
The Online and Offline Digital Literacy Practices of Young Children

A Review of the Literature



Jackie Marsh, Giovanna Mascheroni, Victoria Carrington, Hólfríður Árnadóttir, Rita Brito, Patricia Dias, Reijo Kupiainen and Christine Trueltzsch-Wijnen

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Introduction

There is now a range of evidence that indicates that young children (aged from birth to eight) are using the internet from an early stage of life (Bedford et al., 2016; Chaudron et al., 2015; Korkeamäki, Dreher, and Pekkarinen, 2012; Lauricella, Wartella & Rideout, 2015; Marsh et al., 2015; Thestrup, 2015). This use leads to a range of activities that engage children in online practices, but it is also the case that the online domain cannot be separated from the offline domain in these experiences (Burke and Marsh, 2014). Children are physically located in the material world as they navigate the internet, and they also engage in practices that move seamlessly across online and offline spaces, such as playing with toys that are connected to the internet (Marsh, in press). In these hybrid spaces, new kinds of practices are possible.

In this review of literature, the online and offline domains as they pertain to young children's digital literacy practices are considered both separately and in relation to each other. What is offered is a narrative review of the literature in this area, which offers a critical review of studies conducted to date and identifies the areas in which there is an urgent need for further research.

The Online Digital Literacy Practices of 0-8 Year-Olds

2.1 Access and Use

2.1.1 Access to Devices

Nowadays, many young children are being born in homes filled with a panoply of digital devices, and come into contact with them from an early age. They can be characterised as 'digitods' (Leathers et al., 2013; Holloway et al., 2015), that is, they were born after the launch of smartphones in the market (2007), and their parents are usually experienced digital users themselves. Technologies are integrated in their family's daily routines, and parents tend to be comfortable with allowing occasional use of their devices such as smartphones, laptops and tablets, but children tend to have freer access to their own personal devices, usually tablets and consoles (Findahl, 2013; Genc, 2014; Plowman, McPake & Stephen, 2008). Digital devices have, therefore, become part of the daily routines of young children (Kucirkova, 2011). It is important to note, however, that not all children have access to a range of devices, and that issues of difference, diversity and equity need to be addressed when reviewing the technological landscape of contemporary childhoods.

Many children in the Global North do have extensive access to technologies, however. Lauricella, Wartella & Rideout (2015) have recently surveyed 2326 US

families with children under 8 years old and concluded that 99% had at least one TV set in the home, 86% had a computer, 69% had a smartphone and 40% a tablet. A further study by Kabali et al. (2015), conducted with 350 US families with children aged between 6 months and 4 years old (focusing particularly on families with lower income) reports that there was a TV set in every home, 83% of the families owned a tablet, 77% a smartphone, 58% a computer, 56% a console, and 59% internet access. As age increased, children were more likely to have access to mobile devices such as smartphones and tablets and were more likely to own their personal devices, and the time spent using them increased. In fact, 75% of the 4 years old children already owned at least one personal device, and 50% had their own TV in their bedroom.

The tablet is particularly popular among children under 8 years old, as they prefer touchscreen devices because they are relatively intuitive and easy to use autonomously much of the time, although this depends upon the appropriateness of the software used (Merchant, 2015). They also enjoy their relatively small size and portability, and their interactive nature (OFCOM, 2012). A recent report by OFCOM (2016) corroborates that the use of the tablet is increasing rapidly among UK children aged between 5 and 7 years old, having increased from 11% in 2012 to 67% in 2015. The research on younger children by Kabali et al. (2015) in the US points to the tablet as the absolute favourite device. In this study, only 3% of the children had never used a tablet, while 77% of the children aged up to 2 years old use a mobile device daily to play, watch videos and other activities. In addition, it was common in this study for children under 5 years old to own their personal tablets (25%) and they used it

without any supervision or help from the parents in most occasions (although it was not clear if the devices were bought specifically for the children or handed-down from older siblings or the parents themselves). This pattern of growing ownership of tablets can also be seen in the EU. In Marsh et al.'s (2015) study of tablet use in 2000 families in the UK, approximately a third of children who had access to tablets in the home owned their own device.

Mobile devices are becoming increasingly popular for going online, rather than children using a desktop PC, laptop or netbook to do so. In 2016, 21% of under 8s in the UK used only an alternative device such as smartphone or tablets to go online, up from 15% in 2015 (OFCOM, 2016).



2.1.2 Time spent using technology

It is becoming increasingly difficult to report on time usage in relation to single devices, given the convergence of media. For example, many children now watch television and/ or play games on a tablet rather than a console. Marsh et al. (2015) reported that children in the UK spent on average 1 hour and 21 minutes a day using tablets, which included some television and game use in many cases. In addition, the practices in the use of technology are now less continuous and more interstitial. This relates to, for example, the difference between watching a movie on television and watching short videoclips on *YouTube*. This also contributes to making measures of time more problematic.

Nevertheless, global reports of time spent online indicates that this area is changing for children aged under eight. Parents of 3-4 year-olds in the UK, for example, report that in 2016, their children spent 8 hours 18 minutes online versus 6 hours and 48 minutes in 2015 (OFCOM, 2016). They still spent more time watching television than being online, but online use is growing.

2.1.3 Access to the internet

It is important to note that there is a lack of data on the extent to which children aged from birth to eight across Europe access the internet. As Holloway, Green and Livingstone (2013: 11) suggest, the 'rise in internet uptake by children aged between

0 and 8 is not uniform. Considerable differences exist between EU countries as well as within these countries, so it is not always possible to generalise across countries’.

Eurostat¹ reported that in 2015, % of all households in the EU-28 had access to the internet, and that households with dependent children were more likely to have internet access than those without children. There is variation across countries, with Luxembourg, Netherlands, Denmark, Sweden, UK, Germany and Finland reporting 9 out of 10 households with internet access, whilst Bulgaria identifying 59% of households accessing the internet in 2015. Even in countries with similar levels of high access to the internet, young children’s use differs. For example, Sweden² reported 67% of its two year olds accessing the internet in 2015; in 2016, 53% of 3-7 year olds in the UK accessed the internet (OFCOM, 2016).



¹ <http://ec.europa.eu/eurostat/statistics->

² <http://www.soi2015.se>

2.2 Online Activities

In relation to what children are doing online, there is a range of evidence which indicates that the most common online activities for under 8s are watching films and videos (including television programmes), playing games and listening to music (Chaudron et al., 2015; Marsh et al., 2015; OFCOM, 2016).

There are gender differences in relation to young children's online practices. Chaudron et al. (2015) found differences in children under 8 concerning the choice of apps. These tend to reflect their preferred fictional universes and play, with boys enjoying games about sports and super-heroes and girls having fun dressing dolls, doing make-up and playing games with princesses and pets. This was a pattern also identified in the UK study of under 5's use of tablets (Marsh et al., 2015). These studies of the types of online and app practices engaged in by young children opens the door to questions of gender in relation to app development and marketing, as well as the importance of extending the more established area of gendered family practices to a specific focus on the role of technologies and access to the internet.

Online practices relate to offline practices, particularly with regard to digital play. Fleer (2014) studied the digital play of young children and introduced the concept of 'flickering' to describe their practices. As children use the tablet mostly alone and independently, thus being able to choose freely what to do, Fleer (2014) found that they prefer entertainment activities, mostly games, and these are often related to



cartoon characters and toys. Also, she suggested that children do not focus on one activity for a long period of time, they tend to alternate short periods of engagement between different digital games and also between imaginary worlds in which they are immersed within their physical surroundings.

Marsh et al. (2015) report that, in a study of under 5's use of tablets, online activity was integrated with offline activity in a number of ways. For example, children were engaged with the 'Internet of Toys', toys that are connected to the internet and enable children to connect with others, they played online games that related to offline interests and they incorporated tablet play into traditional offline play, such as making dens.

2.3 Use of YouTube

Traditionally, television is the most attractive communication medium for children aged under eight, and assumes a pivotal role in the family dynamics in the home. Whether in common spaces such as the living room (which is more common for younger children), or for individual consumption in the bedroom (which is more common for older children), the TV tends to be a key source of entertainment and the communication medium they report they would miss the most if it was taken away (OFCOM, 2016:4).

However, the TV is gradually becoming dethroned as the favourite medium as children are increasingly preferring more interactive activities on digital devices, such as playing games, and even watching the same type of content but on portable digital devices. Digital devices are considered by some children as more attractive than TV, and they refer the variety and availability of content on demand, as well as the portability and easiness to use. These are the conclusions of a report presented by Childwise (2016), resulting from an annual survey about the use of digital devices by 2000 children aged 5-16 in the United Kingdom. The report suggests that the multiplicity of screens in contemporary homes significantly increases the average time children spend in front of screens, and more time is dedicated to interacting with smartphones, tablets, computers and consoles as a combined set of practices, than to watching television. Childwise (2016) anticipates that the average time spent daily watching TV will significantly decrease in the next years and that the TV set will lose its importance, as happened with DVD and CD players, for instance. The authors of

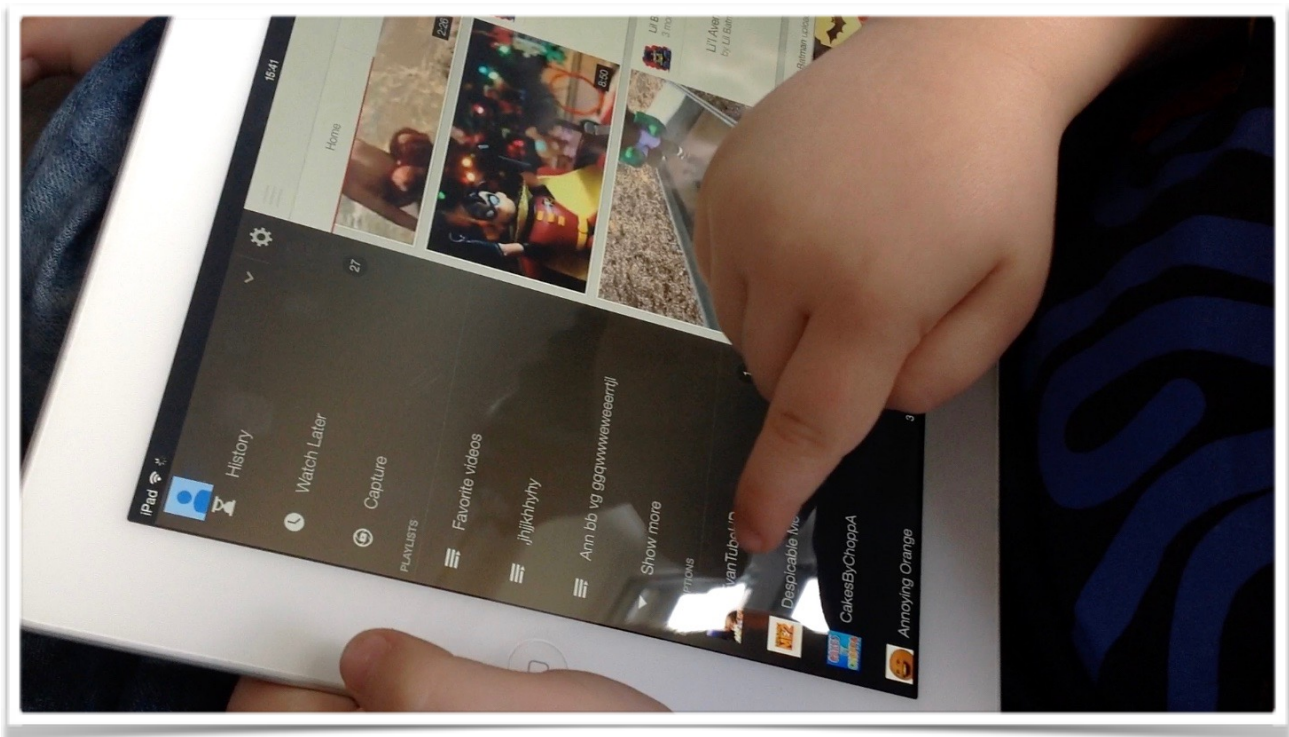
the report consider this change a consequence of the increase of mobile digital devices and Wi-Fi connections in the home, enabling children to choose when and where to watch their favourite content, and also to choose whether to interact with the content or with others. This preference increases as the age increases, as children become more active online and develop skills which support more complex and diversified uses.

When young children go online, their favourite 'destination' is YouTube, mostly for watching short videos, but also watching movies and listening to music (Chaudron et al., 2015; Luscombe, 2015; Marsh et al., 2015). YouTube and Netflix are the most popular alternatives to the TV set for young children. OFCOM (2016) reports that 37% of 3-4s and 54% of 5-7s in the UK access YouTube, and according to Childwise (2016), 50% of children between 5 and 16 years old in the UK visit YouTube everyday. A report from the company Smarty Pants (Luscombe, 2015) suggested that 72% of children aged from 6 to 8 years old visit YouTube daily.

The Childwise report indicates that children's favourite content is music videos (58%), but children also watch 'funny content' (50%), and also videos about games, vlogs, videos related to TV shows, and 'how to' videos (about 33%). Children's tastes on YouTube change with age. Parents of under 8s are, according to OFCOM, more likely to state that their child enjoys watching TV programmes, films, animations and/ or songs on YouTube, whilst older children prefer music videos, funny videos or videos made by vloggers. In other studies of under 8s (Chaudron et al., 2015; Marsh et al., 2015), young children enjoyed popular music videos, gaming videos and funny videos

that their older siblings often watched, viewed alongside content aimed at them, such as nursery rhyme animations and short cartoons.

Production of content on YouTube for children, by children, is also increasing. Niemeyer and Gerber (2015) report on 7 year-old children who have their own YouTube channel. The production of videos about games is very popular, for instance, about how to make changes in 'Minecraft', how to play collaboratively, or how to solve problems connected to avatars. In addition, children are increasingly seeking peer-produced content online. Marsh (2016) reports on the phenomenon of 'unboxing', which involves people unwrapping objects on screen, and outlines how popular these videos are with young children. OFCOM (2016) reported that 27% of UK children aged 3-7 enjoy watching unboxing videos.



On YouTube, young children, some of whom cannot read or write independently, develop complex strategies for doing searches by memorising letters and shapes, as they are keen to access the content they want (Chaudron et al., 2015). Hourcade et al. (2015) studied children aged from 12 to 17 months watching videos on YouTube and found that 50% of the children showed moderate use competencies, which increased to 90% of the sample for 2 year-old children.

Whilst YouTube introduced YouTube Kids in 2015, aimed at the demographic this report is concerned with, there is little evidence as yet that many young children are using that app rather than YouTube. It remains to be seen if its popularity will grow, or whether children prefer to use a site that enables them to watch videos enjoyed by their older siblings and family members.

2.4 Use of Online Games

The OFCOM (2016) report indicates that in the UK, 24% of 3-4 year-olds and 34% of 5-7 year-olds play online games. Game-playing was also a consistent feature of online use by children in the countries involved in Chaudron et al.'s (2015) study. Marsh et al.'s study (2015) indicated that the types of online games played by under 5s include basic strategy (e.g. Angry Birds), nurture and mimics (e.g. Talking Tom), educational games (e.g. shape matching), style creation (e.g. Stardoll), escape and obstacles (e.g. Temple Run and sports games (e.g. FIFA). There were gender

differences, with girls being more likely than boys to use style creation and nurture and mimic games, whilst boys are more likely to play obstacle games and sports games.

Although the increasing availability of Wi-Fi in the homes favours the use of online games, young children face some barriers in relation to engaging in such activities, mostly those whose native language is not English, given the relative lack of games in other languages (Chaudron et al., 2015). In addition, parents perceive contact with others as one of the main sources of online risk, and tend to monitor young children in order to prevent their engagement in online games with others. This is discussed further in Section 4.2.

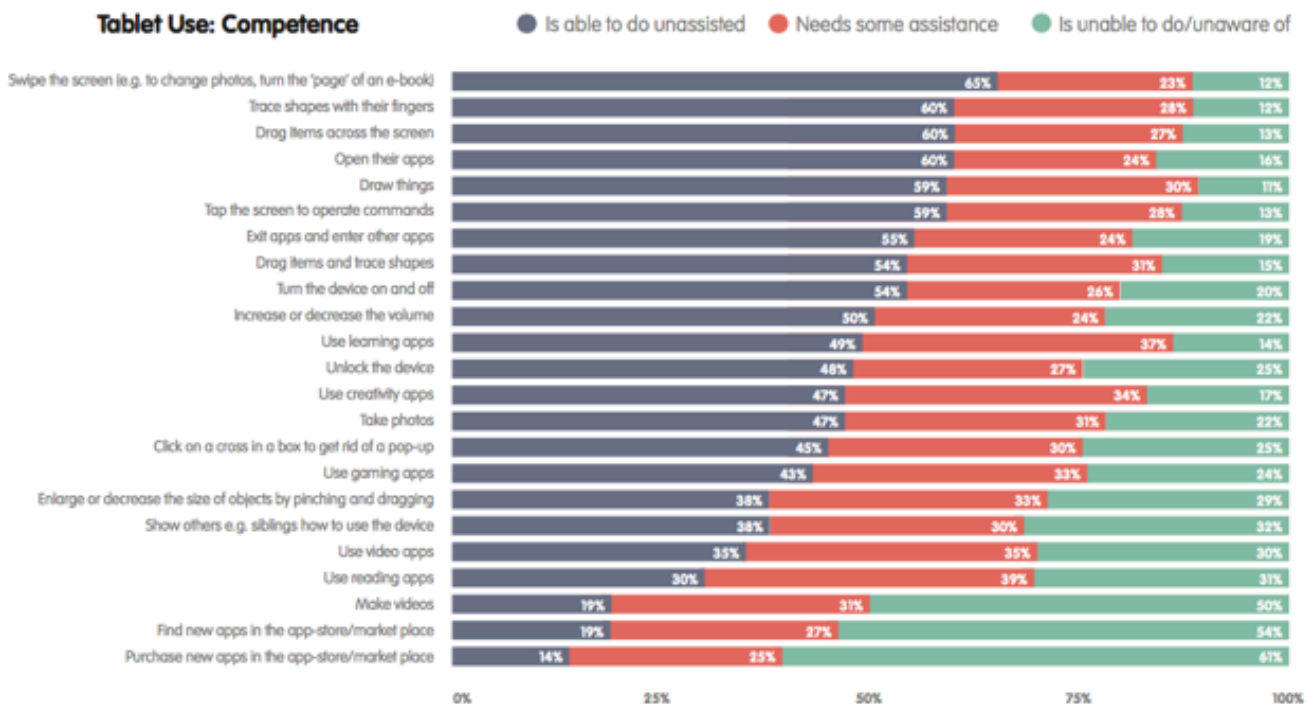
2.5 Use of Creative Sites and Applications

Young children enjoy a range of creative activities online. For the youngest children, the most popular online creative activity is drawing (OFCOM, 2016; Marsh et al., 2015). As children get older, they are more likely to take photographs, or make a video. However, for children aged 3-7, the number of children likely to do this is relatively small (20%), and fewer still are likely to make their own music online (4%).

2.6 Digital Skills

Although young children are not proficient in reading and writing yet, they have more advanced digital skills than their parents think, as 50% of 4 years old children are able to use tablets autonomously, and 25% of 2 years old children do so (Kabali et al., 2015). Thus, they are able to manage their tablets (e.g. installing and uninstalling apps, closing pop-up advertisements, making and editing photos) and undertake some online activities (e.g. searches on YouTube) (Chaudron et al., 2015). Marsh et al. (2015) identified from reports of 2000 parents of under 5s in the UK that they had a range of competences, outlined in Figure 1.

Figure 1: Competences of young children when using tablets³



³ From Marsh et al. (2015)

In a review of these data, Marsh (2016) noted that children's operational and technical skills are well-developed, and they also demonstrate cultural understanding of the uses of technology in society, but less well represented in the literature is an account of the development of young children's critical digital literacy skills. This is an area for focus in future research in this area.

2.7 Summary

From this review of access and use of the internet, it can be seen that young children are enthusiastic users of online sites and applications, and that they undertake a range of activities on line that foster play, creativity and learning. However as suggested previously, children in contemporary society move fluidly across online and offline boundaries and therefore, in Section 3, we move on to consider aspects of this dynamic in more depth.



Online and Offline Relationships

3.1 The Internet of Things

The Internet of Things (IoT) is becoming increasingly relevant to the lives of young children. Interesting emergent questions in the area relate to the traditional concerns with regard to effects and data use (Manches, Duncan, Plowman & Sabeti, 2015). Effects of the digitalisation of everyday objects is a new problem to address in the history of effect studies, which started by examining effects of newspaper, film, television, games and the internet. Increasing use of the IoT means a shift from keyboards and touch screen to more embodied technology. Some IoT technology is designed to capture children's behaviour and interaction, and this raises particularly interesting question about effects, and differs from traditional effects-discourse. One example of this kind of technology is *hereO*⁴, a watch that could inform parents of their children's location. Some wearable devices for toddlers inform parents about children's sleeping patterns. From this point of view, IoT is supposed to bring enhanced safety to the family.

⁴ <https://www.hereofamily.com>

Another aspect of IoT is that children's everyday play and use of 'things', especially toys, are connected to the Internet. These collect data from everyday activities and from the children themselves. For example the Teddy the Guardian soft bear captures health parameters like heart rate, oxygen saturation, body temperature, and measures the stress level of children. As Manches, Duncan, Plowman & Sabeti (2015) write, this function raises questions such as, 'how does the bear influence a child's behaviour as a 'guardian'?''. They suggest that '...hugging the bear may simply be re-interpreted as another health activity. Alternatively [...] children's knowledge of the bear's link to health services may influence their perception of the bear as a protector [as the name indicates]' (Manches, Duncan, Plowman & Sabeti, 2015: 77). Teddy the Guardian, like other IoT devices, collects the data for the use of health professionals, but potentially the data could be misused. Data gathering and 'dataveillance' are emerging problems in the digitalisation of children and education as well (see e.g. Sellar, 2014; Selwyn, 2015; Williamson, 2015; Finn, 2016).

IoT is the Internet of Everything, a world of networked technologies where many choices and decisions are automated, networked and streamlined, including learning. Although it seems that there is a lack of studies in the field, the potentiality of IoT is seen, for example, in museum pedagogy and education (NMC Horizon Report, 2015) in relation to the personalisation of the learning experience and flexible learning environment (Holloway & Green, 2016), and viewed as an assistive technology, especially in the case of the inclusion of persons with disabilities (Coetzee & Olivrin, 2012). 'Potentiality' is the keyword, more than a large-scale solution in the present day.

As IoT in the context of education is rather new, it is also conspicuous that studies which are more technology driven than education driven seem to be very media euphoric and rarely discuss the potential risks or questions of media literacy - or even 'IoT literacy'. The focus is on the creation of personalised learning environments that are expected to offer a rich, interactive, innovative and mobile learning in school as well as in the pupil's leisure time (e.g. Pruet et al., 2015, p. 11; Joyce et al., 2014). Of course IoT offers many possibilities and is a chance to improve education and to create individual education environments, which can be an advantage particularly in exceptionally environments like for example a hospital (Vicini et al., 2012); but still, potential risks of IoT and children as well as ethical questions should be raised as well.

Most of the research on the implementation of IoT in educational settings is addressed to children older than 8 years but some do also integrate younger girls and boys (Vicini et al., 2012: 3). Besides dealing with IoT as educational tool (Pruetl et al. 2015; Joyce et al. 2014) IoT is also used as research tool for evaluating and improving educational tools (Vicini et al., 2014) and seems to be attractive in the context of health education (Vazquez-Briseno et al., 2012) and the education and assistance of children with special needs (Rahman & Bhuiyan 2015). With regards to this, the development of portable devices that guide and assist children in dealing with nutrition or emotional challenges are discussed.

It may be the case for younger children that the emphasis is placed on the Internet of Toys rather than the Internet of Things. For example, Marsh et al. (2015) report on

under-5s use of toys connected to the internet as they play with robots and Furbies. In the next section, we move on to consider the potential role of robots in young children's lives.

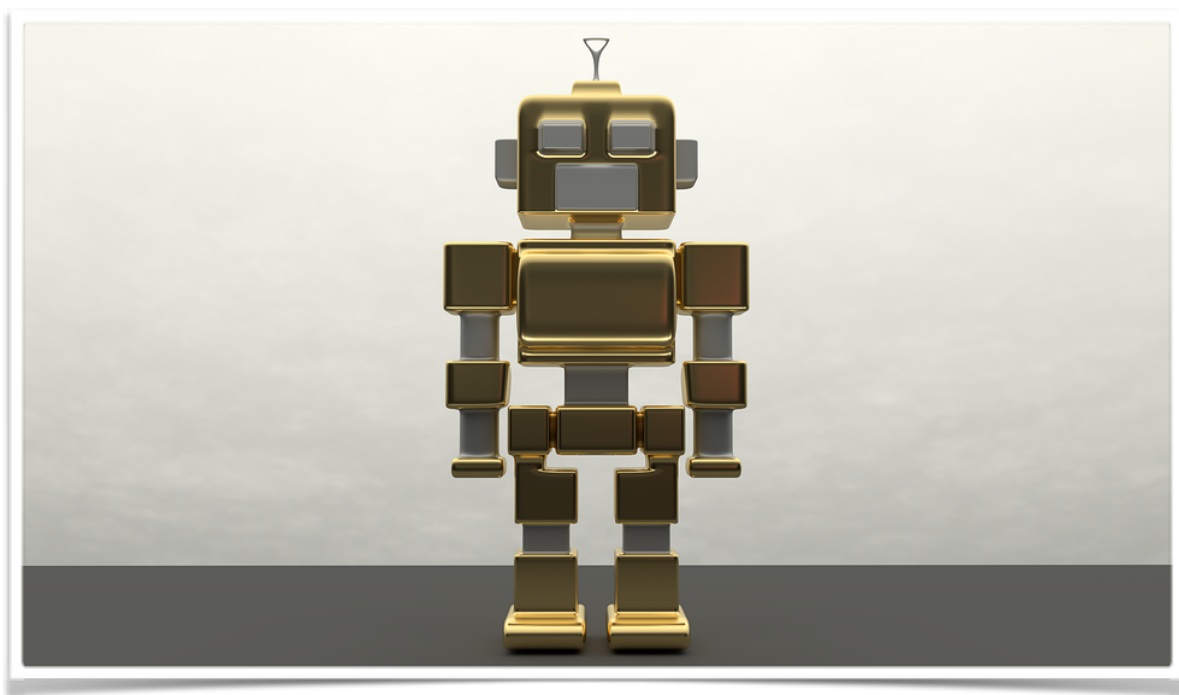
3.2 Robots

Robots are machines that can carry out a series of tasks when programmed. They are becoming increasingly sophisticated in nature, and robots aimed at young children are often shaped to appear human- or animal-like. Robotics, a discipline that considers the construction and use of robots, is turning its attention to the needs and interests of young children. Indeed, some countries are now pursuing the introduction of a robotics and computing curriculum from the first stages of schooling, as is the case in the UK.

Many researchers highlight the difficulties and challenges that must be considered before implementation of a robotics curriculum (Sullivan et. al, 2013; Levy & Mioduser, 2010). These challenges include the need for a great deal of one-to-one help from adults, significant scaffolding and teacher attention.

Robotics has interesting benefits in education. Contrary to the normal technology class in which children sit in front of the computer, robotics allows children to move around the room, work on the floor and use their bodies. It fosters new kind of learning and peer social activities and opportunities for creativity, social and cognitive

development (Sullivan et. al, 2013). The use of robotic manipulatives develop children's fine motor skills and hand-eye coordination, and engage collaboration, problem-solving and trouble-shooting when they build and create. Computer programming and robotics at an early age helps children also to avoid gender-based stereotypes. (Elkin, Sullivan & Bers, 2014.)



Fabiane, Barreto, Vavassori and Benitti (2012) published a systematic review of educational potentials of robotics in schools. They analysed 10 relevant articles from years 2000-2009 and focused on elementary, middle and high schools. Their review indicate that in terms of developing skills through robotics, research is focused on thinking skills, problem-solving approaches and social interaction, but there are both results that demonstrate significant improvements when using robots, as well as use that does not demonstrate this impact.

Hsieh et. al (2015) studied a language teaching/learning robot, *iRobiQ*, the bidirectional interactive toy, and found it more effective as a learning tool than the PC-tablet. Others use robots as surrogates of students to accomplish real-life tasks and found the use to be joyful and engaging for children (Wei et. al. 2011). Some researchers argue that robots could be a vital element of authentic learning the classroom of tomorrow (Chen et. al. 2013), which may be of value for example in a Montessori class, which has traditionally focused on object-based learning (Elkin, Sullivan & Bers, 2014). Bers (2010) argues that teaching children about the human made world (technology and engineering) is as important as teaching them about the natural world. Kuperman & Mioduser (2012) also find the use of technological language important and indicate the importance of an early development of a positive technological stance.

Then there are also researchers who focus on children with autism spectrum disorder (ASD) and attempt to develop technology which can benefit them, such as robots that interact and give real time feedback (Warren et. al. 2015; Billard et. al., 2007).

Findings indicate that as children are growing up in a world with intelligent technology they tend to differentiate robots from other familiar entities and their definition of aliveness is more about more choices than what is 'alive' or a 'machine' (Bernstein & Crowley, 2008). The main focus in robotic studies in education is on programming (Kazakoff & Bers, 2012; Kazakoff & Bers, 2014) and robots' behavior, intelligent and task management (Mioduser, Levy & Talis, 2009).

There has been little research on young children's engagement with robots in their home, in their digital play, which is of concern, given the growing interest by the under 8s of toys of this nature (Marsh et al., 2015).

Of interest to researchers of young children's digital practices, Malmir, Forster, Youngstrom, Morrison and Movellan (2013) conducted a study in which a social robot was left in an early childhood centre for a 28-day period, and collected data on the facial expressions, activities and spatio-temporal proximity of toddlers. The research team found that the robot was as effective as human observers of the children (tested through inter-rater reliability scoring) and argue that robots can be effective 'digital ethnographers' of early childhood. However, it would appear that the data collected was rather rudimentary in nature and far from the rich, complex ethnographic data that is normally collected in research on young children's digital practices.

3.3 Virtual and Augmented Reality

Much of the current research available on young children's use of virtual reality is developed in the disciplines of computer sciences and HCI, or in medicine, as virtual reality interventions are tested on patients with various injuries or movement disorders (e.g. Levac, Miller and Missiuna, 2012). A review of research on virtual reality in education (Freina and Ott, 2015) found no research related to young children (they identify two papers, but on further investigation, both relate to children aged 10 and

older). The authors suggest that this may be because VR may impact on young children's still developing vision, hand-eye co-ordination and balance.

These concerns do not seem to hampering media producers' attempts to reach out to this age group. For example, Mattel launched the VR View-Master range, which it aimed at children aged seven and older. However, for now, the market is stronger for augmented reality toys and apps for the over-eights.

Augmented Reality (AR) is a blend of the physical world and the virtual world. In this blended reality, three-dimensional images or environments are projected onto a physical object, but users are not immersed in the same way as they are with virtual reality experiences. AR systems can be image-based, divided into (1.1) marker-based and (1.2) markless tracking and (2) location-based systems. An example of an image- and marker-based system is Quick Response Code (QRC) that, as a real-world image, makes a connection to the 3D virtual object. Markless augmented reality system means that any physical object in real world may be used as a trigger that is a link to the virtual content.

Koutromanos, Sofos and Avraamidou (2015) suggest that augmented reality games are usually used in science education context (e.g. Enyedy, Danish, Delacruz & Kumar, 2012; Lin, Hsieh, Wang, Sie & Chang, 2011), reading (Cheng & Tsai, 2016). Beyond the science education, AR has been used in children's library services (Meredith, 2015), marine education (Lu & Liu, 2015), music history (Gomes, Figueiredo, Amante & Gomes, 2014) and storytelling (Sugimoto, 2011). From these

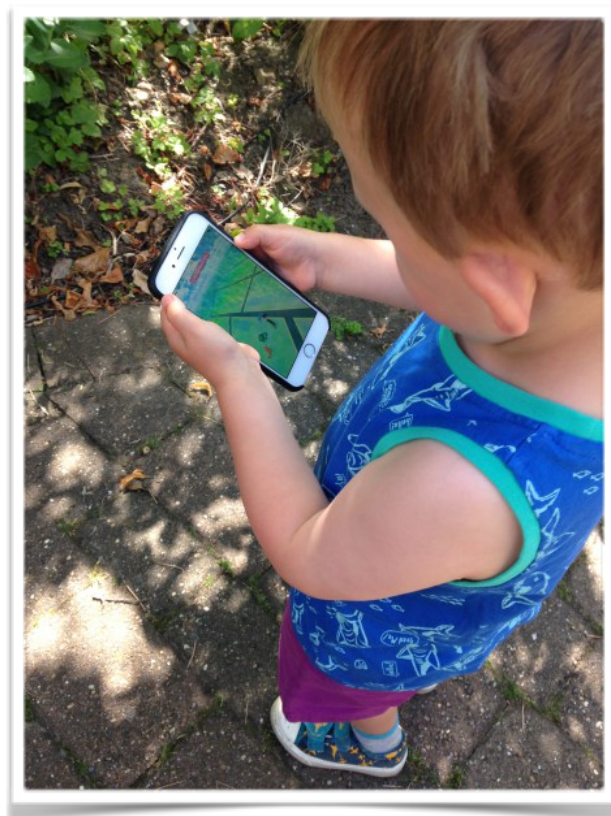
perspectives AR is connected to creativity and game-based learning (Folta, 2010; Enyedy, Danish, Delacruz & Kumar, 2012; Furió, Juan, Seguí & Vivó, 2015; Gomes, Figueiredo, Amante, Domingues & Gomes, 2014; Han, Jo, Hyun & So. 2015).

There have been a number of studies that have considered the potential value that AR might have for young children's play. Bai, Blackwell and Colouris (2015) report on a study in which they developed a finger puppet system, FingAR Puppet, which used AR technology to enhance play with the puppets. Fourteen children aged between four and six used the system, and their responses were analysed to determine the impact of the activity on children's expression and understanding of emotion, their communication around play and their divergent thinking. The findings suggested that AR technology promoted the expression and understanding of emotion and the verbalisation of pretend play, as the children talked about the transformations of objects. Further, Hinske, Lampe, Yuill, Price and Langheinrich (2005) developed an Augmented Knights Castle Playset which linked sound files containing verbal commentaries, sound effects and information with educational content, with specific elements of the playset. One hundred and three primary children aged between 6-10 played with either a non-augmented version of the playset, or the AR playset. The research team found that children had very good retention of the vocabulary learned during the play session with the Augmented Knights Castle, even when tested again two months following the study.

Augmented reality apps are becoming increasingly popular with young children. In a study of under 5s use of apps in the UK, Marsh et al. (2015), 24% of parents reported

that their children used AR apps. It was found that AR apps varied according to the extent to which they fostered play and creativity. Some apps did little more than bring 2D characters to life, whilst other AR apps enabled children to create videos and link them to 2d paper and artefacts (Marsh and Yamada-Rice, 2016). All of the AR apps were fascinating for the children in the study, as they created what appeared to them to be a magical link between the online and offline domains, a phenomenon seen with the release of *Pokémon Go* on to the market, which enables users to locate virtual monsters in the physical environment.

Whilst VR and AR toys and games are relatively new in the marketplace, it is expected that this area will grow further in future years. As with all experiences of using technology, such toys and games will bring with them both benefits and challenges. The EU Kids Online Project⁵ identified the risks and opportunities presented by engagement in online spaces. This is considered in relation to young children in the next section.



⁵ <https://lisedesignunit.com/EUKidsOnline/index.html?r=64>

Online Risks and Opportunities

4.1 Online Opportunities

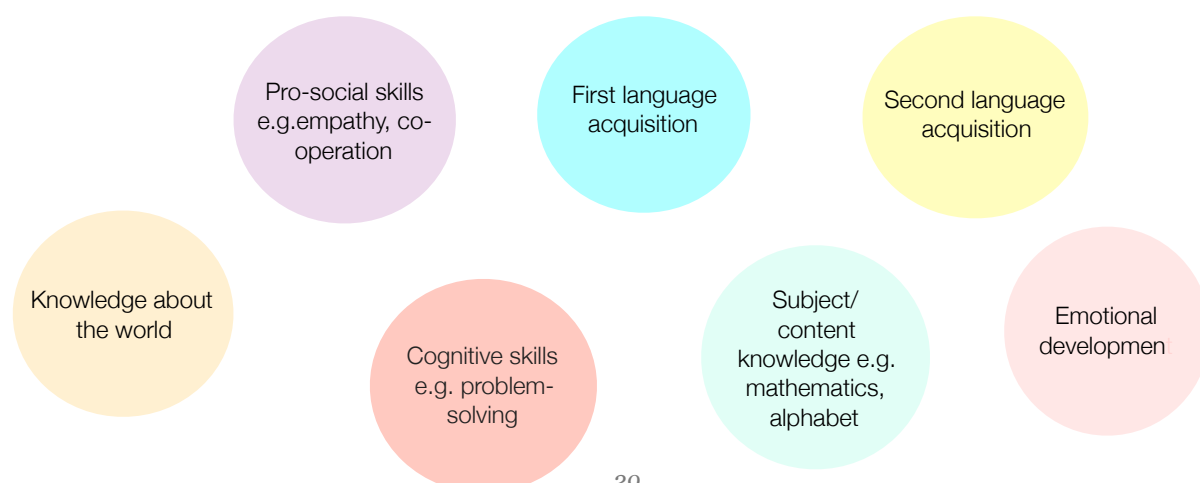
Children's use of the internet provides a range of opportunities for children. As noted by Holloway, Green and Livingstone (2013), studies have indicated a positive correlation between home use of internet in the early years and linguistic (Bittman et al, 2011) and academic achievement (Cavanaugh et al, 2004; Judge et al, 2006, p. 52). This positive correlation is also noted by parents. In numerous studies of parents of young children's attitudes towards technologies, researchers report that parents identify a range of benefits for their children of the use of technology, including linguistic, cognitive and social benefits (Chaudron et al., 2015; Marsh et al., 2015). Children, for example, are reported to learn both first and second languages, subject/content knowledge (e.g. mathematics, literacy, science) and knowledge about the world through their use of technology (Chaudron et al., 2015; Marsh et al., 2015) (see Figure 2).

Children develop a range of digital literacy skills as they engage in online activities. Kazakoff (2015) has developed a model that identifies six components of digital literacy in early childhood: understanding and utilising digital interfaces; non-linear

navigation; critical-thinking and problem-solving skills in digital domains; co-operative learning and play afforded by digital tools in early childhood and creative design afforded by digital tools in early childhood. Whilst there have been few studies that have examined these areas simultaneously, there is indicative evidence that using the internet can develop non-linear navigation skills (Marsh et al., 2015), critical-thinking and problem-solving skills (Vasquez and Felderman, 2013) and pro-social skills such as co-operative learning (Marsh, 2014; Wohlwend and Kargin, 2014). Children also develop empathy with others in online play (Marsh, 2014), and generally have opportunities for emotional fulfilment, reporting much pleasure and fun in such activities (Chaduron et al., 2015).

Online practices can promote a range of types of play. Marsh et al. (2015) found that the majority of types of play identified by Hughes (2002), including socio-dramatic, fantasy, imaginative and creative play, could be identified in young children's use of tablets, which included apps that lined to the internet. Imaginative play is fostered through fantasy worlds, for example those offered in virtual worlds, but also children make playful use of apps and sites in ways that are not always intended by producers.

Figure 2: Skills and knowledge developed through online activities



4.2 Online Risks

The EU Kids Online project identified three main types of online risk for older children and young people: content risks (child as receiver of mass productions), contact risks (child as participant in adult-initiated activity) and conduct risks (child as actor as perpetrator or victim of bullying) (Livingstone, Mascheroni and Staksrud, 2017).

There is evidence that children aged eight and under experience unwanted content, although reported numbers are low. For example, in a UK study, 6% of parents reported that their children had been exposed to content that made them feel uncomfortable, whilst 9% reported that children had been exposed to content that made parents themselves feel uncomfortable (Marsh et al., 2015). In a study of young children's digital engagement in six EU countries and Russia (Chaudron et al., 2015), there was evidence that young children occasionally came across inappropriate content, such as images of naked women, due to their older siblings' internet use.

Commercial content also poses risks to children. In the UK study of under 5's use of apps, 10% of parents reported that children had made in-app purchases by accident (Marsh et al., 2015). This phenomenon was also reported by parents in the Chaudron et al. (2015) study. There are also commercial risks in the use of online games and virtual worlds, as children are often exposed to advertising in these platforms. In fact, brands are keen to explore mobile media as a new channel of access to young children, not only through mobile advertising but also creating appealing content for them, such as advergames. Mallinckrodt & Mizerski (2007) reported on the effects of

online advergames on children aged 5 to 8 years old, highlighting that although in their experience children were not persuaded about the message (that a fruit-flavoured cereal brand was as healthy as fruit) they developed a strong preference of the cereal brand when compared to others. Considering young children's preference for watching videos on YouTube and the exposure to advertising on this platform, this represents a risk.

Whilst contact risks are more limited than is the case with older children, given the more limited independent use of the internet of under eights, there are still concerns. Research undertaken by Dias & Brito (2016) indicates that young children may be playing online or exposed to interactions with other players without being aware, particularly when they borrow the devices from parents or siblings. In their qualitative study of 10 families with children under 8 years old, they observed children playing games with online chats available, but not using or even being aware of that feature, and also playing casual games connected to social networks and other players through their parents' profiles.

Whilst ostensibly under eights are not able to have accounts on social media sites such as Facebook, there is evidence that they do access these sites. Chaduron et al (2015) and Marsh et al. (2015) report that children access the social networking sites of siblings and parents, sometimes uploading photographs to the sites through automated processes. There is also evidence that a small number of children have their own Facebook profiles (OFCOM, 2016), set up by their parents. In a UK study,

this appeared to be a family literacy practice, in that parents mediated this use and stated that they wanted their child to be able to communicate with relatives through the use of social networking (Marsh, 2014).

Conduct risks have not been examined in any depth in relation to young children. Marsh (2010; 2011) reports on a study of 5-8 year old children's use of virtual worlds and indicates that there were reports of unsocial behaviour, such as throwing virtual snowballs at avatars, excluding avatars from parties as they belonged to non-members, and name-calling. However, there was no evidence that experience of these events upset children, although this was not the main focus for the study. Further research is needed on the extent to which young children are exposed to, and made vulnerable by, anti-social behaviour on online sites.

Parents are also concerned for the cognitive and developmental effects of mobile devices. Research on young children is still sparse. The TABLET project in the UK examined the association between the use of touchscreens and the attainment of developmental milestones. The study found no relationship found between the use of tablets and gross motor or language milestones. Instead, use of tablets at an early age is positively correlated with the development of fine motor skills (Bedford et al., 2016).

To conclude, whilst it is important to be cognisant of the risks involved in children's use of the internet, it should be remembered that risks are directly related to

opportunities. Therefore, restricting children's use because of concerns about risks could be counter-productive:

...the more children use the internet, the more online activities they undertake, the more digital skills they gain (and thus the higher it is likely that they climb the 'ladder of online opportunities' to gain the benefits). By implication also... less engaged, skilled or supported children gain fewer opportunities or risks, thereby perpetuating the digital divide. In other words, usage, activities and digital skills operate in tandem to fuel a virtuous or a vicious circle, depending on the circumstances of the child.

(Livingstone, Mascheroni and Staksrud, 2015: 6)

In addition, the deployment of effective parental strategies for mediating young children's online use could provide a strong platform for children's future engagement in online spaces. This issue is considered in the following section.



4.3 Parental Mediation of Young Children's Online Practices

Both industry reports and academic literature demonstrate that many children in contemporary society have parents who have already 'domesticated' (Silverstone & Hirsh, 1992) technologies and integrated them in their homes. Parents are the main mediators of digital experiences, and children learn directly from their help and support or by observation and imitation.

Many parents believe that such young children are not very exposed to online risks because they perceive that their skills and consequently use are rather limited, that their children do not go online very often, and that they do not interact with others on social networks (Chaudron et al., 2015; Marsh et al., 2015). However, it is precisely on YouTube that children under 8 years old are more vulnerable to risks, mostly through exposure to inappropriate content (Dias and Brito, 2016). Because of the touchscreen nature of mobile devices and the tailored functioning of YouTube, children can easily follow the platform's suggestions for content to watch, and some children use their parents or older siblings' accounts, thus becoming exposed to content intended for adults or teenagers.

Drawing on the studies of parental mediation of television, Livingstone and Helsper (2008) and Livingstone et al. (2011) identified the following strategies of parental mediation of the internet: active mediation of internet use (e.g. using the internet together or suggesting positive content online); active mediation of internet safety

(e.g. suggesting how to behave with others online and how to report negative experiences); monitoring (e.g. checking the websites the child has visited); restrictive mediation (e.g. setting rules regarding time spent online or the type of online activities); technical mediations (e.g. using parental controls or other software to restrict access). Building on these categories, Nikken and Jansz (2014) drew on data from a survey of 792 parents of Dutch children aged between 2 and 12 to develop a tool to assess parental mediation of young children's internet use. They found five styles of mediation that could be reliably measured: co-use; active mediation; restrictive mediation i (general restrictions, such as time limitations); restrictive mediation ii (content restrictions, such as banning certain sites) and supervision (parents monitoring children's internet use when nearby). More recently, a survey of 6,400 parents in 8 European countries has shown that the initial set of practices identified by research is resolving into two broad strategies: "enabling mediation" (including practices of active mediation of Internet use, active mediation of internet safety, monitoring, and technical controls) and "restrictive mediation" (Livingstone et al., 2017). The younger and the less skilled the children, the more parents favour restrictive mediation (Chaudron et al., 2015; Livingstone et al., 2017).

Chaudron et al (2015, in press) report on the ways in which parents mediate the technology use of children younger than eight years of age. Parents had a range of rules for mediating children's internet use including rules about time, about where children could use technology and how. However, the role of touchscreen devices in the child-parent relationship is ambiguous. Tablets and other mobile devices generally

permissive with the use of mobile devices in the home, sometimes because they are effective ‘babysitters’ that keep the children entertained while they are busy (see also Dias and Brito, 2016). In many families across all seven countries, access and use of technologies was frequently used as a reward or punishment. Parents who adopted a more permissive parenting style were more likely to also adopt a permissive approach to media-use rules, and vice-versa. Few of the families employed technical restrictions, believing them to be unnecessary with young children. Children in this age group are fairly compliant with parents’ rules and do not tend to challenge them, internalising rules as a set of non-constraining practices. In addition, some children were unaware of the strategies parents used to manage their online use. For example, in one of the families, children were told that the internet shut down at 6pm, which was unquestioned by them.

Parental mediation is influenced by parents’ education and digital skills (Livingstone et al., 2017; Mascheroni et al., 2016): the better the parental skills, the more they prefer enabling mediation, and vice-versa. Parents favour enabling mediation also when they judge their children’s digital skills to be high (Livingstone et al., 2017). Enabling mediation is associated with higher opportunities and risks. By contrast, restrictive mediation reduces exposure to risks, but also opportunities. So, the policy implications of the findings by Livingstone et al. (2017) are important, and suggest that more digitally confident parents can better scaffold children’s digital literacy practices and support them in developing resilience.

Conclusion

This review of research on young children's online and related offline practices has identified that many children aged from birth to eight are engaged in a range of practices that cross both domains. There are both advantages and disadvantages to be gained from this use, but it is clear that if children do not have opportunities to gain online experience, they are disadvantaged in terms of the range of digital literacy skills and experience they do not have opportunities to develop. Parents and carers use a range of strategies to mediate young children's use of the internet, but many of them express a lack of concern about online risks because they do not consider their child to be online without their knowledge.

There are a number of policy and research implications of this review. In relation to policy, it is important that countries that do not already do so should begin to more carefully undertake research on young children's access to and use of technologies in order to identify trends and needs. In addition, there should be guidance offered to parents and carers, health visitors and early years practitioners on ways that young children's use of technologies should be mediated and supported.

In terms of research, there are a number of gaps in the literature with regard to the online and related offline practices of this age group. This summary focuses on the needs of European countries, the interests of this COST Action, but the same applies

to other countries. Indeed, there is a great need for research to be undertaken in the Global South with its different history of internet access and diverse cultural practices, as much of the knowledge we have in this area derives from studies undertaken in Europe, North America and Australia.

First, there is uneven knowledge about how many children have access to the internet – and how - both in homes and early years settings. Large-scale surveys need to be conducted in order to determine this. This research would be well positioned to explore the ways in which gender categories are challenged or reinforced across and within online and family interactions. Second, there is a lack of knowledge with regard to the online practices of young children who have a disability, either physical or cognitive, and of young children who live in marginalised communities, such as asylum seekers and refugees, or children in care. Here, there is also additional work to be done to understand how children influence and often police each other's activities online, beyond the view of adults and providers. The ways in which young children understand the various spaces – which are now combinations and intersections of online and offline - in which they play and engage with friends and family needs exploration. Third, the emergent area of the Internet of Things has many implications for young children, both in relation to issues of data privacy and security, but also pertaining to the opportunities of these technologies for young children's linguistic, cognitive and social development. Finally, there numerous theoretical and methodological challenges posed when examining the interface between children's digital literacy practices across online and offline domains. There are developments in this area relating to the use of post-human philosophy to analyse interactions

between children and technological tools and toys (e.g. Marsh, in press), but further work needs to be undertaken. There also need to be further methodological innovations to ensure the complexity of contexts in which children move in these hybrid spaces is captured. The use of eye-tracking software, headcams and chestcams is becoming more prevalent, but beyond this, there is a pressing need for methods that enable children to have greater participation and agency in the research process be developed and implemented.

The first decades of the twenty-first century have seen rapid developments in relation to young children's access to and use of technologies, but it is clear that there is still much to do in terms of understanding this use. It is important that researchers address the issues outlined in this paper in the years ahead if we are to ensure that policy and practice in this area is appropriate for the needs of young children in the digital age.

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