A rapid review exploring what initiatives are currently available for families to improve digital media literacy for under 5s.

Lucy Betts, Reid Allen, Jane Slater & Cliff Manning

Contents

Executive Summary	3
Introduction	5
Method	8
Results	11
Discussion	18
Summary	22
References	23
Appendix A	29
Appendix B	31

Executive Summary

Ofcom defines media literacy as *“the ability to use, understand and create media and communications in a variety of ways including through online services” (Ofcom, 2024, p 3)*.

Young children’s engagement with digital technology is growing rapidly; however, there is a lack of insight into how parents and families support children under the age of five to develop their media literacy in today’s digitally connected world.

To explore this further, a rapid review was conducted to explore the following questions:

- What initiatives are currently available for families to improve digital media literacy for under 5s?
- What evidence is available on the effectiveness of these interventions?
- What evidence is available on the effectiveness of initiatives for families of children?

A literature search of three key databases was undertaken in February 2024. The inclusion criteria were that papers: (a) were written in English, (b) focused on children under 5, (c) focused on digital media literacy, and (d) involved family as part of the intervention.

Appropriate guidance on how to conduct rapid reviews (e.g., Garritty et al., 2021; King et al., 2017; Varker et al., 2015) was followed. The initial search yielded 3053 results after duplicates were removed. The titles and abstracts of these articles were screened against the inclusion criteria, resulting in 63 articles remaining at stage one. The full text of the remaining 63 articles was then reviewed for eligibility to assess their suitability against the inclusion criteria and 58 articles were excluded. Therefore, stage two of the rapid review yielded five relevant papers, which were subsequently evaluated for risk of bias using the relevant JBI critical appraisal tool

(Moola et al., 2020). The steps from the three-stage thematic synthesis analysis (Thomas & Harden, 2008) were implemented.

Following the analysis of the papers identified, this rapid review identified no current interventions for families to support digital media literacy for the 0-5 age group. Therefore, based on the papers included, it was not possible to review the effectiveness of the interventions. However, the analysis found that where initiatives have been developed, they have focused on reducing screen time or problematic usage, improving wellbeing by adopting a harm reduction approach or improving parents' ability to scaffold children's media usage and negotiate the digital environment themselves.

To mitigate against the possibility that the rapid review failed to identify relevant articles, common alternative keywords were identified and integrated into the search term in turn. Although it was beyond the scope of the review to analyse the results obtained it would seem that the original search term captured relevant literature.

In addition, supplementary publications suggested by the project advisory group were reviewed through the lens of attempting to answer the research questions.
Although young children were mentioned in several of the publications, consistent with the results of the rapid review there appears to be a lack of interventions to support digital media literacy in this age group. Where interventions were reported, these tended to focus on older ages or lacked comprehensive evaluations of their impact. The digital media literacy frameworks reviewed did not include skill development of very young children, with none targeting children under three.

In conclusion, the increased exposure of under 5s to digital technologies means there is a need for them to develop digital media literacy. Given the apparent lack of targeted interventions in this area, further, cross-disciplinary, research that involves key stakeholders is needed to both develop and evaluate effective interventions.

Introduction

Danby and colleagues (2018) argue that as "*our social worlds are now saturated with digital technologies"* (p2), digital technology use is likely an everyday experience for children. Moreover, digital technology is now regarded as an important part of family life, with parents influencing how children use digital technology from a young age (Chaudron et al., 2018).

Recent data from Ofcom (2024) suggests that 84% of children aged 3-4 go online, with 27% having their own mobile phone. Young children are likely to use digital technology for four reasons: (1) leisure and entertainment, (2) information and learning, (3) creation, and (4) communication (Chaudron et al., 2018). However, even from a young age there is variation in children's digital skills (Donoso, 2014) and, of course, simply having access to digital technology in the home does not mean that young children have the opportunity to use it (Mascheroni et al., 2014). Therefore, despite this increase in technology use, Chaudron (2015) argues that research in this domain is limited, especially for young children.

To date, many studies exploring digital technology use with young children have tended to focus on how parents mediate children's access to digital technology and the activities that they engage in. Parents have been acknowledged to act as gatekeepers to facilitating access to, and use of, digital technology (Dias et al., 2016) and are required to set up, initiate, or act as proxy users and curators (Livingstone et al., 2014). This role as a gatekeeper is likely influenced by parents' own experiences and perceptions of technology (Dias et al., 2016) and their values, traditions and experiences that are influenced by their culture, religion, or social position and limitations of time, space, energy, and finance (Livingstone et al., 2015).

Parents also likely experience a tension between the benefits that digital technology affords and perceptions that digital technology is something that needs to be regulated and controlled (Chaudron, 2015). However, while some parents recognise that digital technology is integral to children's education and development and do not want their children's skills to lag behind those of their peers (Liubinienė &

Kasperavičienė, 2019), other parents may consider parenting the digital lives of their children as optional (Velicu & Mitarcă, 2016).

In terms of data around supporting young children's technology use, 34% of parents of children aged 3-4 reported that it was hard to control their child's screen time while 74% reported that they thought their child had a good balance between screen time and other activities (Ofcom, 2024).

Considering how young children acquire digital technology skills is crucial. Although children's digital skills are attributed to their own learning (Matusmoto et al., 2016), parents likely play a central role in supporting young children to develop digital competencies (Chaudron et al., 2018) and deciding when to introduce children to different types of technology (Gillen et al., 2018).

Findings from Chaudron's (2015) exploratory qualitative study with young children (aged 0-8) and their families from across seven European countries suggest that children learn skills through observation. Chaudron suggested that children develop skills through watching their parents and other family members including older siblings and extended family members such as grandparents engage with technology. However, while Chaudron reports that parents were often unaware that their children were mirroring their behaviour, findings from Sandberg et al. (2018) suggest that parents were aware that children gain skills that they are not explicitly taught through observing others using devices (e.g., how to unlock a smartphone).

In addition to family members, Chaudron also suggests that peers are influential in developing children's digital skills. In terms of the skills that young children developed, Chaudron reported that they tended to be basic operational skills, although some of the children demonstrated more advanced online competencies but these were limited by children's cognitive development. Relatedly, Donoso (2014) argues that although young children may possess digital skills, their developing cognitive and emotional skills mean that they may not understand the consequences of their behaviours.

In terms of supporting parents, drawing on the findings from the UK strand of the Young Children (0-8) and Digital Technology project, Livingstone et al. (2014) recommended that evidence-based parental and carer educational materials, developed with industry representatives, are needed. Livingstone et al. proposed that such resources should include information on safety settings, passwords, privacy protection, content filters, and assist with mediating unsupervised internet accesses. Additionally, Livingstone et al. also recommended that communication strategies were needed to support parents to have conversations with young children about managing online risks.

Compared with other media, Park (2012) argues that individuals need to develop a range of skills including social and cultural abilities to successfully engage with digital media. Together, these skills have been referred to as digital media literacy which represents "*the ability to use, understand and create media and communications in a variety of ways including through online services"* (Ofcom, 2024, p 3).

We know from literature on developing literacy skills that a range of interventions exist to support parents in developing children's literacy through shared book reading activities (e.g., Dolly Parton's Imagination Library, Hall & Jones, 2016; Ready Set, Share A Book!, Salley et al., 2022). However, it remains unclear what interventions are currently available to support digital literacy skills development in the under-fives.

Given the growing engagement with digital technology and the lack of insight into how parents and families support children under the age of five to develop their digital media literacy a rapid review was conducted to answer the following research questions:

1. What initiatives are currently available for families to improve digital media literacy for under 5s?
2. What evidence is available on the effectiveness of these interventions?

3. What evidence is available on the effectiveness of initiatives for families of children?

Method

Approach

To ensure transparency for the rapid review (King et al., 2017; Schűnemann & Moja, 2015), a protocol registration was submitted to the OSI network (https://osf.io/3h6nt). The protocol was informed by the PRISMA protocol (Moher et al., 2009) with changes made to reflect the nature of the current rapid review.

Search strategy

To address the three research questions, the following search term was used across three databases: (family AND improve AND intervention AND “digital literacy” OR “digital media literacy” OR “media literacy”) AND (“infant” OR “toddler” OR “early years” OR “preschool*” OR ("young child" OR "young childhood" OR "young children") OR “pre-k*”).

The databases included in the search were: ProQuest, Web of Science, and Scopus. The search term was agreed with Parent Zone colleagues. The literature search took place in February 2024 and was not limited by publication date.

Inclusion criteria

The inclusion criteria for papers to be included in the review was that the paper had: (a) to be written in English, (b) focus on children under 5, (c) focus on digital media literacy, and (d) involve family as part of the intervention.

Process

As outlined in Figure 1, the searches of the databases yielded 3229 results which were uploaded to Rayyan (Ouzzani et al., 2016). After removing the duplicates, the titles and abstracts of 3053 entries were reviewed against the inclusion criteria by one reviewer. Following the recommendations for rapid reviews (Varker et al., 2015),

a random selection of 20% of the articles was reviewed by a second reviewer. As there was 99% agreement between reviewers, following the recommendations of Varker et al. (2015), a full review of the papers was not undertaken by the second reviewer. Next, the full text of the remaining 63 articles were reviewed for eligibility to assess their suitability against the inclusion criteria by one reviewer. Again, a second reviewer reviewed a random selection of 20% of the articles yielding 98% agreement. To minimise selection bias in the second stage, dual screening was subsequently completed for all excluded articles (Garritty et al., 2021; King et al., 2017). Finally, the five papers were reviewed for risk of bias using the relevant JBI critical appraisal tool (Moola et al., 2020). Papers were not excluded at this stage based on the results of the risk of bias review.

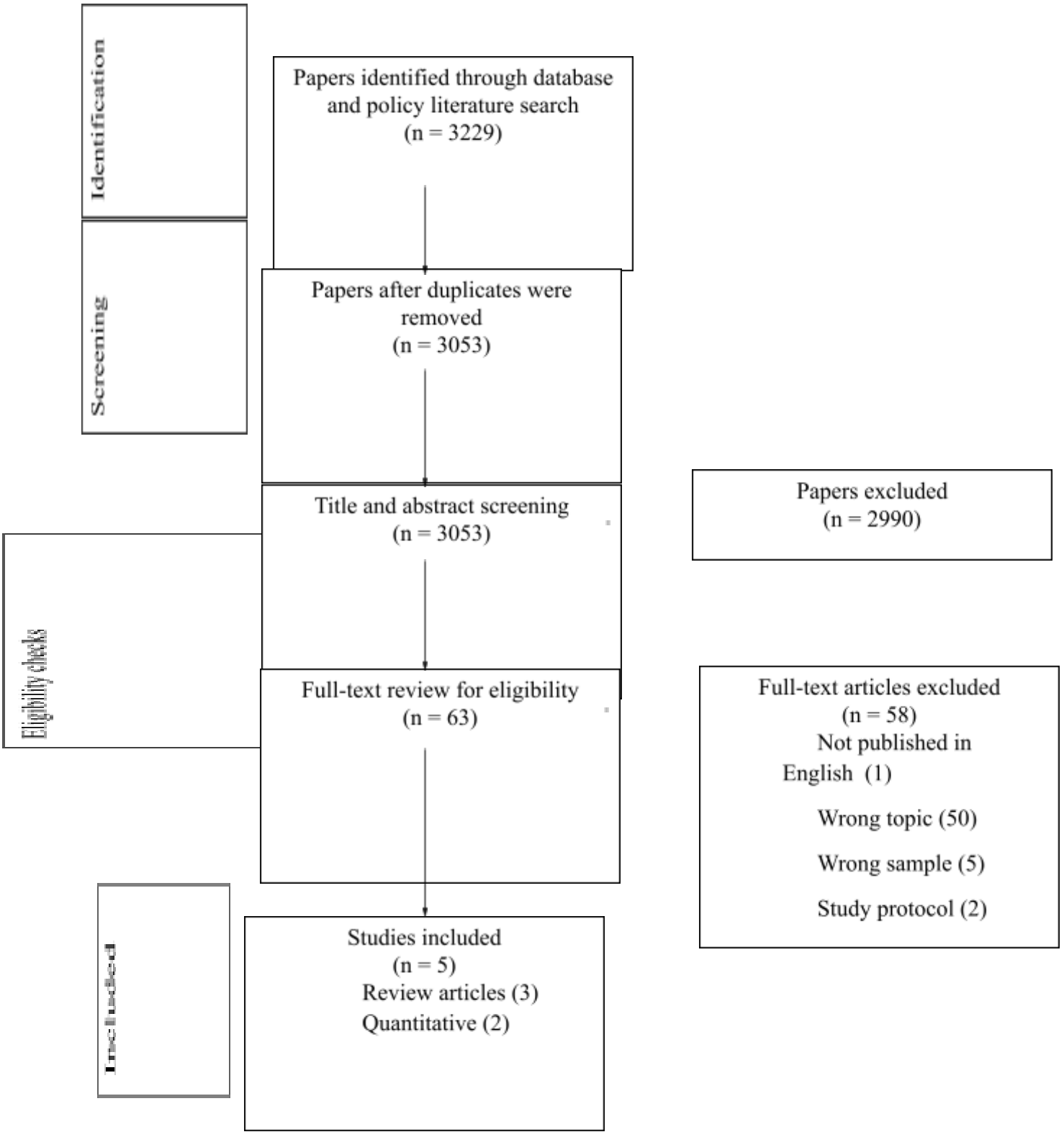

Figure 1. Overview and results of the various stages of the rapid review process

Analytical strategy

As recommended by the Cochrane Rapid Reviews Methods Group (Garritty et al., 2021), a narrative synthesis was initially planned as the analytical strategy. The steps from the three-stage thematic synthesis analysis (Thomas & Harden, 2008) were implemented. In the first stage, one reviewer inductively coded the results section of each article line-by-line, generating codes as they went. The data was then reviewed for consistency and appropriateness (Thomas & Harden, 2008). The agreed codes were reviewed for similarities and differences and grouped into descriptive themes, which were then reviewed again by the research team. Finally, the descriptive themes were used to address research question 1-3.

Results

Following an analysis of the papers identified in this rapid review (see Table 1 below), we found that there are no current interventions for families to improve digital media literacy for the 0-5 age group. Therefore, the answer to the first research question, ‘What initiatives are currently available for families to improve digital media literacy for under 5s?’ is that these initiatives do not exist. The subsequent two research questions, querying what evidence exists on the effectiveness of different initiatives, therefore cannot be answered.

Table 1: Articles included in the rapid review, their methodology and their findings

Article	Methodology	Research aim(s)	Key findings
Cao and Li (2023)	Scoping review	Explore and evaluate the existing literature on young children's digital use and their associated well-being.	• Family-based early interventions can reduce screen time. • Both child factors and parent factors contribute to young children's digital well-being. • There is no consensus regarding the definition of, or measurement tools for, digital well-being.
Fitzpatrick et al. (2023)	Narrative review	To provide a more nuanced portrait of the potential benefits and harms of screen use by examining the consequences of media use according to the content of media, context and nature of child screen use.	• Supports continuing to limit screen media for children under the age of two. • Encourages parents to establish a family media plan and to co-view and supervise older preschoolers' screen use activities. • Harm-reduction perspective supports selecting screen use activities carefully based on children's own characteristics, features of content, nature of use and context of use.
Heller (2021)	Systematic review	To suggest adaptations to the AAP[1] guidelines for infant media engagement using a harm reduction framework.	• Most families with infants are not following AAP guidelines for infant media use. • A solution may be to acknowledge infant screen media use, and help families make decisions informed by known benefits and avoid clear risks. • Providers should encourage developing a 'family media plan' for young children and parental engagement in media use with their children.
Article	**Methodology**	**Research aim(s)**	**Key findings**

[1] American Association of Pediatrics

Neumann (2014)	Education-relating testing of 109 children aged 3-5 years old and parental questionnaire	To study the relationship between child home tablet access, use and emergent literacy skills, as well as parents' views regarding tablet use, access and effects.	• Children's access to tablets at home was positively associated with letter sound knowledge and name writing skills. • Time spent on tablets at home was not related to any emergent literacy skills. • Children mainly used gaming apps and literacy apps on their tablets at home. • The majority of parents were in favour of their child using tablets to support early literacy learning.
Stamatios et al. (2021)	Questionnaire of 325 preschool-aged children and their parents	To study children's smart mobile use at home, such as frequency of mobile device usage, preferred app types, and parents' beliefs and strategies	• Poorer[2] parents had more negative attitudes to children's digital technology use than wealthier parents. • Parents who had positive views of digital technology do not only download apps for their children more often than other parents, but they also try to buy apps instead of using only free apps. • Parents mentioned a lack of scientific literature as a barrier to them finding the best educational apps in the digital app stores.

[2] This is the terminology used in the literature

The analysis proceeded by coding the five papers inductively. Codes were developed such as ‘interventions’, ‘factors affecting screen time/digital well-being’, ‘recommendations for parents’, and ‘positive impacts of digital media’. The analysis found that where interventions have been developed, they have focused on reducing screen time or problematic usage and improving well-being by adopting a harm-reduction approach. Other interventions focused on improving parents’ ability to scaffold children’s media usage and negotiate the digital environment themselves. Despite the dearth of research on interventions around supporting children’s digital media literacy, the following section will detail the messages that arise from existing literature which was coded as part of this review.

Interventions developed to reduce screen time, reduce harm or increase wellbeing

Cao and Li’s (2023) scoping review outlines two types of interventions developed to reduce screen time and problematic usage of digital media among young children. Firstly, the review describes more than 300 digital applications that have been designed to “*prevent or correct attention deficit and hyperactivity disorder*” (p.10). Secondly, Cao and Li consider the early interventions for young children that aim to reduce screen time, citing that:

> “*Schmidt systematically reviewed intervention strategies and identified four school-based and two family-based early education interventions for young children [in the United States]*” (Schmidt et al., 2012 in Cao & Li, 2023, p.10).

Indeed, one of the family-based interventions reduced the screen time of young children (4-7 years old) by 17.5h per week (Schmidt et al., 2012 in Cao & Li, 2023). However, most of these interventions were conducted in Western countries and were specifically targeted at reducing screen time only, especially TV viewing time (Cao & Li, 2023). In another systematic review, Jones et al. (2021) analysed 46 intervention studies for reducing under 5s screen time, and their meta-analysis found that these interventions were not as effective as they expected. Although in their narrative

review, Fitzpatrick et al. (2023) do not review any interventions they do make suggestions for harm reduction early interventions. Specifically:

> "*Interventions that begin in early childhood are likely to be most effective for helping children develop and sustain balanced media habits*" (Fitzpatrick et al., 2023, p.10).

Relatedly, Fitzpatrick et al. suggest that education and health practitioners could adopt a harm-reduction approach to develop interventions and that interventions could also target parents' own screen use.

How digital media can be used to assist education

The papers included in this rapid review also considered how digital media could be used to assist with young children's education, such as supporting the development of numeracy and literacy. Neumann's (2014) research explored the types of apps used by children aged 3-5 on tablets at home and found that, although gaming apps were the most popular (used by 75% of children) other popular apps included literacy apps (55%), creating apps (49%), maths apps (37%), e-book apps (27%) and other educational apps (24%). Stamatios et al.'s (2021) research also reported that most children play educational games on a smart mobile device daily or most days during the week. Despite how many children used educational apps Neumann found a lack of association between time spent on tablets and emergent literacy, suggesting that:

> "*The quality of tablet experiences involving type of app and scaffolding may be factors influencing early learning*" (2014, p.119).

Other research, identified in Heller's (2021) systematic review, described some positive educational impacts of digital use from sign language learning to literacy. Heller also suggested that the use of video chat technologies (e.g., Skype and

Facetime) can facilitate language learning in young children (Roseberry et al., 2014). Moreover, Fitzpatrick et al. (2023) cite Anderson et al.'s (2001) research which suggested that exposure to media content that is age-appropriate and educational has been linked to improved cognitive outcomes in preschool-aged children. Finally, in Stamatios et al.'s (2021) research, although the majority of children under 5 did not download their own applications, some children were choosing and downloading apps independently:

> *"It is not expected that children can choose digital devices and apps with appropriate educational content. Research recognizes that parents play a critical role in children's technology introductory activities"* (p. 2743).

Recommendations for parents

The papers identified in this rapid review all highlighted the importance of parental guidance and input in ensuring young children engage with digital media effectively and avoid harm. Further many of the papers make recommendations as to how parents can be supported in this process. For example, Cao and Li (2023) state that:

> "*parental guidance and support can result in cognitive or social-emotional benefits and self-regulation in children's digital engagement*" (p. 9).

Therefore, by encouraging active discussion and supporting early digital use, parents can build children's skills and agency. Heller (2021) also recommended that parents co-view media content with their children and 'scaffold' the experience by "*talking about what infants are seeing and pointing out important features*" (p. 4). Both Heller (2021) and Fitzpatrick et al. (2023) suggest that parents adopt a family media plan and believe that the implementation of such plans should be encouraged by professionals in education and healthcare. However, Stamatios et al.'s (2021) research describes how while parents are willing to find the best educational apps in

digital app stores, they report lacking the necessary scientific literacy required to do so. Therefore, Stamatios et al. recommend providing parents with support services and strategies for coping with digital media usage, and that educational organisations, stakeholders and researchers should recommend or provide age-appropriate and developmentally appropriate content.

Factors influencing screen time and digital well-being

The papers included in the review identified a number of factors that influence screen time and digital-wellbeing including demographics of the child and family, parents' digital usage and perceptions of technology, and children's general disposition. A range of demographics associated with the child and family were identified (e.g. age, ethnic background, socioeconomic status, siblings). The research suggests that as daily digital screen use increased with age between 2-5 (Przybylski & Weinstein, 2017), boys may be more vulnerable to the negative effects of screen use on behaviour and language skills (Fitzpatrick et al., 2023; Gentile et al., 2017; Liu et al., 2021; MacGowan & Schmidt, 2021; Pagnani et al., 2023) and with American samples, Hispanic and Black children typically spent more time with screens (Fitzpatrick et al., 2023; Hish et al., 2020; Rideout & Robb, 2020). Family socioeconomic status was also found to be a significant predictor of young children's digital use (Cao & Li, 2023), and children's usage of entertainment media was higher in low-income families while digital proficiency was simultaneously lower in low-income families (Nikken & Opree, 2018). Children from lower-income families also have higher levels of screen time and may be more vulnerable to the negative impacts of screens on cognitive development (Nikken & Opree, 2018). Heller's (2021) systematic review also supports these findings. There is also evidence that the number of siblings plays a role in the effectiveness of parents' mediation strategies and therefore young children's digital well-being (Stamatios et al., 2021).

Another key finding across the papers was the impact of parents' own digital use and their perceptions of technology. For example, parents' digital technology use, especially if problematic, may predict children's screen time and psychosocial

difficulties (Cao & Li, 2023; Li et al., 2022; Wong et al., 2020). Both Heller (2021) and Fitzpatrick et al. (2023) also noted that parents' own screen time appears to be a consistent predictor of children's screen time and media use habits in the under 5s. Moreover, parents' perception and mediation of early digital use is another factor. For example, Cao and Li (2023) argue that parents with a negative view of young children's digital usage tend to employ restrictive strategies while parents who perceive early digital usage positively tend to mediate digital usage by actively talking or co-viewing content, resulting in cognitive or social-emotional benefits and better self-regulation by young children. In essence, the more positive the parents' perception, mediation and extent of co-viewing, the more positive the digital well-being of the young child (Cao & Li, 2023; Heller, 2021; Stamatios et al., 2021). Finally, children's general dispositions towards pleasure-seeking behaviour and proneness to negative emotions such as anger and frustration have also been found to be associated with child media use habits (McArthur et al., 2022a; 2022b).

Discussion

Summary of rapid review findings

This rapid review found no current interventions to improve the digital media literacy of the 0-5 age group in the literature that was reviewed. As a result, the review could not consider the effectiveness of any interventions.

From the papers included in the rapid review, there appear to be two different approaches to understanding digital media use by young children. Some research explores digital media use and the correlates of screen time through the lens of reducing harm or improving well-being. Other research has explored how digital media can be used to improve young children's education, in terms of literacy, numeracy, and language learning.

At present, however, based on the papers included in this rapid review there is no discussion of how children under 5 can be supported by family members to develop digital media literacy through targeted interventions. Only two of the papers in this review touch very briefly on notions of agency and critical engagement with digital media. For example, Stamatios et al. (2021) suggested that while some children were choosing and downloading apps independently children cannot be expected to choose digital devices and apps with appropriate educational content. Cao and Li (2023) suggest that parents' encouragement of active discussion and support for early digital use could play a role in improving children's agency, but do not develop this notion any further.

Possible explanations for the lack of relevant literature in the rapid review

The rapid review identified no articles in the included literature that described interventions for families to improve the digital literacy of 0 to 5-year-olds. While the finding may be an accurate reflection of the lack of academic research developing such interventions, it is possible that the nature of the rapid review meant that we failed to identify key literature because of the potential bias associated with rapid reviews due to their compressed time frames (Ganann et al., 2010; Grant & Booth, 2009).

Despite trying to mitigate against this possible bias by agreeing the original search term with key stakeholders as recommended by Garritty et al.(2021) and King et al. (2017), there are two reasons why we may have failed to identify all of the key literature:

(1) disciplinary variations in the terms used to describe digital media literacy which were not reflected in the original search term and

(2) the narrow focus of the literature search meant that relevant policy/government documents were not included.

Discipline variations in terminology

In consultation with the advisory group, we recognise that there is likely variation in how the concepts encapsulated in the term digital media literacy are described across disciplines, especially when considering the interaction between children and their parents.

To explore this further, common keywords used in over 250 randomly selected articles from those included in the first stage of the rapid review were identified. These were supplemented with recommendations from the advisory group.

Having identified these alternate keywords, each was integrated into the original search term in turn and replaced the term ““digital literacy” OR “digital media literacy” OR “media literacy””. For example:

(family AND improve AND intervention AND “AI based technology”) AND (“infant” OR “toddler” OR “early years” OR “preschool*” OR ("young child" OR "young childhood" OR "young children") OR “pre-k*”)

The number of articles returned via ProQuest using each alternate keyword was then recorded. These ranged from 1-7204. Including the phrase parenting practices within the search term yielded the most articles, but it is important to acknowledge that this is a very general term. Typically the number of articles returned was below the number included in the rapid review (see Appendix A).

Therefore, it would seem that the rapid review potentially captured the relevant academic literature.

It was beyond the scope of this project to analyse all of the results obtained through these alternate searches. Further research would be required to determine if or how relevant they may be to this project's research questions. Additionally, the discipline variations found suggest a highly fragmented and possibly siloed approach to young children’s media literacy which warrants further research.

Narrow focus of the literature

The advisory group suggested that another explanation for the lack of relevant literature identified in the rapid review could be because relevant government publications, policy documents, practice reports, and grey literature were not captured.

The advisory group identified a number of publicly available reports and other publications. (see Appendix B). These supplementary publications were reviewed in line with the research questions.

Although young children were mentioned in several of the publications, consistent with the results of the rapid review there appears to be a lack of interventions to support digital media literacy in this age group. Where interventions were reported, these tended to focus on older ages or lacked comprehensive evaluations of their impact.

The digital media literacy frameworks reviewed did not include skill development of very young children, with none targeting children under three.

Therefore, although the rapid review was narrow in its focus, the brief exploration of relevant government, policy and grey literature reinforced the finding of the rapid review that there appear to be no interventions targeting digital media literacy in the under 5s. Further, it also appears that the development of digital media literacy of very young children is not reflected in UK digital skills and media literacy frameworks - which warrants further research.

Summary

In sum, based on the literature reviewed as part of this rapid review, it appears that there are no current interventions designed to support families in developing the digital media literacy of children aged 0 to 5.

While this finding may accurately reflect the academic literature, it is important to acknowledge that there could be disciplinary differences in how digital media literacy is labelled in the literature and due to the compressed nature of a rapid review, it is possible that relevant sources were not identified.

However, supplementary publications identified by the advisory group did not surface many relevant interventions and they focussed on older ages or lacked evidence.

In addition, a limited review of relevant government and policy documents and grey literature highlighted that the digital media literacy skills of under 3s are not captured in current UK frameworks and current definitions of media literacy may not be relevant for 0-5s.

In conclusion, the increased exposure of under 5s to digital technologies means there is a need for them to develop digital media literacy. Given the apparent lack of targeted interventions in this area, further, cross-disciplinary, research that involves key stakeholders is needed to both develop and evaluate effective interventions.

References

Anderson, D. R., Huston, A. C., Schmitt, K. L., Linebarger, D. L., Wright, J. C., & Larson, R. (2001). Early childhood television viewing and adolescent behavior: The recontact study. *Monographs of the Society for Research in Child Development*, 66(1), pp.i–154.

Cao, S. & Li, H. (2023). A Scoping Review of Digital Well-Being in Early Childhood: Definitions, Measurements, Contributions and Interventions. *International Journal of Environmental Research and Public Health*, 20(4), p.3510. doi: https://doi.org/10.3390/ijerph20043510.

Chaudron, S. (2015). Young children (0-8) and digital technology. EUR27052.

Chaudron, S., Di Gioia, R., & Gemo, M. (2018). Young children (0-8) and digital technology: A qualitative study across Europe, EUR 29070, doi: 10.2760/294383.

Childnet (2016). Digiduck's big decision: Four years on. https://www.childnet.com/blog/digiducks-big-decision-four-years-on/

Childnet (undated). Get SMART. https://www.childnet.com/young-people/4-11-year-olds/get-smart/

Danby, S. J., Fleer, M., Davidson, C., & Hatzigianni, M. (2018). In S. J. Danby, M. Fleer, C. Davidson, & M. Hatzigianni, (Eds) *Digital childhoods: Technologies and children's everyday lives*. (pp. 1-14). Springer Nature: Singapore.

Department for Education. (2023a). Early years foundation stage statutory framework for childminders. https://assets.publishing.service.gov.uk/media/65aa5e29ed27ca001327b2c6/EYFS_statutory_framework_for_childminders.pdf

Department for Education. (2023b). Early years foundation stage statutory framework for group and school-based providers. https://assets.publishing.service.gov.uk/media/65aa5e42ed27ca001327b2c7/EYFS_statutory_framework_for_group_and_school_based_providers.pdf

Dias, P., Brito, R., Ribbens, W., Daniela, L., Rubene, Z., Dreier, M., Gemo, M., Di Gioia, R., & Chaudron, S. (2016). The role of parents in the engagement of young children with digital technologies: Exploring tensions between rights of

access and protection, from ‘gatekeepers’ to ‘scaffolders’. *Global Studies of Childhood, 6*(4), pp.414-427. doi: https://doi.org/10.1177/2043610616676024.

Donoso, V. (2014). Young children (0-8) and digital technology: A qualitative exploratory study – National report – Belgium.

European Commission (2022). *Europe’s Digital Decade: digital targets for 2030*. [online] commission.europa.eu. Available at: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en.

Fitzpatrick, C., Binet, M.-A., Cristini, E., Maira Almeida Lopes, Bégin, M.E. and Giana Bitencourt Frizzo (2023). Reducing harm and promoting positive media use strategies: new perspectives in understanding the impact of preschooler media use on health and development. *Psicologia-reflexao E Critica*, 36(1). doi: https://doi.org/10.1186/s41155-023-00262-2

Ganann, R., Ciliska, D., & Thomas, H. (2010). Expediting systematic reviews: methods and implications of rapid reviews. *Implementation Science*, *5*, pp.1-10. Doi: https://doi.org/10.1186/1748-5908-5-56.

Garritty, C., Gartlehner, G., Nussbaumer-Streit, B., King, V. J., Hamel, C., Kamel, C., ... & Stevens, A. (2021). Cochrane Rapid Reviews Methods Group offers evidence-informed guidance to conduct rapid reviews. *Journal of clinical epidemiology*, *130*, pp.13-22. Doi: 10.1016/j.jclinepi.2020.10.007.

Gentile, D. A., Berch, O. N., Choo, H., Khoo, A., & Walsh, D. A. (2017). Bedroom media: One risk factor for development. *Developmental Psychology*, 53(12), p.2340.

Gillen, J., Matsumoto, M., Aliagas, C., Bar-lev, Y., Clark, A., Flewitt, R., Jorge, A., Kumpulainen, K., Morgada, M., Pacheco, R., Poveda, D., Sandberg, H., Sairanen, H., Scott, F., Sjöberg, U., Sundin, E., Tigane, I., Tomé, V. (2018). A day in the digital lives of children aged 0-3 full report.

Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, *26*(2), pp.91-108. Doi: 10.1111/j.1471-1842.2009.00848.x.

Haddon, L., & Vincent, J. (2014). European children and their carers' understanding of use, risks and safety issues relating to convergent mobile media. Report D4.1. Milano: Unicatt.

Hall, C., & Jones, S. (2016). Making sense in the city: Dolly Parton, early reading and educational policy-making. *Literacy*, *50*(1), pp.40-48. Doi: https://doi.org/10.1111/lit.12069.

Heller, N.A. (2021). Infant media use: A harm reduction approach. *Infant Behaviour and Development*, 64, p.101610. DOI: https://doi.org/10.1016/j.infbeh.2021.101610.

Hish, A. J., Wood, C. T., Howard, J., Yin, S. H., Rothman, R. L., Sanders, L. M., & Perrin, E. M. (2020). Infants who watch television become toddlers who watch more television: screen time patterns in the Greenlight Study. *Paediatrics*, 146(1), pp.32–33. Doi: 10.1016/j.acap.2020.11.002.

Jones, A., Armstrong, B., Weaver, R.G., Parker, H., von Klinggraeff, L. and Beets, M.W. (2021). Identifying effective intervention strategies to reduce children's screen time: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 18(1). DOI: https://doi.org/10.1186/s12966-021-01189-6.

King, V. J., Garritty, C., Stevens, A., Nussbaumer-Streit, B., Hartling, L., Harrod, C. S., ... & Kamel, C. (2017). Performing rapid reviews. *Rapid reviews to strengthen health policy and systems: a practical guide*, pp.21-38.

Li, H., Luo, W. and He, H. (2022). Association of Parental Screen Addiction with Young Children's Screen Addiction: A Chain-Mediating Model. *International Journal of Environmental Research and Public Health*, 19(19), p.12788. DOI: https://doi.org/10.3390/ijerph191912788.

Liubinienė, V., & Kasperavičienė, R. (2019). *Young children (2-13) and digital technologies: A case study of Lithuania.*

Liu, W., Wu, X., Huang, K., Yan, S., Ma, L., Cao, H., Gan, H., & Tao, F. (2021). Early childhood screen time as a predictor of emotional and behavioral problems in children at 4 years: A birth cohort study in China. *Environmental Health and Preventive Medicine*, 26(1), p.3. DOI: 10.1186/s12199-020-00926-w.

Livingstone, S., Marsh, J., Plowman, L., Ottovordemgentschenfelde, S., & Fletcher-Wilson, B. (2014). Young children (0-8) and digital technology: A qualitative exploratory study – National report – UK.

Livingstone, S., Mascheroni, G., Dreier, M., Chaudron, S., & Lagae, K. (2015). *How parents of young children manage digital devices at home: The role of income, education and parental style.* London: EU Kids Online, LSE.

MacGowan, T. L., & Schmidt, L. A. (2021). Preschoolers' social cognitive development in the age of screen time ubiquity. Cyberpsychology, *Behavior and Social Networking*, 24(2), pp.141–144. DOI: https://doi.org/10.1089/cyber.2020.0093.

Mascheroni, G., Micheli, M., & Milesi, D. (2014). *Young children (0-8) and digital technology: A qualitative exploratory study* – National report – Italy.

Matusmoto, M., Aliagas, C., Morgade, M., Correro, C., Galera, N., Roncero, C., & Poveda, D. (2016). *Young children (0-8) and digital technology: A qualitative exploratory study* – National report – Spain.

McArthur, B. A., Volkova, V., Tomopoulos, S., & Madigan, S. (2022a). Global prevalence of meeting screen time guidelines among children 5 years and younger: A systematic review and meta-analysis. *JAMA Pediatrics*, 176(4), pp.373–383. DOI: https://doi.org/10.1001/jamapediatrics.2021.6386.

McArthur, B. A., Hentges, R., Christakis, D. A., McDonald, S., Tough, S., & Madigan, S. (2022b). Cumulative social risk and child screen use: The role of child temperament. *Journal of Pediatric Psychology* ,47(2), pp.171–179. Doi: 10.1093/jpepsy/jsab087.

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Qureshi, R., Mattis, P., Lisy, K., & Mu P-F. (2020). Systematic reviews of etiology and risk. In: E. Aromataris & Z. Munn (Eds). *JBI Manual for Evidence Synthesis [online].* Available at: https://synthesismanual.jbi.global.

Neumann, M.M. (2014). An examination of touch screen tablets and emergent literacy in Australian pre-school children. *Australian Journal of Education*, 58(2), pp.109–122. DOI: https://doi.org/10.1177/0004944114523368.

Nikken, P. (2017). Implications of low or high media use among parents for young children's media use. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 11(3). DOI: https://doi.org/10.5817/cp2017-3-1.

Nikken, P. and Opree, S.J. (2018). Guiding Young Children's Digital Media Use: SES-Differences in Mediation Concerns and Competence. *Journal of Child and Family Studies*, 27(6), pp.1844–1857. DOI: https://doi.org/10.1007/s10826-018-1018-3.

Ofcom (2024). *Children and parents: Media use and attitudes report* [online]. 8 May 2024. Available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0035/284867/Child-development-and-online-behaviour.pdf

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan — a web and mobile app for systematic reviews. *Systematic Reviews, 5,* p.210. Doi: https://doi.org/10.1186/s13643-016-0384-4

Park, S. (2012). Dimensions of digital media literacy and the relationship with social exclusion. *Media International Australia*, *142*(1), pp.87-100. Doi: https://doi.org/10.1177/1329878X1214200111

Prywes, D. (2024). *The Big-Little Family Influencers: How to harness the power of family co-viewing to effectively engage preschoolers* [online]. SuperAwesome. Available at: https://www.superawesome.com/blog/the-big-little-family-influencers-how-to-harness-the-power-of-family-co-viewing-toeffectively-engage-preschoolers/.

Przybylski, A.K. and Weinstein, N. (2017). Digital Screen Time Limits and Young Children's Psychological Well-Being: Evidence From a Population-Based Study. *Child Development*, 90(1). DOI: https://doi.org/10.1111/cdev.13007.

Rideout, V., & Robb, M. B. (2020). *The common sense census: Media use by kids age zero to eight*, 2020. Common Sense Media.

Roseberry, S., Hirsh-Pasek, K. and Golinkoff, R.M. (2014). Skype Me! Socially Contingent Interactions Help Toddlers Learn Language. *Child Development*, 85(3), pp.956–970. DOI: https://doi.org/10.1111/cdev.12166.

Sandberg, H., Gillen, J., Aliagas, C., Bar-lev, Y., Jorge, A., Kumpulainen, K., Marsh, J., Matsumoto, M., Morgade, M., Pachedo, R., Sairanen, H., Scott, F., Sjöberg, U., Sundin, E., Tigane, I., & Tomé, V. (2018). A day in the digital lives of children aged 0-3: Summary report by DigiLitEY ISCH COST Action IS1410

Working Group 1: "*Digital literacy in homes and communities"* COST European cooperation in science and technology.

Salley, B., Daniels, D., Walker, C., & Fleming, K. (2022). Shared book reading intervention for parents of infants and toddlers. *Journal of Early Childhood Research*, *20*(3), pp.322-340. Doi: 10.1177/1476718x221091462.

Schmidt, M.E., Haines, J., O'Brien, A., McDonald, J., Price, S., Sherry, B. and Taveras, E.M. (2012). Systematic Review of Effective Strategies for Reducing Screen Time Among Young Children. *Obesity*, 20(7), pp.1338–1354. DOI: https://doi.org/10.1038/oby.2011.348.

Schünemann, H. J., & Moja, L. (2015). Reviews: rapid! rapid! rapid!… and systematic. *Systematic Reviews*, *4*(1), pp.1-3. DOI: https://doi.org/10.1186/2046-4053-4-4

Stamatios, P., Foteini, A. and Nikolaos, Z. (2021). Mobile device use among preschool-aged children in Greece. *Education and Information Technologies*, 27(2). DOI: https://doi.org/10.1007/s10639-021-10718-6.

Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, *8*, 1-10. DOI: https://doi.org/10.1186/1471-2288-8-45

Varker, T., Forbes, D., Dell, L., Weston, A., Merlin, T., Hodson, S., & O'Donnell, M. (2015). Rapid evidence assessment: increasing the transparency of an emerging methodology. *Journal of Evaluation in Clinical Practice*, *21*(6), pp.1199-1204. DOI: 10.1111/jep.12405.

Velicu, A., & Mitarcă, M. (2016). Young children (0-8) and digital technology: A qualitative exploratory study – National report – Romania.

UKCCIS (2020) *Education for a Connected World – 2020 edition: A framework to equip children and young people for digital life*. [online] UK Council for Internet Safety. Available at: https://assets.publishing.service.gov.uk/media/5efa05b4e90e075c5492d58c/UKCIS_Education_for_a_Connected_World_.pdf.

Welsh Government (2019). *Digital Competence Framework - Hwb*. [online] hwb.gov.wales. Available at:

https://hwb.gov.wales/curriculum-for-wales/cross-curricular-skills-frameworks/digital-competence-framework.

Appendix A: Alternative keywords and the associated number of articles returned

Keyword integrated into the search term	Number of articles returned
AI based technology	6
AI education	16
Artificial intelligence	3118
Computational thinking education	21
Digital age	2823
Digital childhood	46
Digital competence	163
Digital environment	2206
Digital game-based learning	134
Digital generation gap	2004
Digital interventions	2447
Digital literacy of digital media	2785
Digital media	3145
Digital media literacy	27
Digital mediation	2010
Digital natives	308
Digital parenting	2068
Digital skills	315
Digital storytelling	253
Digital technology	1372
Digital tools	793
functional literacy	2218
ICT	2735
Media exposure	1141

Media literacy	483
Parental digital education	1999
Parental mediation	2147
Parenting digital natives	2000
Parenting in digital literacy	1999
Parenting practices	7204
Screen time	3057
Smart connected toys	1
Social media	345
Technoliteracy	5
Visual environments	26
Visual processing	1278

Appendix B: Supplementary publications

A 2024 Ofcom report summarising research on children's cognitive development and online behaviour states that children aged 3-5 "*take their first steps towards independent use of online devices*" (p.12). The report also states, referring to children under five, that "*young children have limited ability to make decisions and to critically evaluate information or intentions*" (Ofcom, 2024, p. 6).

The European Commission (2022) released concrete targets for 2030 as part of their 'Digital Decade Decision' to "*ensure that people and society at large are given appropriate digital skills to fully benefit from*" (p.24). The policy, however, only considers people aged 16-74 and does not include children. Other work commissioned by the European Union has tended to focus on:

(a) children's experiences of mobile media and the associated risks and safety issues (e.g., Haddon & Vincent, 2014),
(b) how parents of young children manage digital devices at home (e.g., Livingstone et al., 2015), and
(c) how children aged 0-8 years old engage with technology, how parents mediate technology use, and the potential benefits and risks associated with technology use (Chaudron, 2015).

The 'A Day in the Digital Lives of Children Aged 0-3' project focused on how young children engaged with digital technology, how parents mediated young children's use of digital technology, and parents' perceptions and attitudes towards current and potential technologies used by children (Gillen et al., 2018).

A search of Ofcom's media literacy initiative library[3] was untaken for initiatives with 'families with children' as the audience: 23 initiatives were identified. Several of these initiatives have specific target age groups beyond the early years (e.g., Build

[3] https://www.ofcom.org.uk/media-use-and-attitudes/media-literacy/research-library/

and Talk[4]; Cyber Sprinters[5]; Zero's Quest[6]), others targeted secondary school age (e.g., CyberChoices[7]; My Data and Privacy Online Toolkit[8]) whereas others did not specify a specific target age (e.g., Find the Fake[9]). However, some of the initiatives although targeting a wider age range did include the early years (e.g., Digiduck[10]; Get SMART[11]).

Childnet published an illustrated storybook 'Digiduck's Big Decision' in 2012 to help parents and teachers educate children aged 3-7 years about how to be a good friend online. Initial findings of an evaluation suggested that the story book was well received by educational professionals (Childnet, 2016). For example, one learning coordinator for a county council described that the resource was accessible, the messaging clear and that there was great room for engagement (Childnet 2016). Teachers also highlighted some of the key skills pupils learned, including: "how to be safe online and be a good friend", "to online send appropriate photos and emails" and "about responsible behaviour" (Childnet 2016).

Get SMART provides 4-11s with tips on how to use the internet "safely and positively" (Childnet, undated).

The closest government strategies related to children's digital media literacy are the Digital Competence Framework developed by the Welsh Government in 2018 and the Education for a Connected World Framework developed by the UK Council for Internet Safety in 2020.

The Digital Competence Framework was developed to be inclusive of children aged 3 to 16-plus and includes the development of skills from the earliest stages (Welsh Government, 2019). The framework outlines four broad sections:

[4] Build and talk - Sustainability - LEGO.com
[5] CyberSprinters - NCSC.GOV.UK
[6] Zero's Quest - LEGO.com for kids
[7] Cyber Choices - National Crime Agency
[8] My privacy (lse.ac.uk)
[9] Find the fake quiz - Internet Matters
[10] Digiduck Stories | Childnet
[11] Get SMART | Childnet

‘citizenship’, ‘interacting and collaborating’, ‘producing’, ‘data and computational thinking’, with sub-sections (e.g. ‘identity, image and reputation’) with a series of progression steps for each (e.g. the first being “*I can distinguish between someone I know and someone I have never met*”) (Welsh Government, 2019).

The Education for a Connected World Framework considers different aspects of online education and how children develop competence in these areas over time. The framework describes how as children grow older, “*it is crucial that they learn to balance the benefits offered by technology with a critical awareness of their own and other’s online behaviour and develop effective strategies for staying safe and making a positive contribution online*.” (UKCCIS, 2020, p.2). The competency-based framework suggests age-appropriate competencies ranging from low to high split by age and topic. The age groups are 4-7, 7-11, 11-14, and 14-18. The eight topics are self-image and identity, online relationships, online reputation, online bullying, managing online information, health, well-being and lifestyle, privacy and security, and finally, copyright and ownership. For example, for online reputation in the 4–7-year-old age group, a low competency stage is: “I can identify ways that I can put information on the internet”, and a high competency stage is: “I can explain how information put online about someone can last for a long time” (UKCIS, 2020, p.16).

ProjectEVOLVE[12], developed by SWGfL, is a toolkit of over 600 resources based on the Education for a Connected World Framework.

The Early Years Foundational Stage statutory framework, initially published in 2014, includes one framework document published for childminders (Department for Education, 2023a) and another for group and school-based providers (Department for Education, 2023b) includes information on the early years curriculum. Although these frameworks do not make reference to digital media literacy, the frameworks do include descriptors around understanding and comprehension.

[12] About ProjectEVOLVE online tool | ProjectEVOLVE

Feedback from the advisory group also suggested considering other international contexts, particularly Finland where media literacy is part of the educational curriculum from preschool age, and Sweden where research on young children's digital media use and social and cognitive effects of such use is currently being undertaken at Linköping University. The advisory group highlighted the work of Peter Nikken (2017) in the Netherlands on children's digital media use and media literacy.

It is likely that the reason much of this research was not included in our review is because of the breadth of terminology discussed earlier in this section.

Finally, it was also noted an understanding of young children's digital media literacy could be gained through the lens of the advertising industry and how joint media engagement can impact sales (Prywes, 2024).