and Education of Autistic and Related Communication Handicapped Children) on children with autism	Prior to December 2012	Meta-analysis: 13	<p>The authors conducted a search for studies reporting a TEACCH intervention trial for individuals with autism spectrum disorder, where the intervention group consisted of at least 5 participants. All relevant studies published prior to the search date (1 December 2012) were included. The search identified 13 studies (including 172 participants) for inclusion in the meta-analysis.</p> <p>Five studies included participants with a mean age of under 5; the remaining studies included participants with mean ages ranging from 8.7 to 23.7 years. Overall, the meta-analysis found that TEACCH had moderate to large gains for participants' social and maladaptive behaviour, and small or negligible effects on communication, activities of daily living, and motor functioning.</p> <p>Note: This systematic review is also reported under physical outcomes.</p>

Source: RAND Europe

TABLE G.2 SUMMARY OF STUDIES ON PHYSICAL OUTCOMES

Reference	Programme name	Country of programme	Main level	Outcome measure	Favours treatment	Favours control	No effect
Bhatia, P., Davis, A., & Shamas-Brandt, E. (2015).	Montessori Practical Life Activities	US	Curriculum	Fine motor skills (accuracy) Fine motor skills (speed) Fine motor skills (establishing hand dominance)	X X X		
Favazza, P. C., Siperstein, G. N., Zeisel, S. A., Odom, S. L., Sideris, J. H., & Moskowitz, A. L. (2013).	Young Athletes Program	US	Curriculum	Physical activity	X		
Foulkes, J. D., Knowles, Z., Fairclough, S. J., Stratton, G., O'Dwyer, M., Ridgers, N. D., & Fowweather, L. (2017).	Active Play educational programme	UK	Teacher	Fundamental movement skills Anthropometry			X X
Harden, B. J., Sandstrom, H., & Chazan-Cohen, R. (2012).	Early Head Start	US – targeted group: African American children	Curriculum	Language skills Injury or hospitalisation	X X		
Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Westat, I. (2010).	Head start	US	Curriculum	Language development Child health	X X		
Sasser, T. R., Bierman, K. L., Heinrichs, B., & Nix, R. L. (2017).	Head Start Research-Based, Developmentally Informed (REDI)	US	Curriculum	Working memory Inhibitory control Attention shifting Reading fluency Language arts Mathematics Reading ability Need for/use of special education services Physical growth	X X X X X X X X X		
Schmitt, S. A., Flay, B. R., & Lewis, K. (2014).	Positive Action	US	Curriculum	Understanding of positive action Self-concept Physical health	X X X		

Source: RAND Europe

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