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TODDLERS, TECH & TALK
 0-3-year-old children’s language and literacy learning at home in a post-digital age

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November 2024



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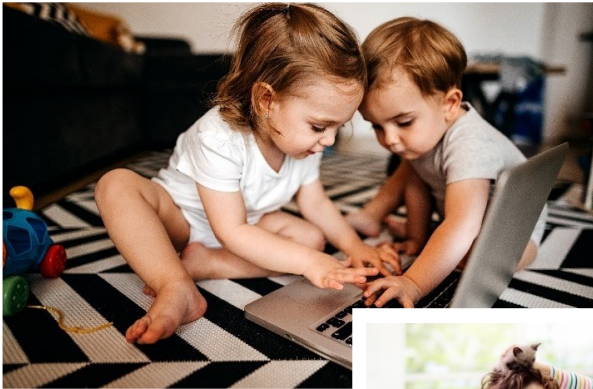
We are grateful to the many parents and legal guardians (hereafter 'parents') of children aged from birth to 36 months who chose to take part in this study, and from whom we have learnt so much about very young children's digital lives at home, including their opportunities for language and literacy learning with digital technologies. We are also grateful to the early care and education professionals who agreed to be interviewed as part of this study. Their perspectives have added important nuances to our findings.

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We wish to thank the international, multisectoral advisory board members for their time and commitment to this project and for generously contributing their expertise at different stages in the research process.

Finally, we express our sincere gratitude to the Economic and Social Research Council for having the vision to fund this study so generously, and to the anonymous experts in the ESRC peer review college who believed in the project's potential value for social science.

TODDLERS, TECH & TALK



Study Overview

Toddlers, Tech and Talk is an ESRC-funded project about 0-3-year-old children's language and literacy learning at home in a digital age (2022-2024). This is the only contemporary project reporting in depth on how digital technologies intersect with the home lives of very young children and their families across the UK. The findings from this study are rich in their breadth and depth. This summary report introduces some of the main themes that we have identified, along with 'bitesize' snippets of data that convey a flavour of our findings.

Research aims

The study's primary objective was to build new knowledge about 0-3-year-old children's early talk and literacy learning at home, in diverse minority and majority communities across the four UK nations. The specific objectives were to:

1. build robust knowledge about digital tech in the lives of children aged 0-36 months at home in diverse communities across the four UK nations.
2. understand how 0-36-month-olds develop early talk and literacy while engaging with different semiotic systems in diverse media and how family members mediate and safeguard tech use.
3. draw on posthuman perspectives to theorise contemporary Home Literacy Environments.
4. develop innovatory participatory methods based on ethical principles of choice, inclusion and responsivity.

Research Design

To achieve these aims, the project was designed in three overlapping phases. This generated a unique body of robust empirical evidence about how very young children's early talk and literacy are mediated by diverse technologies and people at home, with distant family and when out in their local communities.

Phase 1: Online survey of parents/legal guardians of 0-36-month-old children (N=1444, balanced across the four UK nations)¹

Phase 2: Interviews with 10 parents/legal guardians in each of the four UK nations (N=40) and five early childhood practitioners in each of the four UK nations (N=20) (Total N=60)

Phase 3: Intensive case studies of 0-36-month-old children at home with their families (10 in each UK nation. Total N=40), using diverse participatory methods, co-designed with the families.

¹ See Appendix 1 for respondent demographics & Appendix 2 for respondent distribution.

Ethical considerations

Research ethics were central to the design and conduct of this study. Whilst research ethics are necessarily shaped both by the requirements of academic institutions and disciplinary norms, they unfold in the personal spaces between researchers, participants and communities. We therefore adopted a relational and dialogic ethics approach, with child and adult participants' and researchers' rights, wellbeing and dignity as central tenets of the project.

We explored creative and responsive approaches to negotiating voluntary informed consent, and embraced the challenges this can present when working with very young children. Child consent was sought through arts-based activities and enactments of research procedures, with children and their parents being encouraged to handle recording equipment and make their own recordings should they wish to. Child consent was also gauged through attentive monitoring of child behaviours by researchers and parents.

All families who participated in Phase 3 were gifted an iPad to ensure all had equal access to high quality equipment for participatory data collection, and for the secure transfer of data from homes to secure institutional data storage facilities.

For each project phase, initial ethical approval was secured by MMU Faculty of Health and Education ethics approval committee, followed by ethical approval from the collaborating universities. Amendments to ethics followed the same procedures.

Research Team

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Dr Sandra El Gemayel, *Research Associate*

Angie Cooke, *Project Co-ordinator*

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Dr Christina Clark, **National Literacy Trust (NLT)**

Zoe Kernohan-Neely, **Early Years**

Figure 1: Team Structure

Executive Summary

Internet Access and Digital Devices in Family Homes

Virtually all children in the UK are born into highly technologized environments. 98% survey respondents with children aged 0-36 months reported they have internet access with Wi-Fi. 98% own at least one smartphone, 92% a TV/Smart TV, 82% a laptop, 81% a tablet, 65% own Smart home devices, 63% own gaming consoles, 61% Smart watch/ fitness trackers, 18% own internet-connected toys, and 12% a VR headset. During in-depth interviews and case studies, parents also reported owning a very wide range of other digital devices.

Digital disparities across households

There are disparities across families in terms of digital device ownership, use and attitudes. The survey results showed the average number of devices within the home was 12.55, with device ownership per household ranging from a minimum of 1 device to maximum 40 devices. The range of different types of digital device ranged from 1 to 14, with an average range of 7.43 different device types. Parent income and educational status were the highest predictors of device ownership, with families on lower incomes tending to own fewer devices and a narrower range of devices than families with higher incomes.

Problematising 'screentime'

While many popular digital devices have screens (e.g., TVs, smartphones, tablets, laptops, cameras, e-readers etc) many digital devices do not have screens (e.g., electronic toys, interactive books, Smart home devices etc). These are often in frequent daily use and their use is observed by children and imitated, such as reaching for touch-sensitive controls of washing machines. A focus on 'screentime' fails to engage with the many ways that diverse digital media are woven into the fabric of everyday life.

Child device ownership

41% of survey respondents indicated their 0-36-month-old child 'owns' a tablet, 12% a smartphone, 9% a TV or Smart TV, 8% have web-connected toys and 5% a gaming console. As income increased, the range of child owned devices also increased. Fathers reported their child owned a significantly wider range of devices than reported by mothers. However, we cannot be sure how survey respondents interpreted the word 'own'. Through interviews and case studies, we found a tendency for parents' old devices to be handed down to 0-3s, rather than bought specifically for them.

Where 0-36-month-old children use tech

Very young children use digital devices in many different locations, most frequently at home but also in the car, in restaurants, when visiting friends/family, at nursery, on public transport, in their pushchair, when shopping and when enjoying community facilities (e.g., museums, libraries). Very young children sometimes help to scan items at self-service shop checkouts, to register attendance in medical surgeries etc.

What parents and their 0-36-month-old children do together with tech

The most frequent parent-child activities on digital devices are (most popular first) taking photographs, looking at family photographs and videos, video calls with family and friends,

watching children's TV shows and films, playing music, and watching YouTube clips. Mothers were less likely than fathers to report 'often' using digital devices to play with their child. Parents of children with a disability were 1.9 times more likely to report 'often' using a device to play with their child than parents of children with no disability. The most popular device for joint parent-child engagement is the smartphone, followed by tablet and laptop. Parents tend to select one or two episodes of specific TV programmes through On Demand and enjoy co-viewing these with their child or the child views alone while a parent is busy.

What 0–36-month-old children do on their own with tech

The most frequent activities children do alone on digital devices are (most popular first) watching children's TV shows and videos, playing games, taking and looking at photographs, and watching YouTube clips. In our survey, parents who reported their child had a disability were nearly twice as likely to state their child often played on devices on their own. From our interviews and case studies, we learnt that in families with multiple children, watching TV 'on their own' sometimes also included watching with older siblings. Child lone tech use tended to be with carefully selected specific apps and interactive toys, used at home and during parent appointments (medical, social services etc) and travel.

How parents mediate their child's tech use

Parents mediate their child's tech use in many ways, including as 'gatekeepers' (e.g., show child how to use a device, point to items on the screen), in control and supervisory ways (e.g., set parental controls, keep an eye from a distance, limit time), as 'enablers' (e.g., name colours and shapes, play games and activities together), and in critically reflective ways (e.g., encourage a child to seek information via tech and to think about the information). Parents also act as 'models' by using tech themselves in ways that their child seeks to imitate.

Child communication, language and literacy learning with tech

Most 0-3s observe their families' everyday language and literacy practices using tech, and they join in, using sounds, words and symbols in authentic contexts (e.g., interaction when watching TV, viewing and taking photographs, playing games, taking part in video calls in one or more languages etc). In so doing, 0-3s also develop digital literacy skills and knowledge. Many 0-3s learn how to sign, using Sing and Sign apps and programmes to develop these skills along with their parents. Post-pandemic home working practices means 0-3s see parents on laptops, tablets and phones at home, amplifying children's awareness of the importance of tech in working, social and cultural life, and they imitate these practices.

Playful learning with tech

In our survey, most parents agreed that digital devices offer opportunities for young children to develop skills with reading, numbers, and creativity, and most disagreed that digital devices are damaging to children's learning. In interview, parents described how tech gives easy access to fun resources that capture their child's attention, to find information, to enjoy creative activities (e.g., drawing and painting apps) and to stimulate physical activity (e.g., dancing to songs, music and movement apps and programmes). Many children blend digital with non-digital activity (e.g., singing along with songs and nursery rhymes played on a Smart Speaker). In many households, tech is integrated in 0-3s' playful lives as just another play artefact, such as drawing with pencils on paper while the TV is on or a Smart Speaker plays music, which they sometimes attend to.

Parent confidence with tech

Most parents feel confident they can support their child's digital device use, know how to keep their child safe when using tech and know where to access support and advice about child digital usage. Parents of older children were more confident than parents of younger children. Parents who spoke English and another language, and parents who spoke another language only at home reported less confidence than those who spoke English only. Some parents describe their own tech skills as basic, while others are more accomplished. Most parents are confident they know what their child accesses via tech, and many trust recommended age appropriacy guidance on popular media sites and apps but have less confidence in managing their child's tech use in future. Not all parents set parental controls on all digital devices at home.

Parents balance concerns with opportunities for their child's tech use

Most parents view tech as an inevitable component of their young child's present and future life yet were concerned about its potential harm for their child's wellbeing and development. Most parents grow anxious when their child 'spends too long on digital devices' and are concerned that excessive use of tech will negatively impact the amount of time their child spends socialising with others. Most parents worry their child might access inappropriate content online. However, parents value the opportunities offered by digital media and rationalise their child's tech use by weighing up pros and cons.

Early childhood education and care practitioners' views

To gain broader insights into beliefs and practices around 0-3s' tech use, we interviewed 20 professionals working in the early childhood sector (5 in each UK nation). Many recognised the benefits of tech for learning, and appreciated how children's interests can be explored more easily and vivaciously with technology than through traditional printed resources. Some valued how the multiple visual and auditory modes offered by tech helps them connect with children in the early stages of learning English. Some practitioners have negative views about how parents overuse tech, and believe this trend contributes to some children's behavioural and communication challenges. Most recognised that discourses around excessive 'screentime' are reductive and tend to blame parents, which in turn feeds parental anxiety.

Key Findings

Internet Access and Digital Devices in Family Homes

Virtually all children in the UK are born into highly technologized environments. Our survey found that 98% of families with children aged from birth to 36 months have internet access with Wi-Fi connectivity, and the same proportion own at least one smartphone. 92% own a TV/Smart TV, 82% a laptop and 81% a tablet. 65% parents reported owning Smart home devices (such as Amazon Echo or Google Home), 63% said they own gaming consoles and 61% Smart watch/ fitness trackers. 18% reported owning internet-connected toys, and 12% a VR headset. Other devices parents reported their 0-36-month-old child use include story-listening devices, such as Yoto Player or Toniebox. Multiple regression analysis found income and educational status were the highest predictors of device ownership – as income increased so did the number of different device types within the household.

During interview, parents added further insights into how they feel tech is integrated in contemporary everyday life:

... I think it's just part of our culture now as we're such a digital culture and I think if we don't let them use it young in a safe way, then we're almost like disadvantaging them a little bit, growing, moving forward. (Mother of 23-month-old boy)

... even just her being able to use technology, it's part of her, it's ingrained in her everyday life, so she's gonna have to learn to use it at some stage or another. (Mother of 12-month-old girl)

Many parents recognised its benefits as well as its pitfalls, and most parents expressed the view that child use of tech should be balanced with a range of other activities, for example:

... I think that it's all about balance and making sure that your parenting is not being replaced by a device if that makes sense. (Mother of 8-month-old boy)

A notable finding of our case studies with individual families was the prevalence and diversity of primarily mobile technologies (e.g., smartphones, laptops, tablets) in many, but not all, homes. We noted that many very young children regularly observe a range of digital devices being used by different family members for different purposes in many different locations in and around the family home. However, some children encounter a narrower range and number of digital devices at home.

Digital disparities across households

There are notable digital disparities across families in terms of digital device ownership, use and attitudes. In terms of device ownership, the survey results showed the average number of devices within the home was 12.55, with device ownership in households ranging between a minimum of 1 device to maximum 40

devices in one home. The average number of different device types in the home was 7.43 (Minimum = 1, Maximum = 14).

Parent age, educational qualifications, income, and ethnicity all predicted a higher or lower number of different device types within the household, with income and educational status being the strongest predictors. As income increased, the range of devices increased, and as education level increased, so did the range of devices within the household. These findings were echoed in subsequent research phases, where families on lower incomes tended to own fewer devices and a narrower range of devices than families with higher incomes.

Problematizing 'screentime'

Guidelines on children's digital media use often recommend that parents 1) choose high quality content that is suitable for a child's age, 2) interact with their children while they are engaged in digital activity and 3) limit children's 'screentime'. For example, the widely cited American Academy of Pediatrics guidance recommends no digital media use (except video-chatting) for children younger than 18 to 24 months, use of only high-quality programming with children aged 18 to 24 months along with 'adult interaction with the child during media use' (AAP, 2016), and limited screen time of up to 1 hour per day for children aged 2 to 5 years.

However, alongside a wide diversity of digital devices with screens, such as smartphones, tablets and laptops, our study found that participating families owned many digital devices which do not have screens (See *Appendix 3* for an indicative list of digital devices, with and without screens, identified in participant homes across study phases 1, 2 and 3). Many devices that have digital displays, but no 'screens' as such, are in frequent daily use. Some of these devices are also used by very young children, such as digitally responsive toys where digital components are hidden within the toy. Other such devices are observed by children being used by older family members, whose behaviours the younger ones then imitate, such as reaching for the touch-sensitive controls of washing machines and dishwashers, glancing at Smart Home Devices with screens that are connected to Smart Doorbells, or using Smart Baby monitors to communicate with family members in different rooms.

These instances of contemporary digital practices at home call into question the helpfulness of a focus on 'screentime', which we argue, fails to identify the many ways that diverse digital media are woven into the fabric of everyday life. It might be helpful for parents to reflect on their own and other family members' digital media use and what very young children may be observing about the role of technology in everyday life at home.

Child device ownership

Many very young children have access to a digital device for their own use, most often a tablet. In our survey, 41% of respondents indicated that their 0-36-month-old child 'owns' a tablet, 12% a smartphone, 9% a TV or Smart TV, 8% have web-connected toys and 5% a gaming console. Some children were reported to own more than one digital device. Multiple regression analysis found that income and parent gender were the strongest predictors of reported child device ownership. As income increased, the range of child owned devices also increased, and fathers reported that their child owned a significantly wider range of devices than reported by mothers.

It is important to note that we cannot be sure how survey respondents interpreted the word 'own', so we explored this phenomenon during subsequent study phases. Through our interviews and case studies, we found a tendency for parents' or older siblings' devices to be handed down to very young children, rather than bought specifically for them. However, some parents had bought a tablet for their very young child, and used this with their child rather than, for example, their own personal or work-related tablet, phone or other digital device.

Where 0-36-month-old children use tech

Survey respondents reported that very young children use digital devices in diverse locations, most frequently at home but also (in descending order with most popular first) in the car, in restaurants, when visiting friends/family, at nursery, on public transport, in their pushchair and when shopping or walking (see *Figure 2*).

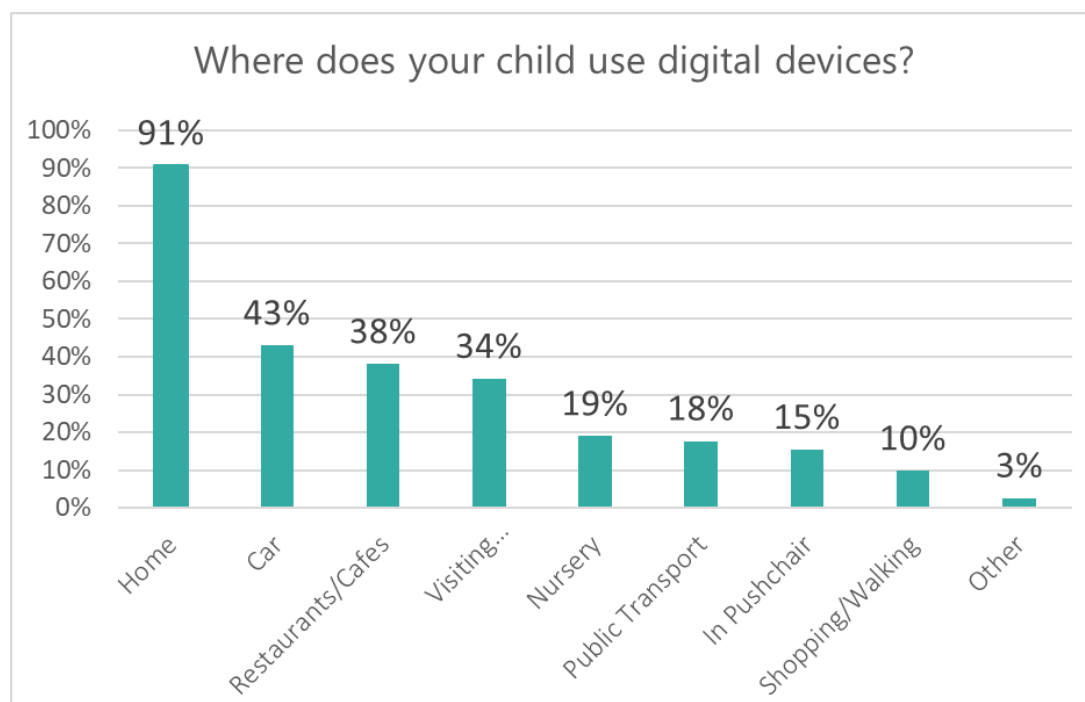


Figure 2: Where 0-36-month-old children use digital devices

Survey results indicate that older children use devices in a wider range of locations than younger children. Children of parents who were unemployed used devices in a significantly narrower range of locations than parents who were in employment.

Some practitioners expressed concern about how parents readily give their phones to very young children:

So I see younger children like that too and children that leave our setting and get in their buggy and their mum gives them their phone straight away to have on the way to catch the bus. (Practitioner)

In interview, parents added further insights into their reasons for giving their child tech outside the home, such as to keep a child 'quiet' or 'busy' in public spaces:

... I've actually discovered a bus that isn't too far away from us, because we are in the middle of nowhere! That means I've got to walk back from the bus stop, and she wasn't very happy the other day, so I did, I turned on some white noise and lullabies ... and that seemed to calm her as well. (Mother of 4-week-old girl)

... When I knew that I have appointment ... I charge the tablet, because they're going to disturb me. I charge the tablet and I give them, and they're busy now. (Mother of 24-month-old girl)

During the Phase 3 case studies, many parents created video and audio diaries of their child's life at home and when out and about in their local communities. These rich insights evidence how children encounter digital technologies beyond their homes, and subsequently mimic their use in their play. For example, very young children enjoy scanning shopping items in supermarkets and travel tickets on buses and at train stations. For those children whose parents are able to take them to museums, especially science and children's museums, many displays are visual and digitally interactive. For some children, such multi-sensory stimulation can be overwhelming. After a visit to a local, interactive science museum, one parent wrote in her case study diary:

I felt (2-year-old girl) was overwhelmed by the number of screens in the anatomy section that she didn't fully engage or ask me to join in much. She often flitted between activities. (Her baby brother) was also very distracted and stared a lot at the screens (Mother of 33-month-old girl).

Even a walk in the woods can include technology, as encountered by one family during a visit to an 'enchanted forest', where interactive screens displayed walkways through the woods with suggested sights of interest, including 'talking trees' that respond to passers-by with welcome greetings (see *Figure 3*).



Figure 3: Exploring an 'enchanted forest'

What parents and their 0–36-month-old children do together with tech

The most frequent activities that survey respondents reported doing with their 0-36-month-old child on digital devices include (in descending order with most popular first): watching children's TV shows and children's films; taking photographs; watching YouTube clips; looking at family photographs and videos; playing games; playing music; speaking with family and friends; doing creative activities; reading e-books and listening to audiobooks for children (See *Figure 4* below).

In multiple logistic regression analysis, parent gender, income, educational status, ethnicity, language spoken at home and child disability status were all associated with parents reporting that they often played with their child on at least one device, with parent gender and child disability status being the strongest predictors of frequent parent-child shared device use. Mothers were less likely than fathers to report often using digital devices to play with their child and parents whose child had disability were 1.9 times more likely to report often using a device to play with their child than parents whose child did not have a disability.

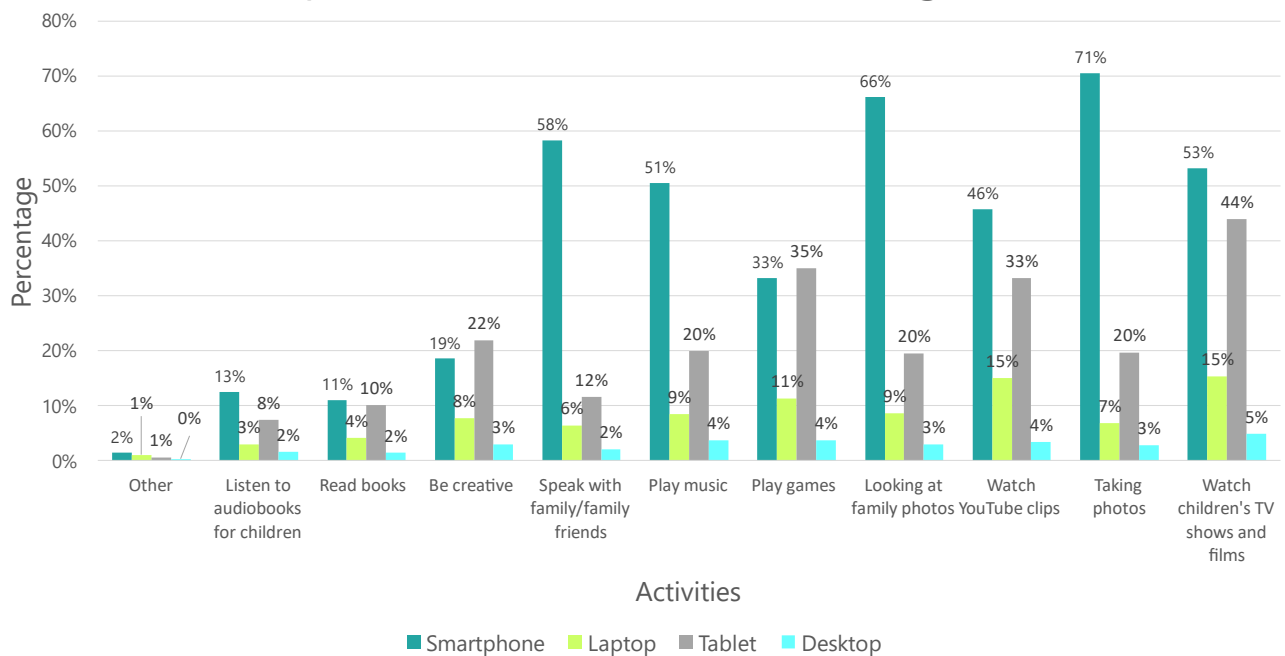


Figure 4: Activities parents do with their child on digital devices²

During interviews and case studies, we asked parents about their TV viewing habits, and found that TV watching with very young children in most homes is a deliberate choice, most frequently accessed for short lengths of time via On Demand on Smart TVs and laptops. The most frequently observed examples of TV viewing include a child and parent watching one or two short episodes of a favourite TV programme together while cuddled up together as part of a child's slow waking-up after an afternoon nap, or a child watching one or two carefully selected programmes on their own while a parent is busy attending to a younger sibling, doing housework or cooking. Many parents shared how much they enjoyed watching and talking with their child about programme content, especially 'educational' and wildlife programmes, and animations featuring dancing fruit on YouTube Kids, playing games, as well as apps with songs and nursery rhymes which they sing or act out together with their child:

I have games on my phone like learn words, games, and puzzle solving kind of games that he'll use from time to time. (.). And, like obviously we put like CBeebies on the TV and he'll watch CBeebies and he'll watch Netflix on my phone or iPlayer and Disney Plus and all those apps, and he never uses my laptop (Mother of 21-month-old boy)

For some parents, repeated activities such as co-viewing particular programmes or listening to particular songs/music together offer opportunities for parents and children to forge and cherish shared experiences which sediment over time into strong affective bonds:

² The activities that parents do with their children are placed in descending order from right to left, with the most popular activity across all four device types on the right.

My husband watches with him. He has, like, a few specific songs that he says 'This is our song' ... So they have a couple of them that they watch every single time ... and my husband says that for these songs he shows more excitement because since baby was baby he was kind of showing it to him and he thinks that he knows them more than the others. He likes them more than the others. (Mother of 13-month-old boy)

We tend to do it together, so it is a thing that we're doing together in the moment. (Mother of 17-month-old girl)

We found no instances of parents turning on a TV so their child could view a specific programme on broadcast TV. Rather, parents tended to access favourite programmes through On Demand facilities on a Smart TV or using Chromecast to cast programmes from their phone to the TV, often using BBC iPlayer, Disney, Netflix or YouTube.

In a few homes, when home alone with a child, a parent chose to keep the TV playing in the background all day. In these rare cases, parents mostly reasoned that they did not like silence at home, so preferred to have the TV on, usually playing whatever schedule was being broadcast on CBeebies rather than selecting specific programmes for restricted time viewing. In these homes, each young case study child appeared to occupy themselves with a wide range of play and learning activities in the same room as the TV and paid very little attention to the TV. During snack and mealtimes, the parent and child sometimes sat together to enjoy their snack/lunch while co-viewing and interacting about a programme. Whereas research literature suggests that TV in the background reduces opportunities for parent-child and sibling interaction, we found to the contrary very high levels of parent-child interaction regardless of whether the TV was playing in the background or not. For example, in one home where the mother did not like silence so tended to switch on CBeebies on the TV whenever at home during the day, her 25-month-old youngest daughter showed highly developed skills with a wide range of traditional play resources both with and without her mother's help, such as completing jigsaw puzzles, drawing pictures with pens and pencils on a coffee table which was situated in front of the TV and was arrayed with literacy-related artefacts for young children. Again, both with and without her mother, this girl frequently looked through print picture books that were available on child-accessible shelves. In this family, we observed very high levels of mutual parent-child enjoyment with non-digital learning and play resources.

When asked about parent-child play using smartphones, mobile phones, laptops, tablets and desktops, the most popular device reported by survey respondents for joint parent-child engagement is the smartphone, followed by tablet and laptop. A few parents (between 1% and 5% respondents depending on the activity type) also reported using desktop computers with their child for a range of joint parent-child activities. Many parents use smartphones with their very young children to connect with extended family networks, and they sometimes do this during mealtimes:

... generally we ... FaceTime with my mom during the time he have lunch together, so we just have a little chat with my mom. (Mother of 26-month-old boy)

Sometimes, video calls might begin with a parent and child together, but the child then sustains a video call with a distant relative on their own:

... (if we) FaceTime or something like that, then it would start off as being together and he quite likes to then run off with it. Like to show like a room or something. (Mother of 22-month-old boy)

In this study, we found video calls are frequent and regular for many families, especially but not exclusively those whose close families live in distant lands:

So every morning she wants to see (her) grandson, so we always do play a video call (.) from ... the birth of my son until now, it's like regular activities to video call with the family. (Mother of 8-month-old boy)

In interview, several parents with more than one child mentioned how their older children enjoy viewing short films and programmes with their younger sibling, how older siblings find programmes for young ones to watch, how they dance together in time with music, or how older children explain content to their younger sibling:

My daughter would put stuff on for him on the TV as well if he wants something to watch, and they would put stuff on Google ... she would let him watch it or she would sometimes put something on her tablet for the two of them to sit and watch, and they would sit together and watch it on their tablet. (Mother of 31-month-old boy)

The survey results suggested that parent gender, income, educational status, ethnicity, language and child disability status were all associated with parents reporting that they often played with their child on at least one device. Parent gender and child disability status were the strongest predictors of frequent parent-child shared device use. Mothers were less likely than fathers to report often using digital devices to play with their child and parents whose child had a disability were almost twice as likely to report often using a device to play with their child than parents whose child did not have a disability.

What 0–36-month-old children do on their own with tech

Many 0–36-month-olds are reported by survey respondents to use tech on their own. As with parent-child joint activity, the most frequent activity children do alone on digital devices is watching children's TV shows and videos. Thereafter, the frequency of activities that children do alone differs slightly from those enjoyed with parents. Watching YouTube was the second most popular activity 0–3s do on their own, followed by playing games, then taking photographs on their own, viewing family

photos, being creative, playing music, speaking with family and family friends, reading books³ and listening to audiobooks (see *Figure 5*).

When asked about whether children play on their own with smartphones, mobile phones, laptops, tablets and/or desktops, the most popular device used by children on their own was reported to be a tablet, with smartphones the next most popular for child sole use. 10% or fewer were reported to use laptops on their own, and 3% or fewer to use a desktop computer on their own.

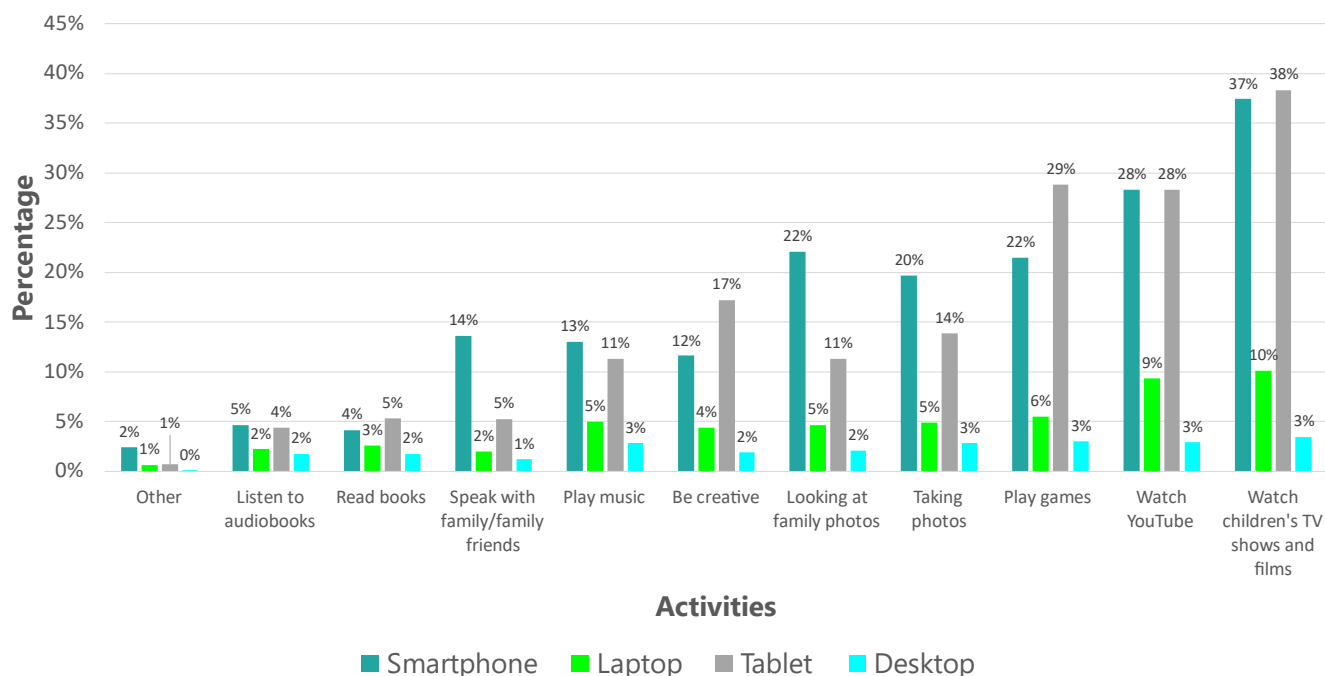


Figure 5: Activities children do on their own on digital devices⁴

In the survey, parent gender, education, ethnicity, child age and child disability were all associated with parents reporting that their child often played alone on at least one device, with ethnicity and child disability being the largest predictors.

Parents whose child had a disability were nearly twice as likely as parents whose child did not have a disability to report that their child often played on devices on their own. In interview, one parent explained how their child with disability needed ‘alone time’ after returning from highly stimulating environments such as nursery, and the parents might use a sensory therapy app on the child’s tablet so she can ‘zone out’. Other parents mentioned that they sometimes allow their child without disability to use tech alone, including TV viewing, as ‘downtime’, for a short time while the parent is busy nearby but not necessarily attending to the same device as the child.

³ Here, reading books may involve looking at pictures and words, turning pages and scrolling, touching hyperlinks, listening to sounds etc in digital books, with some emerging word and/or letter recognition for some, especially older children in the 0-36-month age range.

⁴ The activities that children do on their own are placed in descending order from right to left, with the most popular activity across all device types on the right.

In the survey, parents of 'Black, Asian and Minority' ethnicities were 2.6 times more likely than those of 'White' ethnicity to report that their child often played alone on digital devices. However, this finding was not borne out in the interviews and case studies, where the nuanced difference between a child playing independently with a parent nearby and a child 'being left to play alone' became more apparent; the former being more likely amongst all participating families, regardless of ethnicity.

With regard to what children might view on their own, the survey did not differentiate between YouTube and YouTube Kids but during interviews it became clear that most parents only allow their child access to YouTube Kids and other child-oriented apps such as Spotify Kids. We also learnt that for parents with multiple children, watching TV 'on their own' sometimes included watching with older siblings, as in the example below taken from a parent interview, where a mother explains how her children sometimes co-view programmes while she is busy in the adjoining kitchen:

They watch on their own sometimes. Maybe if I'm doing something here in the kitchen. But I (.) I keep checking on them. (Mother of 34-month-old boy and 19-month-old girl)

Some parents reported only very specific child use of tech on their own:

the only thing that she uses on her own are the interactive toys ... But she's never on her own, she's always supervised anyway. (Mother of 18-month-old girl)

Or for their child to learn with specific apps:

it's mainly his videos (.) he would watch on YouTube Kids (.) umm because it's really the only one we would have on his tablet ... he could also do his learning apps so he has Reading Eggs he'd asked for or Khan Academy and (.) ... it's between those 3 that he would just do it on his own, if I hand him it, he knows how to (.) unlock the videos and or unlock the tablet and get into whatever app he wants to get into. (Mother of 31-month-old boy)

Whilst others found child sole use of tech helpful during formal appointments, where they would join in a child's activity when possible:

... it's very kind of a solitary thing for her. Sometimes I try and interact like if, say, the other day actually I had to go down the Council Housing Office so I took the tablet with me then, because I knew she'd need it. It's the waiting in the buggy. So I was then trying to play the game with her. And she's got this thing about bumblebees at the minute. There's a game on there where bees can go to flowers and you have to pick the right flower and stuff. And I was like, "Oh, which flower is it?" And she was like, "this one", and I was like, "I think so, try it!" (Mother of 33-month-old girl)

How parents mediate their child's tech use

The design of this three-phase study has afforded broad and deep insights into the many and varied ways in which parents mediate their very young child's use of tech. Parents' support for their very young children's use of tech ranges from helping their

children to develop the operative skills to use digital devices, to modelling and encouraging social, creative and critical skills and knowledge.

In our survey, we found that (in descending order with most popular mediation type first), parents are most likely to show their child how to use a device, to join the child in what they are doing with a device, to supervise device use, to point to things on the device and name/explain them to the child, help the child learn words, letters, sounds, shapes and colours, help the child physically to hold the device, to talk with the child about content and about what they are doing, and finally to set limits on the use of the device, in terms of both time and content.

Many parents have developed specific strategies to mediate their child's technology use at home, including acting as **gatekeepers** by restricting their child's access to devices (such as setting time limits, parental locks on devices, and/or negotiating the end of child digital tech use), as **models**, by using tech themselves in ways that their very young children then seek to imitate, and as **enablers** supporting their child's exploration of tech and development of digital competences. We found considerable variation in parental gatekeeping approaches, as indicated in the quotes below:

So what we do now is I get my phone out and I use a timer on my phone, put on like a minute or two and I go to her. Look, once this, ... Once the timer goes 'Ding, Ding, Ding, Ding, Ding' Then you have to leave and it works like so well. Most of the time, maybe 90% of the time it works really well. (Mother of 30-month-old girl)

Most of the times I think he's OK if we just explain him that, for example, it's sleeping time ... that's enough for the day we need to explain him that why we need to turn this off and saying like say bye bye to Ms Rachel and he's doing OK. Bye bye. (Mother of 18-month-old boy)

... my husband and I both have apps on our phones, so we can control the tablets on our phones. (Mother of 31-month-old boy)

Some parents mentioned the time and effort it takes to try to ensure their child's digital safety, and others commented on how ensuring child digital safety and security is an essential element of contemporary parenting:

It just takes a lot of effort and sometimes a bit of expense to make sure that they don't get the wrong type of exposure, but to me it's a positive thing, giving them that digital experience. (Father of 29-month-old girl)

Yeah, it's so easy now to put parental guidance and parental access. There's no excuse to it anymore. There's no excuse for me it is just flat out just child endangerment if you're not putting some kind of parental guidance on your tablets. (Mother of 33-month-old girl)

Many parents are mindful of their own use of tech around their children, and of the need to monitor the presence of tech in the home environment, for example:

I talked to my husband about this, this week, I think we have to put restrictions on our own use. So [child's name] is not far off from the age where he'll be interested in whatever we're interested in. So I'm holding something he wants to hold that thing. Or,

and I think already we've said, we'll try and be mindful about how much we're on our phones in front of him, because it becomes really, really desirable if you're modelling it being used all the time. (Mother of 4-month-old boy)

Parents often reported what their children had learned through tech and explained how they had enabled their child's further learning by using specific programmes, apps or devices deliberately to promote their very young child's curiosity, to expand their learning and to explore specific topics their child is interested in, for example:

Or there's a tiger or (...) I'm not gonna see those in Scotland and be able to, you know, expose her to lots of different things from that respect. (Mother of 12-month-old girl)

... he really like bikes, whales and things like that. And sometimes that's hard for me to explain that it can look at it in a book and things like that. But if I then show it in on like a video of an actual whale move and things like that, it just gets that point across a bit more, I think. (Mother of 22-month-old boy)



In our case studies, we collated many rich examples of how parents and children enjoy tech together in fun, creative ways that prompt children's curiosity whilst also building their knowledge about, with and through tech.

Child language and literacy learning with tech

Given the prevalence of digital technologies in the contemporary home, it is not surprising that very young children frequently observe and take part in their families' everyday language and literacy practices using diverse digital devices. Even the very youngest children hear, see and use language in authentic contexts that include digitally mediated activities, such as watching TV children's programmes and films on Smart TVs, laptops and smartphones, and viewing and taking photographs. Many very young children play with digital toys and games, and regularly take part in video calls with close and extended family members online – with a parent or sibling and sometimes also on their own. In our interviews and case studies, several parents mentioned how the Covid-19 epidemic had changed working practices for them, making working from home for at least some days per week a feature of their daily lives. As a result, very young children regularly see their parents working on laptops and their phones at home, amplifying children's awareness of the presence and importance of tech in contemporary working, social and cultural life.

With regard to language learning opportunities when viewing children's programmes and films, in our interviews and case studies, several parents mentioned that their

child had learnt specific words and phrases when watching certain programmes intently, for example:

I feel like he has such a good memory when it comes to storytelling, and I think that comes from the things he's watched. So, he'll say something to me and then he'll go "all of a sudden out came this shadow". And this is (because) he's watched something which is about a shadow. It seeps into what he is saying. So yeah, overall I don't think it's all bad and I think it's just in moderation really. (Mother of 35-month-old and 6-month-old boys)

Whilst many parents reported that their child did not use apps or games, some parents reported they use apps marketed as beneficial for very young children's language and literacy learning. Popular apps mentioned by parents included, amongst others, apps to promote 2-3-year-olds' reading such as Reading Eggs, Khan Academy Kids, Duolingo ABC, alphabet games and songs, phonics games and apps featuring nursery rhymes.

Popular streaming apps for children's programmes included CBeebies, Disney+, Netflix and YouTube Kids. Popular programmes included Disney+, Netflix and YouTube Kids. Popular YouTube channels and programmes included CBeebies, Bluey, CoComelon and Ms Rachel. Using tech to promote children's signing was also popular amongst many of our case study participants, such as YouTube channel Ms Rachel, which is marketed as using techniques recommended by speech therapists and early childhood experts to promote very young children's language and learning through a range of activities focussed on sounds, songs, nursery rhymes and signing. Some parents subscribed to Sing and Sign⁵, with some also attending local classes with their child run by the Sing and Sign network. One mother recounted how she and her 2-year-old daughter enjoy attending Sing, Sign and Movement classes at a local community hub, and often use the Sing and Sign app at home to silently sign the words in nursery rhymes and use toys as props to enact the songs.

Whilst most parents preferred print books over digital books, some reported how they read digital stories with their children, as well as enjoying print picture books together. Many families we worked with had bought Yoto or Toniebox story-playing devices for their very young child, with audio-recordings of their favourite stories, which children sometimes listened to whilst looking through the same book, or (more often) a different book. These gave very young children agency to decide what stories they wanted to listen to, sometimes on their own, with a sibling or parent. Although some parents had bought digital books or e-books for their very young child, most parents preferred print books, including print books with tactile and interactive features, including digitally produced sounds.

Video calls were mentioned by some families as activities that their very young children take part in. These offer rich opportunities for children growing up in monolingual families to practise using words to express meaning to distant others,

⁵ <https://singandsign.co.uk>; <https://www.youtube.com/@msrachel>

and to act out scenes from their lives and show cherished items, accomplishments and toys to grandparents, aunts, uncles, cousins and sometimes also family friends who they might see infrequently in person. In multilingual families, video calls create opportunities for very young children to hear and learn words and phrases both in English and languages other than English, and to learn about the cultures and social practices of family members who may live overseas.

Through these digitally mediated conversations, very young children learn to use different languages and to develop 'translanguaging' skills and knowledge. That is, they develop the capacity to switch seamlessly between languages, to use two or more languages simultaneously and to include movement and silent modes of communication in their communicative repertoires. These competencies and practices are known to promote cognitive growth whilst the child is also forging loving relationships with distant family members.

We found many examples of very young children taking part in video calls in our case studies, in both monolingual and multilingual families. For example: a child talking with his distant grandmother while eating breakfast, and thoughtfully 'feeding' blueberries to his grandmother via the phone screen; a child acting out scenes from a story in a language other than English with a distant grandma; a child regularly enjoying stories while seated on the floor with her father in the UK and her grandmother in Japan, whose presence and participation in the story-reading event was enabled by the father propping his phone up on the floor so the grandma formed part of the storytelling circle (see *Figures 6 and 7*). In this story-sharing event, the father read a favourite, traditional book in Japanese, while the child acted out the protagonist's rocking movements and the grandmother did the same in her home in Japan. The parents in this case study recounted how their child took part in daily video calls with the grandmother, enjoying shared stories together, yoga activities, songs and language play. This example is just one of many that illustrate how digital activity can be visual, auditory, and experienced through touch and movement, such as dancing and singing, sharing nursery rhymes, stories and playing games.



Figure 6: Traditional Japanese children's story in Japanese enjoyed by father and 22-month-old daughter



Figure 7: Japanese children's story acted out by 22-month-old child in England and her grandmother in Japan during a daily video call on father's smartphone

Combining different ways to communicate is often referred to as using multiple modes of communication. With tech, very young children have to learn which modes are effective with which devices, and this takes practice! As mentioned, many parents reported how their child aged under three years had learnt signing and used this frequently at home with family members. One case study child had tried signing to Google Home to tell it what they wanted, they had gradually learnt that Smart home devices respond to clearly enunciated words. Many very young children do not have sufficiently clear diction to operate such devices, so some children had learnt, though observation, that tapping their Smart device could also make it work if they were unable to activate voice control with their own voice. Similarly, we found many instances of very young children learning different kinds of touch movement to activate touch-responsive screens on Smart phones and tablets.

Some parents who were learning English appreciated the language learning opportunities offered by joint parent-child media activity not only for their child but also for themselves. For example, a mother from Ethiopia who was seeking asylum for her family mentioned that she and her child enjoyed watching cartoons together in English and found that singing along to songs in the cartoons was helping them both to learn English words and phrases. Overall, we found many instances of very young children learning more than one language when using technology, sometimes learning with their parents, and sometimes supported by a parent who was already fluent in a language other than English.

Playful learning with tech

Most parents recognise the value of tech for children to learn skills, knowledge and digital competency. In our survey, most parents strongly or somewhat agreed that digital devices offer opportunities for young children to develop skills with reading, numbers, and creativity. Similarly, most respondents strongly or somewhat disagreed with the assertion that digital devices are damaging to children's learning.

In interview, parents also mentioned how they appreciate the ways that tech gives parents easy access to fun resources that capture their child's attention. For example:

... he loved learning the sounds of the animals as well. So we asked ... hey Alexa play a cow noise So it would play the cow noise ... it's hard to get that from like a book or a toy, isn't it sometimes? (Mother of 22-month-old boy)

Interactive toys are also popular with some parents and children:

... she's got a stacking toy and you put the rings on it, and it'll make a funny noise and then when you've done the whole thing and you've put the star on the top, it starts singing and lights up. And she does enjoy that. So, we've got a couple of interactive toys, but she doesn't do games or anything like that, like, you know, like console games. She's too little for that, but she has got a book, there's also - she's got a little teddy bear, which you press. (Mother of 18-month-old girl)

Some parents mentioned how their young child enjoyed drawing and painting on tablets, and how these activities sometimes blended with learning about literacy and numeracy.

... (there's) YouTube stuff that he looks at, which is number blocks, which I think is a little bit more educational, he does other stuff like more creative things. So, like the Notes pages on ... the iPad, he'll like draw. But now he took some pens to draw on the whiteboard as he likes to do that, so he'll go into the notes page and just draw different shapes asking me to draw something or. He'll say you write the alphabet and then I write from A-Z or numbers for example, and then he'll go through them and read them or he'll say can you write my name and we'll write his name together. So with this finger on the iPhone, on the iPad, my husband has a pen. (Mother of 35-month-old and 6-month-old boys)

Popular children's culture, such as Thomas the Tank Engine, is available to children across diverse media and modes such as moving images and sounds on apps, YouTube clips, TV and Smart TV, as interactive games on apps, static images and words in books, as wearable merchandise, in tangible miniature toy formats and as full-size working models in museums (see *Figure 8*).

During our case studies, we observed how many very young children blend digital with non-digital activity, such as singing songs, enjoying nursery rhymes, drawing with pencils on paper while the TV played in the background or a Smart Speaker played music, which they sometimes attended to.

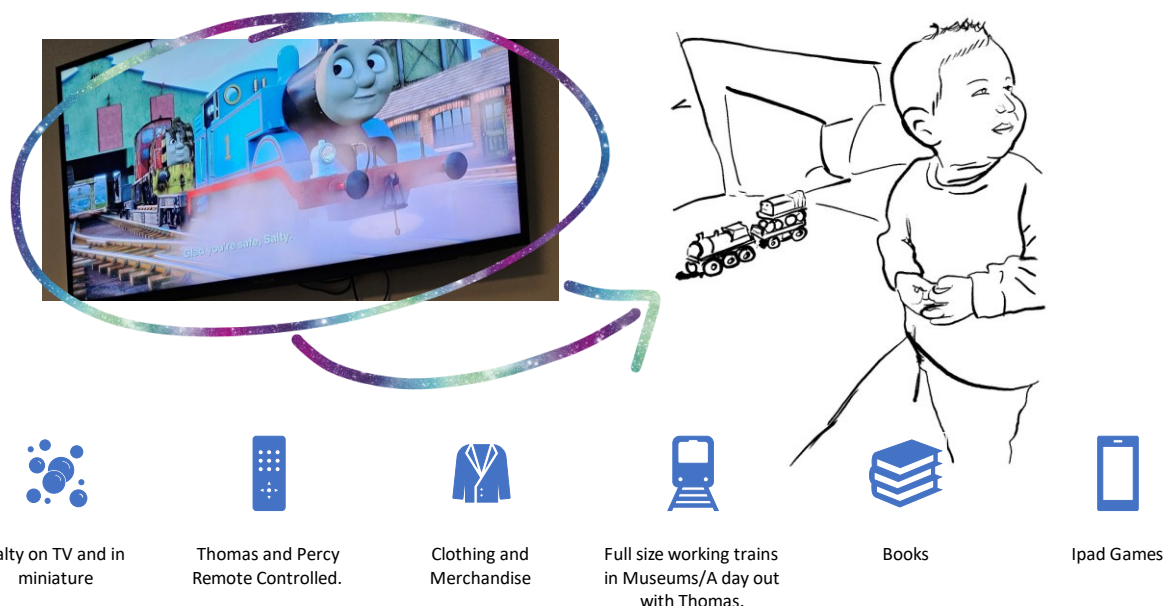


Figure 8: Popular culture across diverse media in children's play

We also observed how many children actively explore their own interests about and with tech. For example, many interactive toys, games and apps marketed as 'edutainment' prompt children's learning about cause and effect, rousing children's interest when they generate a response to a child's action, such as a noise and/or moving image on a screen or a child exploring cause and effect with a digitally enhanced toy shop till. Sometimes, parents reported that their child had become fascinated by particular devices, such as a digital printer and digital displays on washing machine and dishwasher controls. One 26-month-old boy whose mother had very few tech resources at home (smartphone, Smart TV and digital fan heater) found highly creative uses for the digital fan heater, using the energy and air flow created by the fan heater to blow a balloon around the kitchen, which he thoroughly enjoyed attempting to catch or to keep in the air.

In short, we found that in most homes, tech is integrated in very young children's playful lives as just another play artefact, alongside non-tech artefacts. For some children, though, the diversity of tech available is wider than it is for other children whose parents may not own a range of devices.

Sensory stimulation, movement, embodied cognition and tech

Many parents found links between their child using digital devices (both touch screen and non-screen) and their playful development through their bodies and their senses. Parents noted how digital activities prompt their child's physical engagement (e.g. mimicking the gestures and actions of people and characters on TV programmes such as Ms Rachel, and Justin's House), visual development and hand-eye coordination (e.g. drawing games, colouring apps, shape sorters, and matching

games), auditory development (e.g. getting excited when recognising a programme or app jingle, or a family member's voice or face during video calls) and the integration of sensory systems and interactions (e.g. copying a dance when watching TV).

Many parents recognize that, contrary to some social assumptions that equate child tech use with being sedentary and passive, their children are often physically active and interactive whilst using technology:

... if it's something like CoComelon, she will get up and dance and sing away with him. (Mother of 25-month-old girl)

... she wants to run around with it [mobile phone]. (Mother of 27-month-old girl)

There is a clear understanding from parents that children's sensory stimulation when using digital devices enhances aspects of their cognitive learning and development.

... a lot of that comes from the using the phone. So she's particularly good at counting. She can count to 15. She knows her colours, she knows her shapes. She can (..) you can write a letter on a on a bit paper and she'll tell you what that letter is, so I think a lot of that comes from using the tablets and the educational stuff she goes into. (Father of 23-month-old girl)

... if you sing something from Moana, she does put bits in, do you know, so she's obviously picking a lot up and inevitably that will be helping her talking and her communication. (Mother of 25-month-old girl)

These sensory interactions of movement, sound, and vision are not solitary. Rather, parents often join in their child's actions, seizing opportunities offered by their child's embodied responses to digital activity to have fun, interact joyfully and support their child's learning:

... and we often just put music on it [TV] as well and have a wee boogie, so I think it is using it in different ways ... she often doesn't just sit and watch. (Mother of 25-month-old girl)

So I'll talk him through what he's doing or I'll, you know, say the name of the animal that's making the sound, things like that, so it's not too dissimilar to what you were doing with like flash cards. (Mother of 21-month-old boy)

Parents commented and we also observed how very young children attend closely to their parents' digital device use, copying and mimicking their movements and behaviours so effectively that they were developing tech-touch, finger-movement and screen navigation skills that enabled them to access touchscreen devices and digital controls independently:

... I've not really taught him; he's just figured it out! Like pressing the play on videos. (Mother of 21-month-old boy)

... she can do all of that other than turn it on and off. We have to do that for her, but she can swipe through the apps and search. So once the tablet's on, she'll navigate away no problem so (Father of 23-month-old-girl)

As well as physically active and sensorially stimulating activities, many parents reported moments when they turn to digital tech to help calm and settle their child, for example, as part of their child's bedtime routine using devices such as Lumie Lights, Yoto players or TV programmes and apps playing 'white' and 'pink'⁶ noise.

... he watches the same TV shows every night, it's part of his bedtime routine. (Mother of 23-month-old boy)

Okay, she's not watching or using the digital device at that time, but I'm using it to try and help sooth her, maybe back to sleep, or if she's upset. (Mother of 12-month-old girl)

The evidence generated through this study suggests that young children's digital activity often involves sensory exploration through touch, vision, hearing, movement and embodied cognition. In short, very young children are often feeling, thinking and moving when they engage with digital media, which is integrated seamlessly in many homes as part of everyday life. Whilst tech may sometimes be used intentionally by parents to stimulate children's learning and enjoyment, it is also used to calm and settle children's sensory systems or to aid their sleep-wake cycle. Although parents recognise the many benefits of tech for children's development, they balance this with concern that too much tech is detrimental to their child.

Parents' confidence around digital technologies

Most survey respondents reported that they know how to keep their child safe when using digital technology (73% strongly or somewhat agreed with this statement). Fewer parents (60%) strongly or somewhat agreed with the statement that they know where they can access support and advice about children's digital usage, yet 50% either agreed (34%) or neither agreed nor disagreed (16%) with the statement that they did not feel they had enough information to keep their child safe when using digital technology.

Most parents (66%) strongly or somewhat agreed they have all the skills to support their child using digital devices, but this varied across demographic groupings. Parent gender, employment status, ethnicity, language(s) spoken at home and child age were all associated with parent confidence in using digital devices, with child age and language spoken at home the strongest predictors. Parents of older children were more confident than parents of younger children. In the survey, parents who

⁶ White and pink noise are believed to enhance sleep, partly by masking other sounds in the environment. White noise balances all sounds across the human hearing spectrum (e.g. a fan, radio static). Pink noise plays louder low frequency sounds and softer high frequency (e.g. waterfall, rustling leaves).

spoke English and another language, and parents who spoke another language only at home saw themselves as significantly less confident than those who spoke English only. However, in our interviews and case studies with multilingual families, we found most multilingual parents had high levels of confidence as tech users and were reflective and competent in how to support their child's tech use.

Parent confidence was not significantly associated with the number of household devices or child owned devices, or with parents reporting that they often used digital devices to play with their child or that their child often played with digital devices on their own.

In interview, we found that whilst some parents doubt their own tech skills, describing them as 'basic', others feel confident to support their very young child's tech use because they always know what their child accesses on digital devices, and because they trust recommended age appropriacy guidance on popular media sites and apps, even though they may have less confidence in managing their child's tech use in future. Some parents had less faith in the extent to which popular sites' child protection policies are effective:

I would say at the moment confident, but I do worry for her as she gets older... you go on YouTube and you enter a total wide world of stuff. And if she's not got that safety understanding, then she will just click on different links and you know YouTube Kids to an extent protects but absolutely does not. (Mother of 25-month-old girl)

Other parents mentioned that although they felt confident in general to support their child's safe tech use, they recognised they could do more to ensure this, for example:

So I think, am I confident? Yees? (rising tone, drawn out), but I think there's probably more I could do to be a little bit more on top of it. (Mother of 8-month-old boy)

I'm confident in my abilities, but I think there's always room for improvement and there's always something that I can learn. And you're looking and finding out about that online. (Mother of 33-month-old girl)

Whilst some parents reported they use parental controls on devices and social media sites, others had not yet begun to do this, and instead trusted in their own close surveillance of their very young child's tech use.

Parents balance concerns with opportunities for their child's tech use

Most parents in this study seemed to accept tech as an inevitable component of their own and their young children's present and future lives yet were concerned about its potential harm for their own child's wellbeing and development. Whilst parents valued the opportunities offered by digital media for their child to have fun and to learn about language, literacy, numeracy and to build their knowledge about the world in playful ways, most parents also expressed concerns about how tech could

impact negatively on their child, and rationalised their child's tech use by weighing up pros and cons.

The survey results indicate that most parents are concerned that excessive use of digital devices will negatively impact the amount of time their child spends socialising with other children and adults (67% strongly or somewhat agreed with this statement). 64% parents strongly agreed or somewhat agreed that they grow anxious when their child 'spends too long on digital devices', and most parents (62%) worry that their very young child might access inappropriate content online.

With regards to children's health and wellbeing, most survey respondents (80%) somewhat or strongly agreed that digital devices offer opportunities for young children to have fun but also (70%) that young children use digital technology too much too early. Regarding parent attitudes and their children's learning, most respondents (75%) strongly/somewhat agreed that digital devices offer opportunities for young children to develop creative skills, skills with reading, and skills with numbers. At the same time, most parents strongly/somewhat disagreed with the assertion that digital devices are damaging to children's learning.

The interviews and case studies add texture to the survey findings about parental concerns for children's physical, mental, social and emotional wellbeing as well as their perceptions of the opportunities offered to their children by tech. Key concerns voiced by parents include how tech can damage children's physical health, especially their eyesight.

Parents recognise the need for moderation in children's tech use, for example:

... I don't think it is harmful for them to be using some technology some of the time.
(Mother of 12-month-old girl)

However, there was sometimes a tendency for parental views about their child's tech use to differ between fathers and mothers:

... There is not much harm in it, but I believe like there can be harm, there can be some like negative points I would say in them as they like affecting their eyes as his GP mentioned and also making him like if they use technology they wouldn't do any physical activity. So that's what I believe. So that's me more me limiting digital technology than his dad. (Mother of 13-month-old boy)

Many parents also mentioned their awareness of negative social judgement about contemporary parents tending to allow their children to overuse tech, and their views about how they fear they may be perceived as a parent, including open criticism amongst parents, on parent social media groups such as WhatsApp etc.

Early childhood education and care practitioners' views

The ways that parents balanced potential risks with opportunities for their child's tech use contrasted with some early childhood education and care (ECEC) practitioners who we interviewed. Several practitioners appeared to have formed

negative views about parents' misuse or overuse of tech, and to believe that the ubiquity and overuse of technology lay at the heart of some children's behavioural and/or communication challenges. For example:

... so if a health visitor or midwife has put a family in for one-to-one support which might be for speech and language, it might just be for managing behaviour, it might be for, I don't know, toileting or fussy eating, or any of those things. That's about parenting, and within that would come the fact that we would say to them, "turn it off".

... we were already highlighting these other risks prior to Covid that you know language and communication was not developing as good as it was previously and we felt that online technology was at the back of it not necessarily what the child was on, but what the adults were doing.

Despite these reservations, many practitioners were sympathetic towards the dilemmas that parents face due to the ubiquity of tech in daily life. Many recognised the benefits of tech for learning, and appreciated how children's interests can be explored more easily with technology than through traditional printed resources:

I definitely think that technology can be used (.) to in small doses to enrich their learning and their development.

... technology has its place ... it allows children to access the world that they wouldn't necessarily be able to access ... I mean, growing up myself it was ... encyclopaedias that you had to look through and it was all really dull. But ... to learn through a screen about things that you couldn't possibly learn ... on your own, is fantastic, isn't it? It really does bring it to life.

Some practitioners mentioned how they use digital technologies to look things up with children, to teach colours, sequencing, symbols such as for weather forecasts and animals sounds, and for creative literacy activities such as developing animated story boards. Some valued how the multiple visual and auditory modes offered by technology helped them connect with and engage children who were in the early stages of learning English.

Like parents, ECEC practitioners are conscious of some divisive attitudes in the media and society about young children's use of digital media. Most appreciated that children can benefit from media through being entertained, playing, learning and relaxing, and recognised that discussions around children's excessive 'screentime' can be reductive, critical of parents and can lead to parental anxieties.

Summary

Drawing together key findings from the *Toddlers, Tech and Talk* study, there is no doubt that digital technology has a firmly established place in the social and cultural life of families at home and in families' wider communities. However, there are wide disparities in the range and number of digital devices owned in different households and how they are used. Whilst some of these disparities may align with parent

choice, families on lower incomes tend to own fewer devices and a narrower range of devices than families with higher incomes and higher levels of education.

In terms of parent attitudes towards digital technology and young children, compared to research literature, parents seem less resistant to tech and to accept tech as an inevitability in the present and future lives of this young age group. Through digital connections such as video calls, even very young children learn about their family's cultural values, and in so doing, about themselves and their own identity. Families noted the enduring influences of the Covid-19 epidemic on changes to patterns of home working, with children regularly seeing parents working on laptops and smartphones and holding online meetings with distant others.

At home, children aged 0-3 years observe their parent and other family members using a very wide range of digital devices, some of which have screens, but many do not. Through this study, parents have shared with us the many different ways their very young children engage with tech at home, and how they mediate their child's tech use. Most parent-child joint media use is intentionally geared towards learning and creative activities, but tech is also used for fun and mutual enjoyment. While some children are offered tech to use on their own, for example, to listen to a story on an audio storytelling device while their parent prepares a meal nearby and listens in, or while a parent attends to an older or younger sibling, some parents also sometimes use tech for 'downtime', when a child might actively engage with tech on their own, to relax or calm down. Most parents use digital baby monitoring devices in their very young child's bedroom, and/or use Smart devices with screens as a form of intercom within the home. Many parents use apps with 'white' or 'pink' noise to aid babies' sleep. Many parents might give their child a digital device, such as the parent's phone, to keep them occupied while the parent attends a medical or social services appointment, or while travelling on public transport. A minority of parents report their child uses tech while out walking, in a pushchair or when out shopping.

When out and about in their local communities, very young children see a plethora of technology and digital displays as integral to everyday life, at shop checkouts, parking machines, train and bus stations and on public transport as well as in public and private facilities designed for child use, such as museums, amusement parks and, in some locations, even, in one instance, a walk in the forest!

A final word from parents and practitioners about this research

The parents and professionals who took part in this study agreed that the digital experiences of the youngest children in our society have been relatively overlooked, and that adults need richer information on good practice. Parents and practitioners welcomed this study to draw attention to issues around child use of technology and to address their own and societal concerns about the risks for children of using too much tech too soon. In the words of one participant:

... I will say, I do think this study is really important. And I think it needs to be widely

taught just how addictive technology can be on young, influential minds. And also how dangerous and how vast the Internet is for someone who can barely understand certain words. I think more awareness needs to be brought to the situation.

(Mother of 33-month-old girl)

Despite such concerns, parents and practitioners valued the wide array of opportunities offered by technology for their children's present and future lives. With regard to this study, many participants valued its potentially helpful outcomes and recognised a need for reliable, research-informed information to help ensure children's positive experiences with digital devices.

The research team propose that further research is needed to continue to build knowledge and understanding in this field, and to keep abreast of social and technological changes in young children's lives both at home and in early care and education. The knowledge generated through this study and through future work should be used to raise awareness of the presence of tech in very young children's lives, and as a basis to inform policy development and practice guidance. We suggest that a nationwide endeavour is needed to enable the youngest children in our society to thrive in their fast-changing home environments that are increasingly permeated by digital media.

APPENDIX 1: Survey Demographics

Survey development and participant recruitment

A draft survey was designed and piloted July–November 2022 and included the development of bespoke attitudinal measures focusing on parent attitudes towards digital technologies and devices (health and wellbeing); parent attitudes towards digital technologies and devices (learning); parent confidence using digital technologies and devices; and parent anxiety around the use of digital devices (McLaughlin et al., 2024). Target participants were adult (aged 18 years+) mothers, fathers, and legal guardians of children aged from birth to 36 months. Young people and adults aged under 18 years and those who were not legally responsible for the home-based care and education of 0–36-month-old children were excluded.

The survey was designed to respect respondents' right to make choices in what and how much information they shared with us. We asked only 3 compulsory 'qualifying' questions to ensure respondents were: 1) the legal guardian of a child aged 0–36 months; 2) UK residents; and 3) aged 18 years or over⁷. For the remainder of the survey, parents were not obliged to answer questions on personal demographic data.

The survey was launched online 7th December 2022 on the Qualtrics platform, using an open call recruitment strategy via social media and diverse ECEC and Parent networks. In line with the project's ethical stance towards inclusivity, the survey was also offered in print, as an oral interview for visually impaired respondents and was translated into significant languages of UK minority populations, including Welsh and those languages most frequently cited by minority populations in the 2011 Census⁸ as "can't speak English well" or "not at all" (Arabic, Bengali, Chinese, French, Gujarati, Panjabi, Polish, Romanian, and Urdu). To enable the inclusion of recent asylum-seeking populations, the survey was translated into Farsi and Ukrainian.

By March 2023, we had achieved over 550 responses, but completion rates had slowed. We subsequently commissioned a UK-based online survey panel provider to secure an additional, nationally representative sample of 1,000 respondents (250 from each of the UK's four nations). Ethical approvals were granted for this amendment, and the survey closed 28th June 2023.

Total responses and data analysis

1603 valid responses were generated through the combined open call and commissioned panel approaches. These were encrypted and stored on Qualtrics

⁷ This adult age requirement was stipulated by the institutional research ethics approval process.

⁸ At the time of the survey development, results from this aspect of the 2021 UK census data were not available. On release of the 2021 census data, there was one change, that Spanish had replaced French as most frequently cited by families who reported they did not speak English well or not at all.

servers protected by firewall systems. 159 respondents either did not provide a valid response about their child's precise age in months or indicated later in the survey that their child was older than 36 months. These were therefore excluded from our database. All descriptive statistics and analysis are based on the remainder where the age range of the child was 0-36 months (n= 1,444). Of the 1,444 responses, complete responses were provided by 1399 respondents and partial responses by n=45 (97% and 3% respectively).

Data analysis was conducted in SPSS V29 and Jamovi V2.4.11. A descriptive overview of the data was produced in frequency tables for all key variables. Multiple linear and logistic regression analyses were then conducted in SPSS to test associations between a range of outcomes and various parent, child and household demographics.

Summary of child and parent respondent demographics

Child Age: The distribution of child age groups in months was: 0-6 months (n=149); 7-12 months (n=118); 13-18 months (n=165); 19-24 months (n=273); 25-30 months (n=360); and 31-36 months (n= 379) (Total = 1444). This question was completed by all respondents.

Child Gender: 48% (n=687) female and 52% (n=749) male. N=8 respondents did not complete this question.

Child disability: 4% (n=63) respondents reported their child had a disability. N=11 respondents did not complete this question. Reported child disability included: social/behavioural challenges (n=28), learning disability (n=20), and small numbers of children with visual, hearing or mobility disability or issues with dexterity. Some children had more than one disability.

Parent status: 80.6% (n=1161) respondents were mothers, 17.8% (n=257) fathers, 0.8% (n=11) legal guardians and 0.8% (n=12) 'Other' (of these latter respondents, all were acting as legal guardian, some were grandparents (n=5), foster carer (n=1), aunt (n=1), child minder (n=1). N=3 respondents did not answer this question.

Parent age: The largest respondent age group was 31–40 years (59%; n=849 participants), followed by 18–30 years age group (30%; n=423), 41-50 years age group (10%; n=145), then aged 51+ years (n = 16; 1%). N=5 respondents did not answer this question.

Parent employment status: 85% (n=1226) respondents said that there were employed, 8% (n=108) unemployed and 7% (n=107) economically inactive. N=3 respondents did not answer this question.

Parental educational qualification: 60% (n=850) respondents had a degree or higher, 29% (n=409) A-Level, Certificate or Diploma, 11% (n=168) had no qualifications/GCSE only. N=17 respondents did not answer this question.

Parental income: 67% respondents (n=908) were fairly evenly split across three income brackets ranging from £15,600/annum to £51,999 per annum. 12% (n=158) earned 52,000- £99,999, 10% (n=136) earned £10,400-15,600/annum; 9% earned under £10,400 (n=115), and 2% earned £100,000+ (n=35). N=92 respondents (15%) did not answer this question.

Parental ethnicity: 73.1% (n=1043) respondents identified their ethnicity as English/Welsh/Scottish/Northern Irish/British, 8.3% (n=118) Irish, 5% White Other /Gypsy/Traveller, 3.9% (n=56) any other mixed/multiple ethnic background, a further 3.9% (n=56) Asian/British Asian background, 5.2% (n=74) Black/Black British/African/Caribbean, and 0.6% (n=9) 'Other' (including Arab). N=17 respondents did not answer this question.

Languages spoken at home: 79% (n=1430) respondents reported speaking English only at home, 19% (n=269) English and another language. 2% (n=36) spoke other language(s) at home and not English. 14 respondents did not answer this question. In total, 51 languages other than English were spoken in respondent homes, with the most popular being Welsh, Irish (Gaelic), Spanish, Polish, French, Arabic, Urdu, Bengali, Panjabi, British Sign Language, and Chinese, in that order. Yoruba was the most frequently noted free-text 'Other' language.

Residence location: 79% (n=1137) reported they lived in a city, town or suburb and 21% (n=295) in a semi-rural or village rural area. N=12 respondents did not complete this question.

Nation: 52% (n=758) respondents lived in England, approx. 16% Wales, 16% Northern Ireland and 16% Scotland (n=230, n=227 and n=229 respectively). All respondents answered this question.

Marital status: Most respondents indicated they were married (61%, n=861), 21% (n=299) were cohabiting in a partnership and a further 2% (n=29) in a civil partnership. 15% (n=204) were single and 1% (n=20) were divorced. Less than 1% (n=4) reported they were widowed from marriage or civil partnership. 31 respondents did not reply to this question.

APPENDIX 2: Survey Response Distribution

The map below illustrates the range of geographic locations of survey respondents, as indicated by red dots across the four UK nations of England, Northern Ireland, Scotland and Wales.



APPENDIX 3: Examples of the range of digital devices in contemporary homes

Below is an indicative list of digital devices mentioned by parents and/or noted by the research team as being present in participant homes. Some of the devices without screens have digital monitors, displays or connect to screens, but these are optional, and most did not have these.

DIGITAL DEVICE (screen integral)	DIGITAL DEVICE used/ touched/ watched by children (without screen, or with optional screen connection)	DIGITAL DEVICE without screen used by adults and seen by children being used
Amazon Fire Kids Tablet	Alarm Clock (for child)	Air Fryer
Baby monitor	Amazon Firestick	CD Player
Desktop/PC	Bluetooth Alexa Mirror	Chromecast
Drawing tablet (no internet)	Car Radio	Digital cat flap
Camera	DAB Radio	Microwave
CCTV	Digital fan or heater	Printer
E-Reader	Digital thermometer	Projector
Facebook Portal	Digital Toys not connected to internet	Record Player
Gaming Console	Dishwasher	Smart coffee machine
Interactive Whiteboard	DVD player & control	
Laptop	Interactive Books	
Mobile Phone	Internet connected toys	
Peloton	Karaoke system	
Smart Home Device (with screen, Alexa, Google etc)	Lava lamp	
Smart TV /TV	Leapfrog leap tv	
Smart watch/Fitness Tracker	Lumee Lamp	
Smartphone	(Digital) Music books	
Snap touch	Raspberry Pi	
Tablet	Ring doorbell/ Smart doorbell	
VR Headset	Robot vacuum and robot mop	
	Security cameras as baby monitor/ camera	
	Smart guitar amp	

DIGITAL DEVICE (screen integral) ctd.	DIGITAL DEVICE used/ touched/ watched by children (without screen, or with optional screen connection)	DIGITAL DEVICE without screen used by adults and seen by children being used
	Smart home device (Alexa, Google etc)	
	Smart home technologies (alarms, lights, motion sensors, thermostats, vacuum cleaners etc)	
	Smart music speaker	
	Smart star projector	
	Smart washing machine	
	Smart weather station	
	Storytelling devices (Toniebox/ Yoto player)	
	Toys connected to Internet (Smart robots for Kids, Robot dog) / Internet of Toys ⁹	
	TV Soundbar	
	Voice activated lights	
	Wearable technologies (e.g., Owlet Dream Sock Smart Baby Monitor)	

⁹ 'Internet of Toys' describes toys that connect to the internet, which can be controlled using a smartphone app, voice commands or Bluetooth. Such toys collect, use, and share data via the internet and now constitute a multi-billion US\$ share of the global toy market (statista.com).