**DIGITAL CHILD** WORKING PAPER 2022-02

# Topaz Project: How to conduct a transdisciplinary systematic review

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**Suggested citation**
Beynon, A., & Straker, L. 2022 How to conduct a transdisciplinary systematic review (with or without meta-analysis) to support decision-making regarding children and digital technology. Digital Child Working Paper 2022-02, ARC Centre of Excellence for the Digital Child, Brisbane, Australia.

**ISSN:** 2653-5270

**DOI:** https://doi.org/10.26187/mw0g-9m78

## NON-TECHNICAL SUMMARY

This paper is part of a 'how to…' series aimed at supporting researchers from different specialist areas to work together to summarise evidence regarding technology use with, by and for young children.

Society expects the individuals making decisions that impact on children's well-being and development to be informed by trustworthy evidence. Academic review articles are a valuable way to support evidence-based decision-making through synthesising available knowledge and thus helping increase the likelihood that decisions made will have the intended impact on the lives of young children.

Whilst there are a variety of types of reviews, a systematic review is one of the most widely used and valued. Systematic reviews offer the potential to provide decision makers with trustworthy syntheses of knowledge to support better outcomes for children growing up in a digital world.

The purpose of this paper is to provide a readily accessible resource of information on how to conduct 'transdisciplinary' systematic reviews. By 'transdisciplinary' we mean researchers from different discipline areas working together with a shared understanding. For example, a review team could include a psychologist, a software engineer and an educator. The systematic review process is conceptualised to include eleven steps conducted in sequence, with potential for some iteration across steps. This 'how to…' guide provides explanations of what to do at each step, along with a curated list of resources relevant to each step.

Before conducting a systematic review, first consider whether a systematic review is needed or desirable, and then ensure the resources necessary to conduct the review are available. It is useful to incorporate end-users (the people who will use the synthesis of evidence) early and throughout the process. Systematic reviews should address answerable questions and fill important gaps in knowledge. A detailed plan for the systematic review should be written before commencing. The search for evidence should be designed to capture as many relevant reports as possible. Captured reports are then screened to remove reports that are not relevant. After screening, relevant information from the included reports is gathered. The strengths and limitations of each report are appraised, to provide an indication of the trustworthiness or believability of the evidence in each report. An evidence summary is then prepared and presented in a report, which may be published in an academic journal. Consider who might want to use this information, so useful information is created and publish the findings to allow those who might be interested to access the findings.

Overall, this paper promotes the use of systematic reviews across multiple specialist areas relevant to young children and digital technologies. It draws on resources from various specialist areas, examples from a variety of disciplines, and uses inclusive language to be more readable across disciplines, aiming to be an integrated resource supporting transdisciplinary systematic reviews.

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## ACKNOWLEDGEMENTS

This work was supported by the Australian Research Council Centre of Excellence for the Digital Child (Grant# CE200100022).

Thanks to Diana Blackwood, Senior Librarian, for providing critical review and input.

# How to…conduct a transdisciplinary systematic review (with or without meta-analyses) to support evidence-based decision-making with, by and for young children

## ABSTRACT

This paper is part of a 'how to…'series aimed at supporting transdisciplinary reviews regarding technology use with, by and for young children. Systematic reviews are a widely used mechanism to develop trustworthy evidence to support decision-making. Whilst early use of systematic reviews was focussed on determining unbiased estimates of the effect of health interventions tested in randomised controlled trials, such reviews are now used across many disciplines to identify, appraise and synthesise evidence from a wide range of study designs, sources and types of data to address many different types of questions. However, many support resources are focussed on specific discipline needs and tend to use discipline-specific language. This paper aims to support transdisciplinary collaboration by bringing together resources from various disciplines and presenting information in a format that is sensitive to discipline differences. The aim is to encourage the transdisciplinary understanding by providing a structured pathway for researchers from different discipline backgrounds to work together with end-users to provide credible, believable, and useful syntheses of available evidence.

# TABLE OF CONTENTS

# INTRODUCTION

This paper is part of a 'how to…'series aimed at supporting transdisciplinary reviews regarding technology use with, by and for young children. This paper focuses on how to conduct a systematic review. Other papers in this series are focussed on how to conduct scoping, rapid and realist reviews (Beynon and Straker, 2022a; Beynon and Straker, 2022b; Beynon and Straker, 2022c). Society expects the individuals making decisions that impact on children's well-being and development to be informed by trustworthy evidence. Academic review articles are a valuable way to support evidence-based decision-making through synthesising available knowledge, and thus helping increase the likelihood that decisions made will have the intended impact on the lives of young children (Straker et al., 2022).

Whilst there are a variety of types of reviews (Straker et al., 2022), a systematic review is one of the most widely used and valued. A systematic review is a way of finding, appraising and synthesising evidence from different sources in order to answer a particular question in a standardised, structured and systematic way. That is, authors conducting a systematic review aim to locate all available evidence, appraise the quality of relevant available evidence, and then report unbiased, trustworthy conclusions based on the available evidence taking into consideration potential biases within the evidence. Conducting a systematic review is an effective way for a researcher to become familiar with the existing body of evidence on a given topic (Newman and Gough, 2020).

Systematic reviews follow a highly structured process to support a synthesis of the available knowledge that is unbiased, reproducible, rigorous and transparent (Aromataris and Munn, 2020). Systematic reviews therefore aim to give a transparent overview of all evidence surrounding a particular question (Higgins et al., 2021). Structured processes support finding all relevant evidence, appraising the quality of that evidence, and providing a summary of the evidence. Relevant evidence can include peer-reviewed articles, conference papers, and 'grey' literature (literature published informally or non-commercially, or remains unpublished) located by systematic searches. Checklists are commonly used to support structured appraisal of evidence quality. Evidence summaries are provided as either a meta-synthesis or a meta-analysis. Meta-synthesis is a non-statistical summary of the results. Meta-analysis is the statistical synthesis combining results from separate but similar studies, resulting in a quantitative summary of the pooled results (Last, 2001, p114).

Systematic reviews were initially developed to synthesise evidence for health intervention effectiveness and only included peer-reviewed journal articles on randomised control trials (Higgins et al., 2021). However, now this approach is also used to provide evidence summaries on a broad range of questions, including lived experiences and meaningfulness, opinion and policy, prevalence and incidence, assessment accuracy, costs of interventions and processes, as well as theory and mechanisms (Aromataris and Munn, 2020; Higgins et al., 2021). Systematic reviews now also consider evidence from a wide variety of experimental and other types of studies, including qualitative and quantitative studies, as well as mixed-methods studies. So, whilst systematic reviews have a strong and longer tradition in health sciences, they are valued and used within a wide variety of domains including health, physical sciences, business, design, engineering, education, and social sciences (Straker et al., 2022), as well as for transdisciplinary knowledge synthesis.

Whether it is appropriate to use the systematic review process depends on the review purpose (Straker et al., 2022), and the decision to conduct a systematic review should be made taking into consideration the advantages and disadvantages of this approach (Higgins et al., 2021; Ioannidis, 2016; Palmatier et al., 2018) (see Table 1).

TABLE 1 ADVANTAGES AND DISADVANTAGES OF SYSTEMATIC REVIEWS

| Advantages | Disadvantages |
|---|---|
| Can have a lower risk of bias as primary sources of information are included or excluded as processes support identifies all relevant evidence, reducing the chance of review authors selectively including evidence supportive of their perspective | Can be very time-consuming to complete, which can be a barrier for both the author team and for potential end-users (the decision-makers) and can require substantial resources, including funded author time |
| Can have a lower risk of bias of erroneous evidence included as processes support rigorous appraisal of the quality of evidence | Can be a very mechanical process that may lead to misleading and redundant results, which are not informed by important context knowledge |
| Can have a lower risk of bias in conclusions drawn as processes support reproducible synthesis of evidence | Can be quite constrained and not provide useful conclusions of practical relevance |
| Can be used to synthesise evidence from multiple types of studies, including both quantitative and qualitative data | Can become outdated quickly, especially if focussed on peer-reviewed published sources with longer publication delays |
| Can be used to synthesis evidence addressing a wide variety of types of questions | |

Systematic reviews therefore provide a potentially highly valuable method to provide decision-makers with trustworthy syntheses of knowledge to support better outcomes for children growing up in a digital world.

The purpose of this paper is to provide a readily accessible resource of information on how to conduct transdisciplinary systematic reviews. The systematic review process is conceptualised to include a number of steps conducted in sequence, with potential for some iteration across steps (see Table 2). Some steps may not be relevant to every review, so steps may need to be skipped. Before starting a systematic review, it is good to have an understanding of all the steps involved.

TABLE 2 OUTLINE OF STEPS INVOLVED IN CONDUCTING A SYSTEMATIC REVIEW

| **Preliminary Activities:** Determine need for and type of review and available resources | |
|---|---|
| Step 1 | **Engage and involve users:** Develop an advisory group to ensure uptake of review |
| Step 2 | **Define and formulate the research question**: Create an answerable question |
| Step 3 | **Write a protocol:** Establish the methods |
| Step 4 | **Search the literature:** Locate available reports |
| Step 5 | **Screen the reports:** Include relevant reports |
| Step 6 | **Extract data:** Collate relevant information |
| Step 7 | **Evaluate quality of each report**: Consider potential risk of bias |
| Step 8 | **Formulate a synthesis:** Summarise and evaluate the overall body of evidence |
| Step 9 | **Write the report:** Consolidate the information and conclusions |
| Step 10 | **Disseminate**: Make academic community aware of the findings |
| Step 11 | **Translate knowledge and engage end-users**: Help end-users apply the evidence |
| **Follow up activities:** Renewal watch, update as needed | |

This 'how to…' guide provides explanations of what to do at each step, along with a curated list of resources relevant to each step.

Systematic reviews have a longer history in the health domain, and therefore more health-focussed resources are available. However, this paper promotes the use of systematic reviews across multiple domains relevant to young children and digital technologies. It therefore draws on resources from various domains, with examples from a variety of disciplines, and uses inclusive language to be more readable across disciplines. The goal is an integrated resource supporting transdisciplinary systematic reviews.

## RESOURCES

- The Cochrane Collaboration was established in 1993 in the UK to synthesise medical research evidence from randomised controlled trials. It provides a wealth of resources to support systematic reviews focussed on health and now covers some non-randomised controlled study designs.
    - Available at https://cccrg.cochrane.org/resources
    - Cochrane Consumers and Communication Group: What are systematic reviews? Available at https://www.youtube.com/watch?v=egJlW4vkb1Y
        - This Cochrane Collaboration short video provides a nice short overview of systematic reviews, although with a health focus.
    - Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). Cochrane Handbook for Systematic Reviews of Interventions 6.2 (updated February 2021). Available from www.training.cochrane.org/handbook
    - This handbook provides detailed resources mainly focussed on health intervention effectiveness, but it is a useful resource for many disciplines and now also covers qualitative research.

- Centre for Reviews and Dissemination. (2008). Systematic Reviews: CRD's Guidance for Undertaking Reviews in Healthcare UK: University of York.
    - Available at https://journals.plos.org/plosone/article/file?type=supplementary&id=info:doi/10.1371/journal.pone.0201887.s005
        - This manual is focussed on health care and covers the principles and methods of systematic reviews and specific details regarding reviews on clinical tests, public health interventions, adverse effects, and economic evaluations diagnostic test accuracy as well as incorporating qualitative evidence in or alongside effectiveness reviews.

- The Joanna Briggs Institute, named after the first matron of the Royal Adelaide Hospital, was established in Australia to ensure appropriate information is disseminated to the individuals who make healthcare policy and practice decisions. The Institute has pioneered the use of systematic reviews across a broader range of data, disciplines and questions, from quantitative through to qualitative studies, than the Cochrane Collaboration.
    - Aromataris, E., & Munn, Z. (2020). JBI Manual for Evidence Synthesis. In JBI. Available from https://synthesismanual.jbi.global. https://doi.org/10.46658/JBIMES-20-02
    - This manual provides detailed formal guidance resources for systematic reviews focussing on:
        - experiences or meaningfulness
        - effectiveness
        - text and opinion/policy
        - prevalence and incidence
        - costs of a certain intervention, process, or procedure

- etiology and risk
- mixed methods
- diagnostic test accuracy

- In light of the success of the Cochrane Collaboration reviews on health interventions, the Campbell Collaboration was established in 2000 in the USA to promote positive social and economic change, initially through systematic reviews of research evidence on the effectiveness of social interventions (Littell and White, 2018; Petrosino, 2013). It now also includes evidence and gap map reviews and covers a broad range of social issues including education, business, crime, disability, international development and social welfare.
    - Whilst it recommends using the Cochrane Handbook, the Campbell Collaboration has a range of training resources
    - available at https://www.campbellcollaboration.org/research-resources/training-courses.html covering:
        - Question formation
        - Searching, coding and quality
        - Meta-analysis methods
        - Advanced methods
        - Policy engagement

- Petticrew, M., & Roberts, H. (2008). Systematic Reviews in the Social Sciences: A practical guide. Malden, MA: Blackwell Publishing.
    - This guide is written for social scientists and covers the purpose and methods of systematic reviews including:
        - deciding on a question
        - which types of studies to include
        - creating the eligibility criteria and search strategy
        - appraising the quality and relevance of qualitative and quantitative research
        - how to summarise the results- narratively or quantitatively
        - disseminating the results

- Newman, M., & Gough, D. (2020). Systematic reviews in educational research: Methodology, perspectives and application. In K. M. Zawacki-Richter O., Bedenlier S., Bond M., Buntins K. (Ed.), Systematic Reviews in Educational Research (pp. 3-22): Springer VS, Wiesbaden. Available from https://doi.org/10.1007/978-3-658-27602-7_1. https://library.oapen.org/handle/20.500.12657/23142
    - This resource provides guidance in conducting systematic reviews in the context of education research. It includes various methodological aspects of systematic reviews and also experiences from higher-education researchers through worked examples.

- Borrego, M., Foster, M. J., & Froyd, J. E. (2014). Systematic literature reviews in engineering education and other developing interdisciplinary fields. Journal of Engineering Education, 103(1), 45-76. https://doi.org/https://doi.org/10.1002/jee.20038
    - This study is an overview of the methods for conducting a systematic review in the field of engineering education.

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Beynon, A., & Straker, L. (2022a). How to conduct a transdisciplinary scoping review to support decision-making regarding children and digital technology. Digital Child Working Paper 2022-02, ARC Centre of Excellence for the Digital Child, Brisbane, Australia.

Beynon, A., & Straker, L. (2022b). How to conduct a transdisciplinary rapid review to support decision-making regarding children and digital technology. Digital Child Working Paper 2022-03, ARC Centre of Excellence for the Digital Child, Brisbane, Australia.

Beynon, A., & Straker, L. (2022c). How to conduct a transdisciplinary realist review to support decision-making regarding children and digital technology. Digital Child Working Paper 2022-04, ARC Centre of Excellence for the Digital Child, Brisbane, Australia.

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Petrosino, A. (2013). Reflections on the genesis of the Campbell Collaboration. *The Experimental Criminologist, 8*(2), 9-12.

Straker, L., Beynon, A., Smith, S., Johnson, D., Wyeth, P., Sefton-Green, J., & Kervin, L. (2022). Towards a transdisciplinary approach to evidence-based decision making regarding digital technology use with, by and for children. Digital Child Working Paper 2022-01, ARC Centre of Excellence for the Digital Child, Brisbane, Australia.

# Preliminary activities: Determine need for and type of review and available resources

### A: Determine if a systematic review is needed or desirable

- Consider if a systematic review is the right type of review to answer the question and address the issue.
- Check if there is already an existing or ongoing review on the issue
    - Check major databases and registries to determine whether there already are published reviews (or protocols) on the same topic
    - Conduct preliminary relevant database searches such as within: Cochrane Database, Campbell Collaboration, PubMed/MEDLINE, Embase PROSPERO and DARE (Database of Abstracts of Reviews of Effects), CareData, Educational research abstracts, ERIC (Educational Research Information Centre), Sociological abstracts (formally Sciofile), ACM (Association for Computing Machinery), Digital Library, CINAHL, PsychINFO, EmBase, Institute of Electrical and Electronics Engineers Xplore.
- Consider who will use the results of the review, and how.
- Determine if the review will be useful to inform decision-makers.

### B: Ensure the resources necessary to conduct the review are available

- Consider the time commitment.
- Consider other resources:
    - Review team
        - Reviews should include a team of more than one person.
        - In creating the review team, the need for domain expertise and review methodological expertise should be considered. For example, a review on human-computer interactions would benefit from including experts in technology design. First-time review authors should work with others who are experienced in the procedure of systematic reviews
        - Having a team ensures tasks are shared and, importantly, that certain tasks (Screening the reports, data extraction, assessing risk of bias etc.) can be performed by at least two people independently, which reduces bias and likelihood of errors.
        - Consider involving stakeholders (see Step 1)
    - Access to databases (see Step 4)
    - Technology (see Step 5 and Step 8)

### RESOURCES

Centre for Reviews and Dissemination. (2008). *Systematic Reviews: CRD's Guidance for Undertaking Reviews in Healthcare* UK: University of York.

Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). *Cochrane Handbook for Systematic Reviews of Interventions 6.2 (updated February 2021)*. Available from www.training.cochrane.org/handbook.

Petticrew, M., & Roberts, H. (2008). *Systematic Reviews in the Social Sciences: A practical guide*. Malden, MA: Blackwell Publishing.

## Step 1: Engage and involve users: Develop an advisory group to ensure uptake of the review

- Consider incorporating end-users (stakeholders) such as policy makers, parents, carers, educators, consumers, clinicians, guidelines developers, designers, engineers, policy makers etc. throughout the process.
- For research regarding children, consider involving children as stakeholders, providing input relevant to their developmental capacity.
- The priorities of end-users and decision-makers could be different from the priorities of researchers. Involving people with a range of experience will ensure the systematic review is relevant to a broad range of end-users (Rees and Oliver, 2017; Thomas et al., 2004). Engaging consumers and other stakeholders is also likely to increase relevance, promote mutual learning, improve uptake and decreases research waste.
- Reviews are likely to be more relevant if the end-users are involved from the early stages. End-users can be involved in formulating the question (Step 2), commenting on the protocol (Step 3), and assisting in the whole review process.

### RESOURCES

Lasserson TJ, Thomas J, Higgins JPT. Chapter 1: Starting a review. In: Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). *Cochrane Handbook for Systematic Reviews of Interventions 6.2 (updated February 2021)*. Available from www.training.cochrane.org/handbook.

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Thomas, J., Harden, A., Oakley, A., Oliver, S., Sutcliffe, K., Rees, R., . . . Kavanagh, J. (2004). Integrating qualitative research with trials in systematic reviews. *British Medical Journal, 328*, 1010-1012.

## Step 2: Define and formulate the research question: Create an answerable question

Systematic reviews should address answerable questions and fill important gaps in knowledge. Question formulation should involve the intended end-users of the review (more information on this in Step 1).

- Consult the FINER criteria when developing the research question. These criteria state that questions should be Feasible, Interesting, Novel, Ethical, and Relevant (Cummings et al., 2013).
    - A feasible review asks a question that the author team is capable of investigating based on the ability of the team, the available resources and the available evidence.
    - Ensure the authors are interested in the question so they are committed to completing the review.
    - A novel review will focus on a gap in knowledge. This decreases duplication of effort. Check if there is already an existing or ongoing review focussed on the question (see Preliminary Activities).
    - The review should be relevant. To facilitate knowledge to inform decisions, end-users (stakeholders) should be involved in developing the and formulating the question (See Step 1), as well as in writing the review (See Step 11).
    - Ethical issues should consider questions that should be prioritised and the manner in which questions are framed.
- A standardised question format can be helpful, although every component of the format and the order of components does not necessarily need to be followed strictly. Review questions can also be broken down into sections. See Figure 1 for example review questions/objectives.
    - PICO format from health sciences: P-Patient, problem or population, I-Intervention, C-comparison, O-outcome
    - PICO format: P - Population, I - phenomena of Interest and Co - Context.
    - PICOC format from social sciences: P- Population, I- Intervention or cluster of interventions, C-Comparison, O-Outcomes, C-Context

**FIGURE 1 EXAMPLE REVIEW QUESTIONS/OBJECTIVES:**

- "To systematically review available literature on musculoskeletal symptoms and exposures associated with the use of mobile touch screen devices" (Toh et al., 2017)
- "Is time spent using mobile touch screen devices associated with parent-child attachment in contemporary families?" (Hood et al., 2021)
- "This study aimed to analyze current applications of gamification for mental health and well-being by answering 3 research questions (RQs). RQ1: which gamification elements are most commonly applied to apps and technologies for improving mental health and well-being? RQ2: which mental health and well-being domains are most commonly targeted by these gamified apps and technologies? RQ3: what reasons do researchers give for applying gamification to these apps and technologies?" (Cheng et al., 2019)
- "This review of the literature was recommended to ECA by the Digital Policy Group to inform the development of the Statement. It examines studies published between 2012 and 2017 to advise adults on appropriate digital technology use by and with children aged birth to eight." (Mantilla and Edwards, 2019)

## RESOURCES

Lockwood C, Porrit K, Munn Z, Rittenmeyer L, Salmond S, Bjerrum M, Loveday H, Carrier J, Stannard D. Chapter 2: Systematic reviews of qualitative evidence. In: Aromataris, E., & Munn, Z. (2020). *JBI Manual for Evidence Synthesis*. *JBI*. Available from https://synthesismanual.jbi.global. https://doi.org/10.46658/JBIMES-20-02

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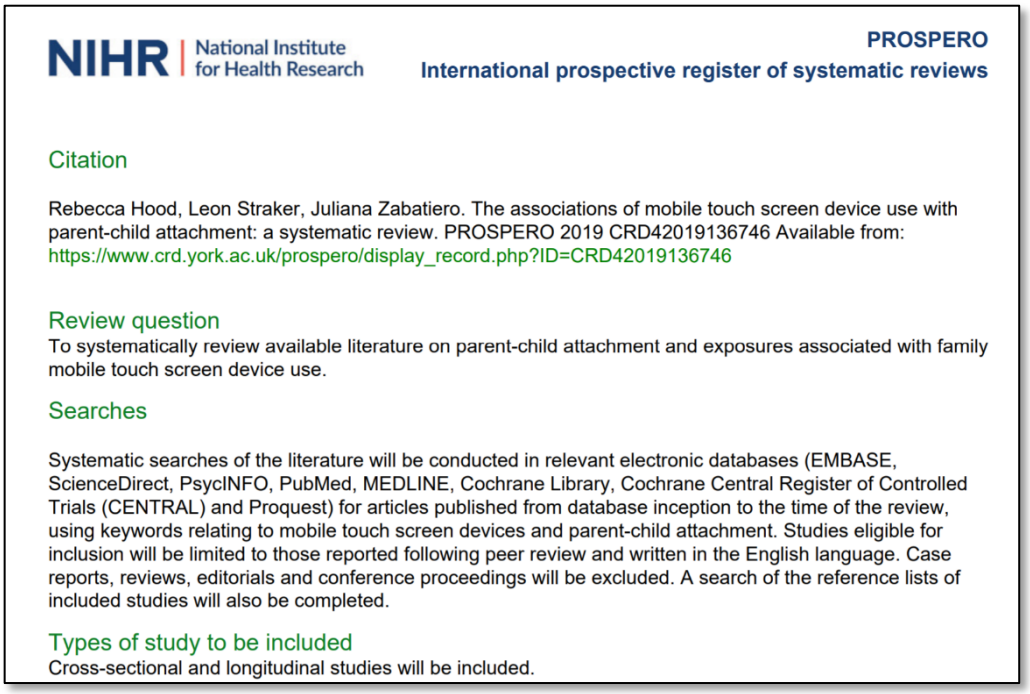
## Step 3: Write a protocol: Establish the methods

A protocol for the systematic review should be written before commencing the search for evidence. The protocol is a separate document to the final systematic review report and focuses on what will be done whereas the final report documents what was done along with the findings.

- The protocol should include objectives, scope and intended methods for the review. The methods should be written in future tense. Protocols help ensure the team has considered the important issues prior to starting.
- A protocol extension to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, PRISMA-P, outlines standards for what systematic review protocols need to include (Moher et al., 2015). It can also be useful to examine the PRISMA statement to anticipate what the final report on the systematic review will need to include (Page et al., 2021).
    - The protocol for a systematic review is likely to require the following sections (consult other steps for more information)
        - Title (include Systematic review protocol)
        - Background
        - Objectives
        - Eligibility criteria for considering primary sources for inclusion in the review
        - Search methods for identifying primary sources
            - Include a list of all sources that will be searched and a complete search strategy for at least one database or registry
            - Outline a search strategy that aims to capture as many reports as possible that meet the eligibility criteria
        - Data collection and analysis
            - Outline how risk of bias/quality assessment will be conducted, including which tools will be used and how judgments will be made
            - Describe how a synthesis of included reports will be created (qualitative summary (meta-synthesis) and/or quantitative synthesis (meta-analysis)
            - If relevant describe how heterogeneity will be assessed and the choice of measure (e.g., effect measure for an effectiveness review)
            - Describe how the trustworthiness of the overall body of evidence will be assessed and any tool that will be used
        - Other information (e.g., acknowledgments, contributions of authors, declarations of interest, and sources of support).
- Consider making the systematic review protocol publicly available. This reduces the risk of reporting bias as later users can assess the completed systematic review against the protocol to evaluate if the review has fulfilled its original objectives (Higgins et al., 2018).
- Currently the main international register for systematic reviews is the health-focussed PROSPERO (the international register of systematic reviews). Depending on the purpose of the review protocol, it can also be submitted through the Campbell Collaboration and the International Database of Education Systematic Reviews. Systematic review protocols may also be published and/or made

publicly available on research repositories such as Open Science Framework, Figshare and Research Square. Some journals also publish review protocols (e.g., BMJ Open). See Figure 2 as an example of a review protocol.

**FIGURE 2 AN EXAMPLE - THE INITIAL SUBMISSION FOR A PROSPERO REGISTRATION FOR A SYSTEMATIC REVIEW EXAMINING PARENT-CHILD ATTACHMENT AND USE OF MOBILE TOUCH SCREEN DEVICES**



NIHR | National Institute for Health Research

PROSPERO
International prospective register of systematic reviews

Citation

Rebecca Hood, Leon Straker, Juliana Zabatiero. The associations of mobile touch screen device use with parent-child attachment: a systematic review. PROSPERO 2019 CRD42019136746 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42019136746

Review question

To systematically review available literature on parent-child attachment and exposures associated with family mobile touch screen device use.

Searches

Systematic searches of the literature will be conducted in relevant electronic databases (EMBASE, ScienceDirect, PsycINFO, PubMed, MEDLINE, Cochrane Library, Cochrane Central Register of Controlled Trials (CENTRAL) and Proquest) for articles published from database inception to the time of the review, using keywords relating to mobile touch screen devices and parent-child attachment. Studies eligible for inclusion will be limited to those reported following peer review and written in the English language. Case reports, reviews, editorials and conference proceedings will be excluded. A search of the reference lists of included studies will also be completed.

Types of study to be included

Cross-sectional and longitudinal studies will be included.

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O'Dea, R. E., Lagisz, M., Jennions, M. D., Koricheva, J., Noble, D. W., Parker, T. H., . . . Moher, D. (2021). Preferred reporting items for systematic reviews and meta-analyses in ecology and evolutionary biology: a PRISMA extension. *Biological Reviews*. https://doi.org/10.1111/brv.12721

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# Step 4: Search the literature: Locate available reports

### A: Create a search strategy

Design a search strategy aimed to capture as many reports as possible that meet the eligibility criteria. Systematic reviews require a thorough, objective and reproducible search of a range of sources to identify as many eligible reports as possible (within resource limits). This is a major factor distinguishing systematic reviews from traditional narrative reviews and helps to minimise bias and achieve more reliable estimates of evidence and its uncertainties. Consider not restricting the search by language and ensure that relevant time periods are captured.

- Consult an experienced subject librarian to assist in creating the search strategy.
- Determine **what** to search for, and whether only peer-reviewed journal papers and conference papers will be included or whether a broader range of sources will be accessed.
    - Consider including grey literature in the search because this can reveal more up-to-date material than traditional published sources, could be more comprehensive than just including published sources, could be a more relevant source of information in certain areas such as policies and programs, can help reduce publication bias in systematic reviews, and is often a good source of raw data (https://guides.lib.monash.edu/grey-literature/whatisgreyliterature). However, depending on the location and type of grey literature, it may not be peer-reviewed and therefore may contain biased information. In many research areas, such as in the social sciences, a significant volume of the relevant evidence may not appear in journals but will be located in reports in the grey literature, which may not be indexed in electronic databases.
- Determine **where** to search, i.e., which databases (and other sources) should be searched.
    - Potential databases and registries to search for journal articles include (examples of subject-specific bibliographic databases):
        - ACM Digital Library (computing Machinery)
        - ASSIA (social sciences)
        - BIOSIS (life sciences)
        - British Education Index (education and training)
        - CareData (social care)
        - CINAHL (nursing and allied health)
        - Computer Science (computing)
        - Educational research abstracts (education)
        - Embase
        - ERIC (education)
        - IEEE Xplore (electrical engineering, computer science, and electronics)
        - Medline/PubMed (health and biomedicine, PubMed is free access to Medline and includes some extra citations)
        - ProQuest (multidisciplinary)
        - PsycINFO (psychology and psychiatry)
        - SAGE Journals (multidisciplinary)

        - Scopus (multidisciplinary and citation index)
        - Sociological abstracts (social science, formally Sciofile)
        - SPORTDiscus (sports, fitness and sports medicine)
    - Trials registers and trials results registers
        - ClinicalTrials.gov (US site listing clinical trials in the US and other countries-including Australia
        - WHO International Clinical Trials Registry Platform (ICTRP) portal
        - International Clinical Trials Registry Platform (clinical trials being undertaken worldwide-including Australia)
        - Australian New Zealand Clinical Trials Registry (ANZCTR) (Clinical trials being undertaken in Australia and New Zealand
        - Cochrane Central Register of Controlled Trials (CENTRAL) (randomised trials on health issues)
    - Potential databases to search for grey literature:
        - **Subscribed databases** such as Scopus and Web of Science index conference papers, technical and other reports. ProQuest indexes dissertations and theses, conference papers and proceedings. Informit (an Australian database) indexes conference papers and many government documents.
        - **Websites** or key organisations in the research area are useful to search or browse. These may include: government agencies, academic or research institutes, professional associations, and advocacy groups.
        - **Grey literature databases** Specialised databases, such as Open Grey, GreyNet International and MedNar index grey literature in a number of subject areas.
        - Trove is an overarching search interface to search the content of most Australian libraries as well as archives and repositories.
        - **Search engines** such as Google are useful when searching for grey literature. A simple search for keywords is often the best approach. To restrict the search results, limit to particular domains (.org, .gov) or by file type (pdf). e.g., vaccination rural Australia filetype:pdf or vaccination rural Australia site:org
    - Potential places to search for books or theses:
        - **Library catalogues** index local, national and international books. Search these to locate relevant resources. Institutional or public libraries may be able to obtain items that are not held in their collections via inter-library loan. (Note: this does not apply to ebooks held in university libraries, which are covered by institutional licences).
        - Use Trove for Australian books and theses and WorldCat for international material.
        - **Digital theses** are indexed in a number of open-access resources. These include institutional repositories (see Australasian Open Access Repositories for a list of research repositories), WorldCat, OAIster, the Networked Digital Library of Theses and Dissertations and the British Libraries – EthOS e-theses online service.
- Determine **what key concepts** and words to search on. Key concepts and terms may be used differently in different databases, so specific search strategies for each database are usually required.

- Both free-text and subject headings (e.g., Medical Subject Headings (MeSH) and Emtree) should be used. Subject headings are standardised terms used for indexing and therefore by using them it can help in creating a more effective search. See Figure 3 as an example of a list of key terms and Figure 4 as an example of part of a database search.

FIGURE 3 AN EXAMPLE - THE KEY TERMS USED IN A SYSTEMATIC REVIEW ON WHEELCHAIR INTERVENTIONS FOR CHILDREN. NOTE * IS OFTEN USED TO ALLOW FOR DIFFERENT ENDINGS TO WORDS – E.G. ADOLSCEN* WILL FIND ADOLSCENT, ADOLSCENTS, ADOLESCENCE, ETC. (SOURCE: BRAY ET AL., 2014)

**Table 1 Keywords for intervention, opinion and economic evidence searches**

| Population | Disability | Intervention | Study type/outcome measures (economic evidence searches only) |
|---|---|---|---|
| Child* | Disab* | Wheelchair | Cost benefit |
| Adolescen* | Physically impair* | Buggy | Cost utility |
| Young* | Physical impair* | Mobility technolog* | Cost effective* |
| Teen* | Handicap* | Mobility aid | Qaly |
| Disab* child* | Dystroph* | Powered wheelchair | Quality-adjusted life year |
| Disab* | Cerebral palsy | Mobility equipment | Quality adjusted life year |
| Adolescen* | Spina bifida | Motorised | Health economic* |
| Disab* young* | Wheelchair* | Mobility training | Economic analys* |
| Disab* teen* | Special needs | Wheelchair service | Cost minimisation |
| | Amputee | Electric scooter | Health care cost* |
| | Complex needs | Pushchair | Healthcare cost* |
| | Brain injury | Mobility | Social economic* |
| | Brain damage* | | Social care economic* |

*Indicates truncation of keywords.

- When creating a search strategy, conduct an exploratory search first. Locate key papers that the search should capture. Create a list of key words from titles and abstracts of the key papers, and of the index terms used in a bibliographic database to describe relevant reports in order to build a comprehensive and specific search strategy for each included database.
- Ensure correct use of the Boolean 'AND' and 'OR' operators. Within each concept, terms are joined together with the Boolean 'OR' operator, and the concepts are combined with the Boolean 'AND' operator. The 'NOT' operator should be avoided where possible to avoid inadvertently removing records that are relevant from the search set.
- The published review should be as up to date as possible. Searches of all the relevant databases (and other sources) should be rerun prior to submission if the initial search date is more than 12 months (preferably six months) from the intended submission date.

### B: Implement the specific searches for each database/registry/source

- Pilot-test the search strategy in the relevant sources and check it correctly identifies the key known papers/primary sources.
- Some refinement of the search strategies is often required to ensure relevant literature is not missed and to try to reduce the number of irrelevant reports incorrectly identified

- Once refined, run the search strategy.

### C: Searching reference lists

- Check reference lists of included reports and any relevant systematic reviews identified to search for additional reports.

**FIGURE 4 EXAMPLE OF THE DATABASE SEARCH STRATEGY FOR A SYSTEMATIC REVIEW ON WHEELCHAIR INTERVENTIONS FOR CHILDREN (SOURCE: BRAY ET AL., 2014)**

**Table 2 Example database search strategies**

| Database | Search strategy |
|---|---|
| **CINAHL and MEDLINE** | Abstract only, 1997–2012 AB ( child* OR adolescen* OR young* OR teen* ) AND AB ( disab* OR physically impair* OR physical impair* OR handicap* OR dystroph* OR cerebral palsy OR spina bifida OR wheelchair* OR special needs OR amputee OR complex needs OR brain injury OR brain damage* ) AND AB ( wheelchair OR buggy OR mobility technolog* OR mobility aid OR powered wheelchair OR mobility equipment OR motorised OR mobility training OR wheelchair service OR electric scooter OR pushchair OR mobility NOT crutch* NOT prosthe*) |
| **ASSIA** | 1997-2012 all(child* OR adolescen* OR young* OR teen*) AND all(disab* OR physically impair* OR physical impair* OR handicap* OR dystrophy* OR cerebral palsy OR spina bifida OR wheelchair* OR special needs OR amputee OR complex needs OR brain injury OR brain damage*) AND all(wheelchair OR buggy OR mobility technology* OR mobility aid OR powered wheelchair OR mobility equipment OR motorised OR mobility training OR wheelchair service OR electric scooter OR pushchair OR mobility) AND all(cost benefit OR cost utility OR cost effective* OR qaly OR quality-adjusted life year OR quality adjusted life year OR health economic* OR economic analys* OR cost minimisation OR health care cost* OR healthcare cost* OR social economic* OR social care economic*) |

*Indicates truncation of keywords.

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# Step 5: Screen the reports: Include relevant reports

## Step 5A: Screen titles and abstracts

- Consolidate the search results from the different databases or registries
    - Merge search results from different sources using reference management software
        - For example: EndNote or Covidence
    - Remove duplicate records of the same report (i.e., records reporting the same journal title, volume and pages).
- The criteria for both including and excluding reports should have been pre-specified within the protocol. This could have included aspects such as: the population of interest (e.g., children), which study designs to include, the date range of publication, the publication type and whether the report was peer-reviewed, and the publication language. See Figure 5 for examples of inclusion and exclusion criteria.

FIGURE 5 AN EXAMPLE - SELECTION CRITERIA IN A SYSTEMATIC REVIEW OF TECHNOLOGY-BASED INTERVENTIONS FOR PROMOTING PHYSICAL ACTIVITY BEHAVIOR IN CHILDREN (SOURCE: LAU ET AL., 2020).

**Selection Criteria**

To be included, articles had to (1) be published in international academic peer-reviewed journals (book chapters, abstracts of conference proceeding, and dissertations were excluded); (2) use a randomized controlled trials design; (3) evaluate an intervention that aimed to promote PA behavior; (4) include at least one PA behavior variable as the outcome (no restriction was defined regarding the types of PA behavior outcomes, which could be cognitive [ie, PA knowledge], psychosocial [eg, PA intention, PA self-efficacy, social support to PA, stage of change], or behavioral [ie, energy expenditure, step counts, or self-reported PA level]; (5) focus only on children (6-12 years old) and adolescents (13-18 years old) in both the intervention and control group; and (6) employ Internet, email, and/or SMS as one or more major or assistive modes to deliver the intervention. No further limits were set on the types and content of the control group. Control groups were non–ICT-based, no treatment, or different types of ICT-based interventions.

- First pilot-test the eligibility criteria on a sample of reports (approximately six to eight reports, including ones that are thought to be definitely eligible, definitely not eligible and some that are doubtful). The pilot-test can be used to refine and clarify the eligibility criteria, train the people who will be applying them and ensure that the criteria can be applied consistently by more than one person.
- Screen the titles and abstracts against the eligibility criteria to exclude obviously irrelevant reports. Be generally over-inclusive at this stage (i.e., if in doubt include report for full-text review).
- It is commonly recommended that at least two people independently screen the titles and abstracts; however, some reviews only independently screen a sub-sample.
- The protocol should have outlined the process for resolving disagreements, which is generally by discussion of the two reviewers, or through consulting another person. A common cause of disagreement is a simple oversight by one of the reviewers. This can generally be resolved through

discussion and consensus. If the disagreement is due to differences in interpretation, this may require arbitration by another person.
- The decision and reasons for exclusion should be tracked using reference software, a simple document or spreadsheet, or using specialist systematic review software.

### Step 5B: Screen full-text reports

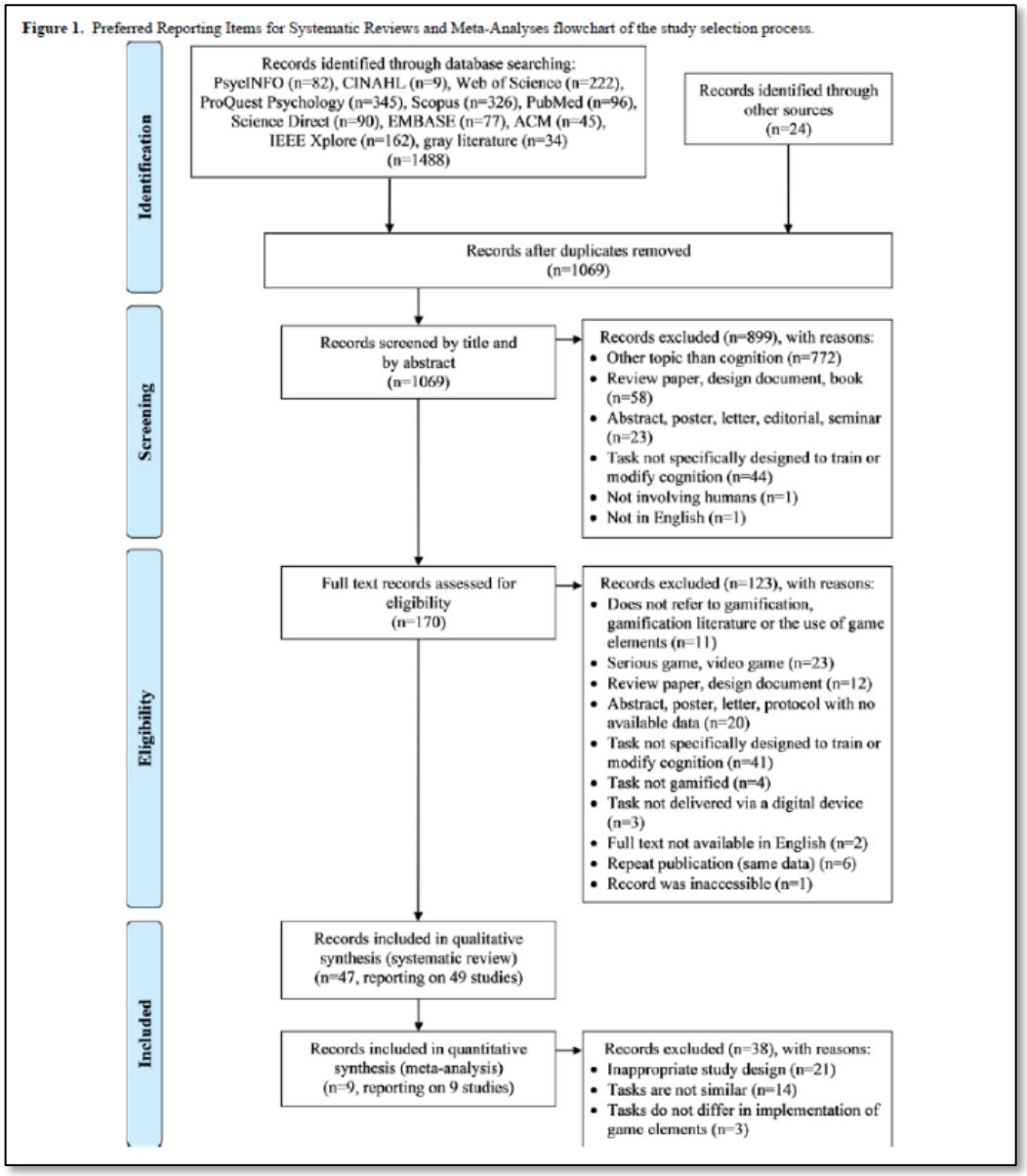
- Retrieve the full texts of potentially relevant reports.
- Again, first pilot-test the eligibility criteria on a sample of reports (approximately six to eight reports, including ones that are thought to be definitely eligible, definitely not eligible and doubtful). As for Step 5A, the pilot-test can be used to refine and clarify the eligibility criteria, train the people who will be applying them and ensure that the criteria can be applied consistently by more than one person.
- Screen full-text reports against eligibility criteria.
- If necessary, contact the authors of the report to request further information to assess study eligibility. This could include missing methods information or results.
- As with title and abstract screening, it is commonly recommended that at least two people independently determine if each study meets the eligibility criteria. The process for resolving disagreements should have been pre-determined and reported in the protocol.
- The decision and reasons for exclusion should be tracked using reference software, a simple document or spreadsheet, or specialist systematic review software.

### Overall

- Throughout the selection process, keep track of the number of reports so that a flow diagram can be constructed (such as in a PRISMA flow diagram [see flow diagram below] or QUORUM flow diagram). See Figure 6 for an example of a PRISMA flow diagram.
- In managing and keeping track of the selection process, some basic productivity tools can help including: word processors, spreadsheets and references management software, and there are systematic review tools that can assist in the process of screening search results.
    - Research Screener – an artificial intelligence tool developed to reduce the need to manually screen all titles and abstracts. It learns from the decisions made on the first sample of 50 reports and presents a prioritised list of reports for manual review. This iterative process continues until the reviewer is confident subsequent batches of 50 do not include relevant reports.
    - Abstrackr – a web-based screening tool that can prioritise the screening of records using machine-learning techniques.
    - Covidence – a web-based software platform for conducting systematic reviews, which includes support for collaborative title and abstract screening, full-text review, risk of bias assessment and data extraction.
    - DistillerSR – a web-based software application for undertaking bibliographic record screening and data extraction. It has a number of management features to track progress, assess interrater reliability and export data for further analysis.

- EPPI-Reviewer– web-based software designed to support all stages of the systematic review process, including reference management, screening, risk of bias assessment, data extraction and synthesis.
- Rayyan – a web-based application for collaborative citation screening and full-text selection.

FIGURE 6 AN EXAMPLE PRISMA DIAGRAM FROM A SYSTEMATIC REVIEW ON ELECTRONIC GAMES IN TRAINING (SOURCE: VERMEIR ET AL., 2020).




## RESOURCES

Lefebvre C, Glanville J, Briscoe S, Littlewood A, Marshall C, Metzendorf M-I, Noel-Storr A, Rader T, Shokraneh F, Thomas J, Wieland LS. Chapter 4: Searching for and selecting studies. In: Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). *Cochrane*

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## Step 6: Extract data: Collate relevant information

- Collect relevant information from the included reports
    - Collect characteristics of the included reports in sufficient detail to populate a table of 'Characteristics of included reports. Typical data collected include: Study design, participants, outcomes, results. See Figures 7 and 8 for examples.
- Pilot-test the data collection form on several reports to ensure suitable content coverage and depth.
- It is commonly recommended that at least two people independently extract data from each included report to minimise errors and reduce the risk of introducing potential biases by review authors.
- After data have been extracted independently (by two or more members of the review team), compare the responses to ensure agreement or to identify discrepancies. The process for resolving disagreements should have been predetermined, usually through discussion and/or consulting another member of the review team.
- It can be beneficial to include end-users at this stage in order to ensure relevant information is collated and help build end-users' understanding of the evidence base.

FIGURE 7 AN EXAMPLE OF PART OF A DATA EXTRACTION SUMMARY TABLE FROM A SYSTEMATIC REVIEW ABOUT YOUNG CHILDREN'S WRITING ON SCREEN. (SOURCE: KUCIRKOVA ET AL., 2019)

*Table 1: Overview of the 21 studies that were analysed thematically and comparatively*

| *Author/s* | *Year* | *Journal/Book* | *Title of the article* | *Theoretical underpinning* | *Age of child participants* |
|---|---|---|---|---|---|
| Skantz Åberg, Lantz-Andersson & Pramling | 2014 | Early Child Development and Care | Once upon a time there was a mouse: children's technology-mediated storytelling in preschool class | Socio-cultural and technology-mediated learning | 6–7 |
| Åberg, Lantz-Andersson & Pramling | 2015 | Understanding Digital Technologies and Young Children | I think it should be a little kind of exciting | Socio-cultural perspective on learning | 6–7 |
| Andersson & Sofkova-Hashemi | 2016 | Nordic Journal of Digital Literacy | Screen-based literacy practices in Swedish primary schools | Digital literacies, new literacies and multiliteracies | 7–8 |
| Baker | 2017 | Reading Research Quarterly | Apps, iPads, and literacy: examining the feasibility of speech recognition in a first-grade classroom | Socio-cultural perspective and systems theory perspective | 6–7 |
| Beam & Williams | 2015 | Computers in the Schools | Technology-mediated writing instruction in the early literacy program: perils, procedures, and possibilities | Activity theory | 5–6 |
| Beschorner & Hutchison | 2013 | International Journal of Education in Mathematics, Science and Technology | iPads as a literacy teaching tool in early childhood | Roots of literacy proposed by Goodman (1986) | 4–5 |
| Bigelow | 2013 | PhD Dissertation | iWrite: digital message making practices of young children | Children as meaning-makers; socio-cultural and multimodality as rooted in social semiotics | 3–4 |
| Björkvall & Engblom | 2010 | Journal of Early Childhood Literacy | Young children's exploration of semiotic resources during unofficial computer activities in the classroom | Social semiotic ethnography | 7–8 |
| Bratitsis, Kotopoulos & Mandila | 2012 | International Journal of Knowledge and Learning | Kindergarten children's motivation and collaboration being triggered via computers while creating digital stories: a case study | Narrative theories | 4–5 |
| Genlott & Grönlund | 2013 | Computers and Education | Improving literacy skills through learning reading by | Socio-cultural perspective | 6–7 |

FIGURE 8 AN EXAMPLE OF PART OF A DATA EXTRACTION SUMMARY TABLE FROM A SYSTEMATIC REVIEW ABOUT TECHNOLOGY DELIVERED INTERVENTIONS FOR DEPRESSION IN CHILDREN. (SOURCE: GRIST ET AL., 2018)

**Table 1** Selected study characteristics

| Study | Country | Age of sample (years) | Sample size | Diagnostic status | Referral | Intervention setting | Primary outcome | Continuing other treatment |
|---|---|---|---|---|---|---|---|---|
| Bar-Haim et al. (2011) | Israel | 10 | 35 | Elevated (Anx) | Subsample of larger RCT | University site | STAIC | NR |
| Conaughton et al. (2017) | Australia | 8–12 | 42 | Diagnosed (Anx) | Professional and self-referral | Home/AWI | CSR on the ADIS for DSMIV | Psychological—No Pharmacological—NR |
| De Voogd et al. (2017) | Amsterdam (Netherlands) | 11–19 | 70 | Elevated (Anx and Dep) | School | Home | SCARED (Anx) CDI (Dep) | NR |
| Fitzgerald et al. (2016) | Ireland | 15–18 | 120 | Elevated (Anx) | School | School | SPAI-C | No |
| Fu et al. (2013) | China | 12–17 | 28 | Diagnosed (Anx) | Professional | MH centre | Negative mood on VASs derived from PANAS-C | NR |
| Hoek et al. (2012) | Amsterdam (Netherlands) | 12–21 (m = 16.1 (2.3) | 45 | Elevated (Dep and Anx) | Professional and self-referral | Home/AWI | CES-D (Dep) HADS-A (Anx) | Psychological—No Pharmacological—NR |
| Ip et al. (2016) | China | 13–17 | 257 | Elevated (Dep) | School | Home/AWI | CESD-R | Psychological—NR Pharmacological—No |
| Le Moult et al. (2017) | USA | 7–13 | 46 | Diagnosed (Dep) | Self - referred | Home and university site | CDI | NR |
| Lenhard et al. (2017) | Sweden | 12–17 | 67 | Diagnosed (OCD) | Professional and self-referral | Home/AWI | CY-BOCS | Yes (pharmacological) |
| March et al. (2009) | Australia | 7–12 | 73 | Diagnosed (Anx) | Professional and self-referral | Home/AWI | CSR on the ADIS for DSMIV | No |
| Merry et al. (2012a, b) | New Zealand | 12–19 (m = 16.6, SD = 1.6) | 187 | Elevated (Dep) | Professional | Primary care health sites | CDRS-R | No |
| Muris et al. (1998) | Netherlands | 8–17 | 26 | Diagnosed (Spider Phobia-Anx) | Self-referred | University site | SPQ-C | NR |
| Pergamin-Hight et al. (2016) | Israel | 6–18 | 67 | Diagnosed (SAD) | Self-referred | University site | CSR on the ADIS for DSMIV | No |
| Poppelaars et al. (2016) | Netherlands | 11–16 | 101 | Elevated (Dep) | School | Home/AWI | RADS-2 | No |
| Rickhi et al. (2015) | Canada | 13–18 | 31 | Diagnosed (Dep) | Professional and self-referral | Home/AWI | CDRS-R | Yes |
| Schleider and Weisz (2017) | USA | 12–15 | 96 | Elevated (Dep and Anx) | Self-referral | University site | CDI (Dep) SCARED-C (Anx) | NR |
| Scholten et al. (2016) | Netherlands | 11–15 | 138 | Elevated (Anx) | School | School | SCAS | No |

## RESOURCES

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## Step 7: Evaluate quality of each report: Consider potential risk of bias

An appraisal of the strengths and limitations of each report should be conducted to provide an indication of the trustworthiness or believability of the evidence each report presents (Hartling et al., 2009). This is separate to the later step of estimating the quality of the overall body of evidence, that is, considering the evidence from all available reports. Issues such as overall generalisability, applicability, and publication bias should be considered at this later step (see Step 8C).

- Understanding the quality of each report relies on the clarity of details included in each report, although poor reporting does not necessarily mean the study was poorly conducted. Some aspects of good research practice do not impact on the believability and are therefore often not included in evaluation within a systematic review, e.g., participant consent.
- Aspects of internal validity quality, which can include risk of bias and potentially other methodological aspects (such as imprecision), need to be considered.
- Errors in evidence can be categorised as either systematic errors or random errors. Imprecision is a random error and reduces the certainty of evidence but does not present a bias. For example, small sample size can result in very broad estimates of the evidence.
- Methodological issues can also result in systematic error that does create a bias, creating an under- or over-estimate (Jüni et al., 2001). Additionally, biases can be created by external factors such as funding support with a conflict of interest (e.g., a technology company funding an evaluation of their product).
- While the actual levels of biases in a study are unknown (Savović et al., 2012) an assessment of the risk of bias can be made.
- To evaluate the quality of the evidence provided by each study, utilise a previously published and structured tool, ideally one which has been validated. Earlier appraisal tools tended to be called ‘quality’ assessment tools, with a later trend to focus on just the ‘risk of bias’ aspects of quality. There are a wide range of tools available. Selecting an appropriate tool needs to consider the types of studies to be reviewed (e.g., randomised control trials, observational studies or qualitative studies) and the aspects of quality considered critical to the review purpose. Further, tools often have more value if they enable transparency in appraisal by allowing for descriptive information to support assessments and shy away from a simplistic numerical summary score.

TABLE 3 SHOWS THE NHMRC AND OTHER RESOURCES LIST OF SUGGESTED APPRAISAL TOOLS

| Question or Study type | Appraisal tools |
|---|---|
| For randomised trials | Cochrane RoB 2 tool<br>SIGN checklist for randomised control trials |
| Non-randomised studies of interventions | ROBINS-I tool<br>Newcastle Ottawa Scale<br>SIGN checklist for case-control and cohort studies<br>STROBE Checklist |
| Prognostic | QUIPS<br>PROBAST<br>JBI checklist for prevalence studies |
| Diagnostic | QUADAS-2<br>SIGN checklist |
| Qualitative | JBI checklist for Qualitative research |
| Observational studies of exposures | Navigation Guide risk of bias checklist |
| Measurement properties | COSMIN |
| Mixed methods | MMAT McGill Mixed Methods Appraisal tool |
| Clinical Practice Guidelines | AGREE-II Appraisal of Guidelines for Research and Evaluation |
| Economic Studies | Consensus Health Economic Criteria (CHEC) List<br>CASP- Economic Evaluation |

- General procedures for risk of bias or quality assessment:
    - First, pilot-test the risk of bias tool on a sample of reports (approximately three to six reports). The pilot-test can be used to improve the reliability of assessments and to help ensure that the criteria are being applied consistently by reviewer team.
    - Assessment of the reports is commonly conducted by at least two people independently performing the risk of bias assessment and using a pre-determined the process for resolving disagreements. This is done to reduce errors and ensure judgments are not influenced by one person's preconceptions.

- Disagreements can be generally resolved by discussion, or through consulting another person.
- It is sometimes necessary to contact the authors of the included reports to clarify incompletely reported information.
- If the risk is not uniform across all key outcome, summarise the risk of bias for each outcome in each study.
- The procedure of the risk of bias judgements should be transparent, with justifications for assessments reported in the review. A clear summary of the risk of bias of each report can be presented, acknowledging the dangers of a single numerical score. See Figures 9 and 10 and as examples of risk of bias summaries.

**FIGURE 9 AN EXAMPLE OF A SUMMARY FIGURE OF THE ASSESSED RISK OF BIAS FOR EACH ITEM FROM A SYSTEMATIC REVIEW ABOUT TECHNOLOGY DELIVERED INTERVENTIONS FOR DEPRESSION IN CHILDREN. (SOURCE: GRIST ET AL., 2018)**

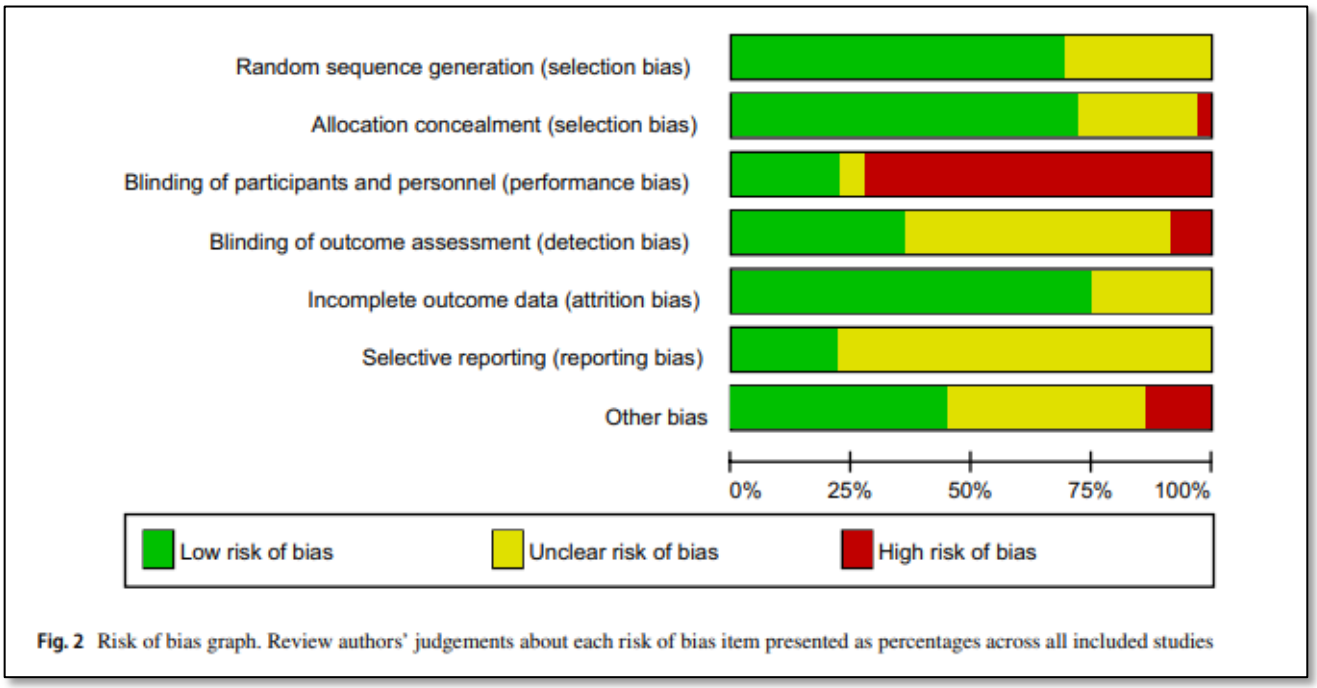


**Fig. 2** Risk of bias graph. Review authors' judgements about each risk of bias item presented as percentages across all included studies

FIGURE 10 AN EXAMPLE OF A SUMMARY TABLE SHOWING THE ASSESSED RISK OF BIAS FOR EACH OF 6 ITEMS IN THE COCHRANE RISK OF BIAS ASSESSMENT FOR RCT REPORTS FOR EACH STUDY IN A SYSTEMATIC REVIEW ON ELECTRONIC GAMES AND COGNITION (SOURCE: VERMEIR ET AL., 2020)

**Table 4.** Risk of bias assessment of the included studies.

| Study[a] | Random sequence generation (selection bias) | Allocation concealment (selection bias) | Blinding of participants and personnel (performance bias) | Blinding of outcome assessment (detection bias) | Incomplete outcome data (attrition bias) | Selective reporting (reporting bias) |
|---|---|---|---|---|---|---|
| Boendermaker et al [47] study 1 | Low | Low | High | High | Unclear | Low |
| Boendermaker et al [54] | Low | Low | High | High | Unclear | Low |
| Boendermaker et al [55] | Low | Low | High | High | Unclear | Low |
| Choi and Medalia [56] | Low | High | High | High | Unclear | Low |
| Dorrenbacher et al [57] | High | High | High | High | Unclear | Unclear |
| Katz et al [8] | High | High | Unclear | Unclear | Unclear | Unclear |
| Mohammed et al [53] | Low | High | Low | Low | Low | Low |
| Ninaus et al [18] | Low | Unclear | High | Low | Unclear | High |
| Prins et al [25] | Unclear | Unclear | High | Unclear | Unclear | Unclear |

[a]Risk of bias assessment using the Cochrane risk of bias tool.

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Boutron I, Page MJ, Higgins JPT, Altman DG, Lundh A, Hróbjartsson A. Chapter 7: Considering bias and conflicts of interest among the included studies. Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). *Cochrane Handbook for Systematic Reviews of Interventions 6.2 (updated February 2021)*. Available from www.training.cochrane.org/handbook.

Petticrew, M., & Roberts, H. (2008). *Systematic Reviews in the Social Sciences: A Practical Guide*. Malden, MA: Blackwell Publishing.

Risk of bias tools: https://www.nhmrc.gov.au/guidelinesforguidelines/develop/assessing-risk-bias

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Savović, J., Jones, H. E., Altman, D. G., Harris, R. J., Jüni, P., Pildal, J., . . . Gluud, L. L. (2012). Influence of reported study design characteristics on intervention effect estimates from randomized, controlled trials. *Annals of Internal Medicine, 157*(6), 429-438.

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# Step 8: Formulate a synthesis: Summarise and evaluate the overall body of evidence

Evidence summaries can be provided as either a meta-synthesis or a meta-analysis. Meta-synthesis is a non-statistical summary of the results (see Step 8A). Meta-analysis is statistical synthesis: combining results from separate but similar reports resulting in a quantitative summary of the pooled results (see Step 8B) (Last, 2001, p114). The final component of the synthesis should be a summary of the trustworthiness or believability of the overall body of evidence (see Step 8C).

## Step 8A: Synthesis of results (Narrative meta-synthesis)

- Summarising study characteristics, study quality, and study results
    - Synthesis is the process of bringing together the data from the included reports with the aim of making a conclusions about a body of evidence. See Figures 11 to 13 for examples.
    - This step typically builds on the tabulation of study characteristics in Step 6 as this facilitates inspection and evaluation of the important characteristics across reports, supporting the synthesis of evidence results.
    - Based on the study characteristics tables, consider which reports are similar enough to be grouped within each comparison and synthesise the results of the reports contributing to each comparison. Results can be presented in additional table/s and figures.
    - Alternative synthesis and visual display methods should be planned and specified in the protocol. When writing the review, details of the synthesis methods should be described. Examples of alternative synthesis:
        - Summarising effect estimates. This provides information on the magnitude and the range of effects. Can be presented as box-and-whisker plot or bubble plots.
        - Vote counting based on direction of effect. This method can be used when only the direction of effect is reports or there are inconsistencies in the effect measures. Can be presented as harvest plot or effect direction plots.
    - Tables and plots structure information to show patterns in the data and convey detailed information more efficiently than text. This aids interpretation and helps readers assess the veracity of the review findings.
        - Can be grouped by certain characteristics (comparison, outcome domains, populations)
        - Can be ordered by most relevant and/or trustworthy evidence (certainty of the evidence, risk of bias, study size or study design characteristics).

FIGURE 11 AN EXAMPLE OF A THEMATATIC DIAGRAM IN A SYSTEMATIC REVIEW ON GAMIFICATION IN APPS FOR IMPROVING MENTAL HEALTH (SOURCE: CHENG ET AL., 2016).

**Figure 5.** Thematic diagram showing themes, subthemes, and codes.

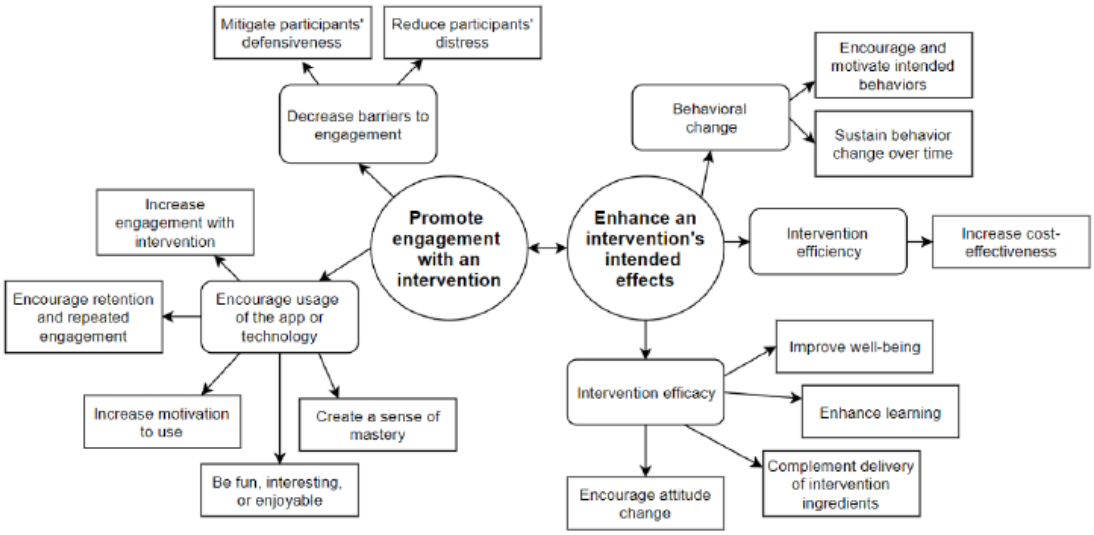



FIGURE 12 AN EXAMPLE SUMMARY OF RESULTS OF QUANTITATIVE STUDIES OF TECHNOLOGY-BASED INTERVENTIONS FOR PROMOTING PHYSICAL ACTIVITY BEHAVIOR IN CHILDREN (SOURCE: LAU ET AL., 2020).

**Table 3.** Effect of ICT-based intervention on PA outcomes

| Sources | | Effect[a] | | |
|---|---|---|---|---|
| | Outcome Measure | Within-Group | Between-Group | Effect Size |
| Franklin et al [41] | Perceived social support to exercise | ↑ | + | 0.76 |
| Jago et al [42] | Light PA | ↑ | O | 0.03 |
| | Moderate PA | → | O | 0.08 |
| | Step counts | → | O | 0.24 |
| Lubans et al [43] | Step count, boys | ↑ | + | 0.80 |
| | Step count, girls | ↑ | + | 1.2 |
| Marks et al [44] | PA self-efficacy | ↑ | O | Not applicable |
| | PA intention | ↑ | — | 0.41 |
| | Self-reported PA | → | O | 0.39 |
| Newton et al [45] | Step counts | → | O | Not applicable |
| Patrick et al [46] | Moderate PA | ↑ | O | Not applicable |
| | Vigorous PA | → | O | Not applicable |
| Prochaska et al [47] | PA level, boys | ↑ | + | 0.95 |
| | PA level, girls | → | O | 0.03 |
| Shapiro et al. [48] | Self-reported PA | → | O | 0.14 |
| Williamson et al [49] | Self-reported exercise behavior | ↑ | O | Not applicable |

[a] The pre-post difference in PA behavior outcome in the intervention group was indicated by: "↑" for positive and significant, "→" for no significant change and "↓" for significant negative change. The pre-post difference in PA behavior outcome between the intervention group and control group was coded as "+" (significant difference favoring the ICT intervention group), "O" (no significant difference between groups), and "—" (significant difference favoring the control group).

FIGURE 13 AN EXAMPLE SUMMARY OF RESULTS OF QUANTITATIVE STUDIES OF SUBGROUP ANALYSES (SOURCE: VERMEIR ET AL., 2020)

**Table 2.** Results of the subgroup analyses for motivation/engagement outcomes.

| Moderator | n[a] | k[b] | g[c] | 95% CI | *P* value | $Q_w$[d] | *P* value | $Q_b$[e] | *P* value |
|---|---|---|---|---|---|---|---|---|---|
| **Cognitive domain** | | | | | | | | —[f] | — |
| Arithmetic ability | 57 | 1 | 1.64 | 0.13 to 3.16 | .03 | — | — | | |
| Attention | 61 | 1 | 0.02 | -1.45 to 1.49 | .98 | — | — | | |
| Executive control | 27 | 1 | 1.00 | -0.59 to 2.59 | .22 | — | — | | |
| Inhibition | 169 | 2 | 0.62 | -0.43 to 1.65 | .25 | 8.84 | .003 | | |
| Working memory | 200 | 3 | 0.67 | -0.20 to 1.54 | .13 | 12.74 | .002 | | |
| **Age group** | | | | | | | | 0.94 | .33 |
| Adults | 282 | 4 | 0.51 | -0.12 to 1.13 | .11 | 18.86 | <.001 | | |
| Children and adolescents | 232 | 4 | 0.96 | 0.30 to 1.61 | .004 | 12.19 | .007 | | |
| **Population type** | | | | | | | | 0.14 | .71 |
| Low risk | 298 | 4 | 0.63 | -0.08 to 1.34 | .08 | 11.99 | .007 | | |
| High risk | 216 | 4 | 0.82 | 0.10 to 1.54 | .03 | 27.74 | <.001 | | |
| **Game elements type** | | | | | | | | — | — |
| Achievement, progression, and immersion | 408 | 6 | 0.69 | 0.12 to 1.26 | .02 | 26.12 | <.001 | | |
| Achievement, progression, immersion, and social | 106 | 2 | 0.84 | -0.15 to 1.83 | .10 | 13.14 | <.001 | | |

[a]n: combined sample size.
[b]k: number of studies.
[c]g: Hedges g.
[d]$Q_w$: heterogeneity statistics within each group.
[e]$Q_b$: heterogeneity statistics between groups.
[f]Not available due to insufficient observations.

## Step 8B: Quantitative synthesis- Meta-analysis (optional)

- A decision to combine the numerical results of all, or perhaps some, of the reports should be made carefully.
- Potential advantages of meta-analyses include:
    - Improved precision as individual reports may have low statistical power.
    - The opportunity to settle controversies arising from conflicting report results, e.g., by creating a weight-of-evidence summary effect.
    - The ability to answer questions not posed by individual reports, e.g., combining results of separate reports may allow comparisons at different age groups.
- Conversely, meta-analysis also has the potential to mislead if there is significant variability between the reports, if there are within-study biases, or if reporting biases are not considered (see Step 7).

First determine if a meta-analysis is possible.

- Meta-analysis should only be conducted if the individual reports are sufficiently comparable, considering elements like study design, participants, interventions, and outcomes. There will be differences between individual reports. The variability between the individual reports is known as

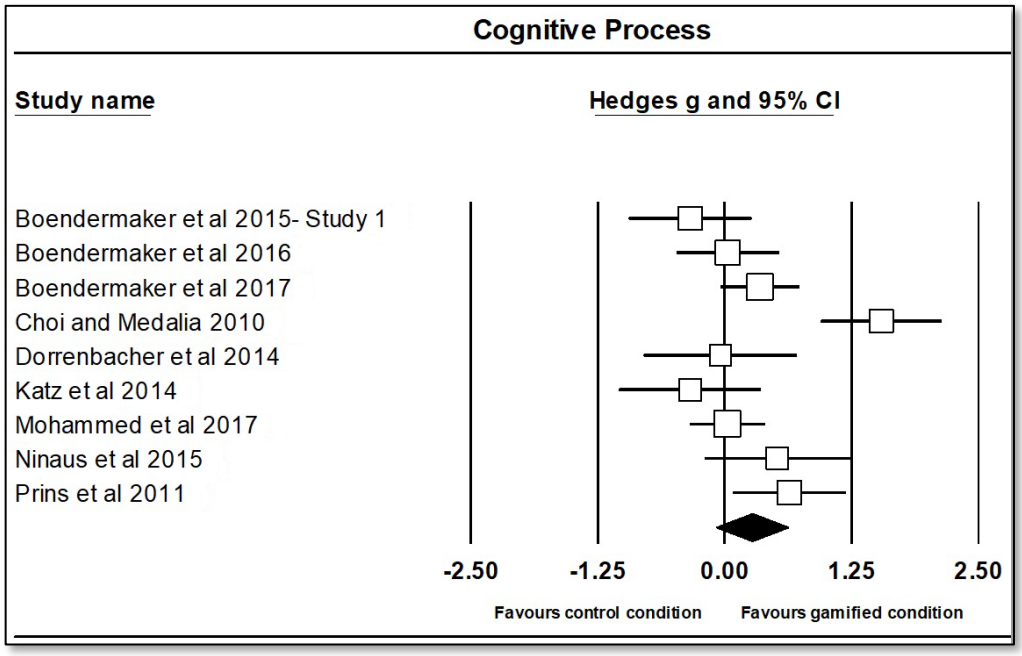
heterogeneity. There are different types of heterogeneity: clinical heterogeneity, methodological heterogeneity, and statistical heterogeneity (Askia and Offringa., 2015):

- Clinical heterogeneity could be due to differences (or variability) in the participants, interventions and outcomes studied in the individual reports.
- Methodological heterogeneity could be due to differences (or variability) in study design and quality of the individual reports.
- Clinical and methodological heterogeneity is generally based on a 'clinical' judgment call as to whether it makes 'clinical' sense to combine reports together.
- Clinical and/or methodological heterogeneity can lead to statistical heterogeneity. Statistical heterogeneity is the overall variability in the results from all the reports. Statistical heterogeneity manifests as differences in the results more than anticipated due to chance alone and can be assessed through statistical software (such as with P-value, $Chi^2$ test or $I^2$). $I^2$ details the percentage of variability in the effect estimates that is due to heterogeneity rather than chance variability.
- Decisions on whether to include reports together in a meta-analysis should not purely be made on one statistical heterogeneity statistic, and there is no clear cut-off points or agreement on $I^2$ interpretation (Higgins., 2008; Rücker et al., 2008). However, there are rough guides to interpretation of $I^2$: 0–40% may represent low heterogeneity, 30–60% may represent moderate heterogeneity, 50–90% may represent substantial heterogeneity, and 75–100% may represent considerable heterogeneity.

- There are times when it may not be possible or appropriate to undertake a meta-analysis. Some reasons include:
    - Limited evidence: meta-analysis is not possible if there are no reports or only one report.
    - Incompletely reported outcomes/results
    - Different statistical measures used to access studies
    - Unacceptably high clinical or methodological heterogeneity
    - Unacceptably high statistical heterogeneity
- Conducting a meta-analysis
    - Statistical software such as Stata, R and Comprehensive Meta-Analysis may be used to perform statistical analyses
    - Most meta-analysis methods are variations on a weighted average of the effect estimates from the different reports, although meta-analysis of individual participant data is becoming more popular (Riley et al., 2010).
        - A meta-analysis of individual participant data is when data is synthesised at the raw individual participant level from multiple related studies. By using the individual participant data, there is an ability to increase the power to detect differences in results across individuals and may allow for adjustments for confounding variables in observational studies. However, this approach can be very time- and resource-intensive, as it may involve contacting the report authors for the raw data, and then analysing the data, which may be complex and require advanced statistical expertise. Additionally, there may be a need for ethical approval if using data at an individual level, and some data may not be available.

- Meta-analyses based on report group data are usually illustrated using a forest plot (see example in Figure 14).
    - A forest plot shows effect estimates and confidence intervals for each individual report and the overall meta-analysis estimate (Lewis and Clarke., 2001). Each individual report is denoted by a block at the point estimate of result with a horizontal line extending either side of the block. The size of the block indicates the weight assigned to that report in the meta-analysis while the horizontal line depicts the confidence interval (usually a 95% level of confidence). The confidence interval depicts the range of intervention effects compatible with the study's result. Studies with more power (larger sample sizes) will carry more weight (larger size block), generally narrower confidence intervals (shorter horizontal lines) and will have more impact on the summary results (depicted as a diamond).
    - Following summarising and representation of the synthesis, a judgement on the overall body of evidence should be made – see Step 8C

FIGURE 14 AN EXAMPLE OF A FOREST PLOT SHOWING THE EFFECT ESTIMATES AND CONFIDENCE INTERVALS FOR EACH STUDY ALONG WITH THE META-ANALYSIS OVERALL ESTIMATE (DIAMOND) (SOURCE: VERMEIR ET AL., 2020)



### Step 8C: Summary of findings and quality assessment

- In addition to the narrative and/or statistical summary of the body of evidence created in Steps 8A and 8B, it is important to characterise the certainty or trustworthiness of this summary for the specific purpose of the systematic review being undertaken.
- Where suitable, it is advisable to utilise a recognised process for assessing and reporting the certainty in the body of evidence
- The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach is widely used. Other approaches include PRECEPT (for public health) (Harder et al., 2015), and GRADE-CERQual (qualitative evidence syntheses).
- The GRADE approach was created to support guideline developers in the area of health and initially focussed on intervention effects typically from randomised control trials. However, variants of GRADE have now been developed with applicability to evidence from observational studies, economic evidence, overviews of reviews, qualitative evidence and patient preference and values evidence.
- GRADE specifies four levels of the certainty for a body of evidence for a given outcome: high, moderate, low and very low.
    - GRADE 'Summary of findings' tables display the main findings of a review regarding the certainty of quality of evidence (i.e., the confidence or certainty in the range of an effect estimate or an association).
    - 'Summary of findings' tables can be produced using GRADE's software GRADEpro GDT. GRADE's official software package developed to support the GRADE approach: GRADEpro GDT (www.gradepro.org).
    - GRADE assessments of certainty are generally determined through consideration of five domains: risk of bias, inconsistency, indirectness, imprecision and publication bias. Consideration of further domains can also be included (e.g., large effects, dose response, and opposing plausible residual bias and confounding).
        - Risk of bias (more information in Step 7) relates to internal study validity due to limitations in study quality in terms of design and execution.
        - Inconsistency or heterogeneity is when different reports give extremely differing results.
        - Indirectness refers to when there are indirect comparisons or the included report results are based on indirect results (not the primary focus of the report).
        - Imprecision refers to random error which could be due to sampling variation. Precision can depend on the sample size of the study and is reflected in the confidence interval around effect estimates. The smaller the sample size the less precise the results.
        - Publication bias refers to the publication or non-publications of research results, depending on the nature and direction of results. Research findings are less likely to be published if they are statistically non-significant or unfavourable/unexpected results.
        - Large effects refer to the magnitude of the effects and the variance of the results (confidence intervals)

- Dose response refers to results that have shown increased exposure leading to increased outcome
- Opposing plausible residual bias and confounding occurs when there are plausible biases and confounders that have not been considered.

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## Step 9: Write the report: Consolidate the information and conclusions

- Systematic reviews are often reported as a peer-reviewed journal article but can also be disseminated as a self-published detailed report, and, less commonly, in a brief report perhaps aimed at a community level.
- Regardless of the report format chosen, the report should be written clearly and identify recommendations for policy, practice, product and/or future research.
- Interpreting results and drawing conclusions
    - When interpreting the results and drawing conclusions, ensure the results are applicable to the question asked. Consider the external validity of the findings. Consider whether the overall evidence is derived from studies conducted in specific populations and/or through specific methods, such that the findings may not be able to be applied more generally.
    - When reporting quantitative data, it is usually preferable not to describe results as 'statistically significant', 'not statistically significant', or 'non-significant' based on thresholds for P-values, but instead report the effect size and confidence interval, potentially with the exact P-Value. Importantly, report whether the effect size magnitude has practical meaning.
    - In drawing conclusions, consider the implications of the results for the end-users, which could include a range of people including (but not limited to) researchers, educators, policy makers, clinicians, patients, etc.
    - It is often desirable to have end-users engaged in this process to assist in the report being relevant and comprehensible.
- If the plan is to publish within an academic journal (more information in Step 10) check the author guidelines for requirements.
- Whether aiming to publish in a journal or not, it is useful to use journal guidelines relating to the publication of systematic reviews, which help to ensure consistency of reporting. There are also internationally recognised checklists to follow depending on the type and purpose of the review.
    - The PRISMA statement (Page et al., 2020), or Preferred Reporting Items for Systematic Reviews and Meta-Analyses, provides a checklist for review authors on how to report a systematic review, and a flowchart
    - MOOSE Guidelines (Meta-analysis of observational studies in epidemiology). A checklist for authors, editors, and reviewers of meta-analysis of observational studies (Stroup et al., 2000)
    - QUORUM guidelines (QUality Of Reporting Of Meta-analyses). Includes a checklist for reporting and presentation of systematic reviews and meta-analysis, and a flow chart for reporting sectional of studies (Moher et al., 2006).
    - Check the EQUATOR Network (Enhancing the Quality and Transparency Of health Research). Contains a range of reporting guidelines for various types of research/study designs. https://www.equator-network.org/

Example outline for the review
(always check that all relevant information as per the relevant reporting guidelines has been included):

- Background and objectives

    - Include the rationale for the review and why the questions being addressed are important.
    - At the end of the background, usually includes the review objectives
- Methods
    - In a completed review, the methods should usually be written in past tense.
    - Should describe what was done to obtain the results
    - Should include
        - Inclusion/exclusion criteria (eligibility criteria)
        - Search methods for identification of reports
        - Selection of reports
        - Data extraction
        - Assessment of risk of bias/quality
        - Data synthesis (i.e., meta-analysis)
        - Summarising findings
- Results
    - Description of reports
        - How many reports identified, how many included- PRIMSA OR QUORUM flow diagram.
        - Characteristics of included reports e.g., study designs, study population.
    - Risk of bias/quality assessment of each included report
    - Summary of results- could be presented in table or figures as well as well as any meta-analysis
    - Overall trustworthiness of body of evidence
- Discussion
    - Summary of main results
    - Comparison with other studies/reviews
    - Implications of findings
    - Strengths and limitations of the review
- Conclusion
- Disclosures and contributions
    - Systematic reviews should be transparent regarding contributions and organisations, conflict of interests and sources of funding

## RESOURCES

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., . . . Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews, 4*(1), 1-9.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., . . . Brennan, S. E. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ, 372*.

Schünemann HJ, Vist GE, Higgins JPT, Santesso N, Deeks JJ, Glasziou P, Akl EA, Guyatt GH. Chapter 15: Interpreting results and drawing conclusions. In: Higgins, J. P., Thomas, J., Chandler, J.,

Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). *Cochrane Handbook for Systematic Reviews of Interventions 6.2 (updated February 2021)*. Available from www.training.cochrane.org/handbook.

Stroup, D. F., Berlin, J. A., Morton, S. C., Olkin, I., Williamson, G. D., Rennie, D., . . . Thacker, S. B. (2000). Meta-analysis of observational studies in epidemiology: a proposal for reporting. *JAMA, 283*(15), 2008-2012.

## Step 10: Disseminate: Make academic community aware of the findings

Consider publishing the review in an academic journal. When deciding on a journal, consider the scope and aims of the journal, where it is indexed (i.e., whether other researchers will be able to easily find the review), the impact factor of the journal relative to the field, and the requirements of the journal (check the author guidelines for requirements). Aim for Q1 journals, but also consider target audience, including industry.

- Sites to help in searching for journals and their impact include: Scimago Journal & Country Rank https://www.scimagojr.com/journalrank.php
- Sites to help select a journal appropriate for topic - JANE
- Journal guidelines relating to the publication of systematic reviews can be consulted to ensure consistency of reporting. Checklists to follow differ depending on the type and purpose of the review (More detail in Step 9)
- The report should be transparent and easily available to others. Also, it should clearly identify recommendations for policy, practice, product and research. End-user engagement can help the relevance and impact discussion.
    - Identify and prioritise key messages
    - Many journals require a brief description of "What do we already know? And what does this article add?" Answering these questions are key first steps to presenting key messages
- To help dissemination of the review message, consider having a shorter, user-friendly summary, potentially with an infographic for social media, targeting other researchers.
- Promote review to academic audiences
    - Presentations at conferences
    - Via social media
    - By direct email to key academics
    - Academic industry newsletters

### RESOURCES

Scimago Journal & Country Rank https://www.scimagojr.com/journalrank.php

JANE: https://jane.biosemantics.org/

Petticrew, M., & Roberts, H. (2008). Chapter 8: Disseminating the review. *Systematic Reviews in the Social Sciences: A Practical Guide*. Malden, MA: Blackwell Publishing.

## Step 11: Translate knowledge and engage end-users: Help end-users apply the evidence

Effective dissemination and, importantly, knowledge translation involves considering who might want to use this information, creating useful information and putting it in the right place to allow those who might be interested to utilise the findings. For the research to be useful and available for use, the research findings need to be communicated effectively.

- End-user engagement — preferably from the early steps of the review process as indicated in Step 1—.
- To achieve its purpose as an information base, we need to know the most effective means of:
    - making research outcomes accessible to the appropriate end-users
    - ensuring research addresses issues of value to the end-users
    - interpreting the practical and theoretical implications of research into the policies, procedures, and activities of organizations.
- Consider:
    - 1. What message needs to be delivered? Should be clear and relevant to an end-user
    - 2. Who should the message be delivered to? Identify the target audience
    - 3. Who should deliver the message? Use a credible delivery method.
    - 4. How should the message be delivered? Transfer of the message should be interactive.
- Strategies for effective dissemination and communication
    - Engage users early and throughout in the review process (including dissemination)
    - Be clear in your strategy and objectives for the review
    - Develop a simple clear message and adapt it for different sources (newspaper, social media, webpage)
    - Be clear about your target audience and end-user
    - Think about the best ways to target your audience to maximise impact
    - Keep your review manageable and do not underestimate the time involved
- Ways to get the information out:
    - Involvement with end-users to guide best modes (having previously assisted with selected key messages and how to word them).
    - Websites and blog posts
    - Newsletters
    - Invitation seminars
    - Direct mailing to agencies
    - Social media
    - Press releases

### RESOURCES

Petticrew, M., & Roberts, H. (2008). Chapter 8: Disseminating the review. *Systematic Reviews in the Social Sciences: A Practical Guide*. Malden, MA: Blackwell Publishing.

## Follow-up activities: Renewal watch, update as needed

- Consider a plan for renewal as systematic reviews can become outdated
    - As new reports are completed, the results of a systematic review could become outdated and thus be misleading.
- Consider updating the systematic review:
    - If the review question is still relevant for end-users, there is new information, and the new information would have a meaningful impact on the results of the review.
    - There is no set time to update a review; this would depend on the topic area. An analysis of 100 systematic reviews published from 1995 and 2005 found that median time needed for an update was 5.5 years. However, 23% of reviews were out of date within 2 years, 15% within one year, and 7% were out of date by the time of publication (Shojania et al., 2007).
- When updating a review, ensure the latest guidelines are used, which may have also changed since the original review.
- Consider evaluating the impact of the review. This should normally involve discussions with end-users.

### RESOURCES

Cumpston M, Chandler J. Chapter IV: Updating a review. In: Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2021). *Cochrane Handbook for Systematic Reviews of Interventions 6.2 (updated February 2021)*. Available from www.training.cochrane.org/handbook.

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Shojania, K. G., Sampson, M., Ansari, M. T., Ji, J., Doucette, S., & Moher, D. (2007). How quickly do systematic reviews go out of date? A survival analysis. *Annals of Internal Medicine, 147*(4), 224-233.

## CONCLUDING COMMENTS

Systematic reviews provide a very structured process for finding, appraising and synthesising evidence. Transdisciplinary systematic reviews can therefore provide an incisive mechanism for not only aiding in transdisciplinary understanding of issues, but for creating evidence syntheses that are relevant to end-user needs. The goal is informed decision-making by those supporting the vision of a digital world that benefits children.


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