

Research report

Children, technology and play



Marsh, J., Murris, K., Ng'ambi, D., Parry, R., Scott, F., Thomsen, B.S., Bishop, J., Bannister, C., Dixon, K., Giorza, T., Peers, J., Titus, S., Da Silva, H., Doyle, G., Driscoll, A., Hall, L., Hetherington, A., Krönke, M., Margary, T., Morris, A., Nutbrown, B., Rashid, S., Santos, J., Scholey, E., Souza, L., and Woodgate, A. (2020) Children, Technology and Play. Billund, Denmark: The LEGO Foundation.

June 2020

Table of contents

Section 1: Background to the study • 4

- 1.1 Introduction • 4
- 1.2 Aims, objectives and research questions • 4
- 1.3 Methodology • 5

Section 2: South African and UK survey findings • 8

- 2.1 Children, technology and play: South African survey data analysis • 8
- 2.2 Children, technology and play: UK survey data analysis • 35
- 2.3 Summary • 54

Section 3: Pen portraits of case study families and children • 56

- 3.1 South African case study family profiles • 57
- 3.2 UK case study family profiles • 72
- 3.3 Summary • 85

Section 4: Children's digital play ecologies • 88

- 4.1 Digital play ecologies • 88
- 4.2 Relationality and children's digital ecologies • 100
- 4.3 Children's reflections on digital play • 104
- 4.4 Summary • 115

Section 5: Digital play and learning • 116

- 5.1 Subject knowledge and understanding • 116
- 5.2 Digital skills • 119
- 5.3 Holistic skills • 120
- 5.4 Digital play in the classroom • 139
- 5.5 Summary • 142

Section 6: The five characteristics of learning through play • 144

6.1 Joy • 144

6.2 Actively engaging • 148

6.3 Iteration • 150

6.4 Meaningful • 152

6.5 Socially interactive • 155

6.6 Summary • 156

Section 7: Adult mediation of digital play • 158

7.1 Introduction • 158

7.2 Adult views about children's use of technologies • 159

7.3 Adult mediation in family contexts: parents • 162

7.4 Adult mediation in family contexts: adults beyond parents • 165

7.5 Adult mediation in school and community contexts • 166

7.6 Summary • 167

Section 8: Conclusion • 168

8.1 Summary of key findings • 168

8.2 Implications of the study • 175

8.3 Concluding comments • 179

References • 180

Appendix 1: Methodological approaches in the UK and South Africa • 186

Endnotes • 198

Section 1: Background to the study

1.1 Introduction

This report outlines the key findings of a co-produced study, developed in collaboration between academics from the University of Sheffield, UK, University of Cape Town, South Africa, LEGO Foundation and Dubit. The project was co-produced in that all project partners contributed to the development of the project aims and objectives and were involved in data collection, analysis and dissemination. The aim of the study was to identify the relationship between children's uses of technology, play and learning.

Children have increasing access to a range of digital technologies in homes, schools and communities from birth and this is inevitably impacting upon the play landscape of children (Marsh, Plowman, Yamada-Rice et al., 2015). There is a need to investigate in depth the relationship between play and technology to identify ways in which technology might facilitate or hinder play, and the opportunities it offers to enable children to develop and learn.

Play is a complex activity that has been theorised from a variety of disciplinary perspectives, meaning that there is not one unifying definition; rather, we need to acknowledge its ambiguous nature (Sutton-Smith, 1997). In this context, nonetheless, it is useful to consider the qualities of play that are agreed upon consistently in the literature, namely that 'play is apparently purposeless, voluntary, outside the ordinary, fun, and focused by rules' (Eberle, 2014: 215). The purpose is within the activity and not outside of it. Play is a child's work or practice and inspires adults to also see play as their work (Paley, 2004: 3), thereby identifying play as lifelong (Haynes & Murris, 2019). There is extensive evidence that play supports learning, and Zosh, Hopkins, Jensen et al. (2017: 16), based on a review of relevant literature, suggest that:

optimal learning through play happens when the activity (1) is experienced as joyful, (2) helps children find meaning in what they are doing or learning, (3) involves active, engaged, minds-on thinking (4) iterative thinking (e.g., experimentation, hypothesis testing), and (5) social interaction.

These five characteristics of learning through play were explored in this project in relation to children's uses of technology. The role of adults in the facilitation of playful learning (Jensen, Pyle, Zosh et al., 2019) through technology use was also explored.

1.2 Aims, Objectives and Research Questions

The aims of the study were to explore the contemporary play environments of children in order to identify the ways in which children's play is shaped by technology, to examine the relationship between digital play, learning and creativity, and to explore the role of adults in mediating digital play.

The research objectives were as follows:

- To explore how children engage with digital experiences across different contexts of their daily lives and to identify how far these experiences relate to the LEGO Foundation's Five Characteristics of Learning Through Play.
- To explore the dynamics operating across the digital ecology of children's play (in homes, communities and schools) in terms of synergies, dissonance and transfer, and to identify the implications for learning.

- To consider the relationship between the extent and type of children's use of technologies in their everyday lives and specific skills, particularly creativity, knowledge and dispositions, including an assessment of the relationship between technology use and well-being.
- To examine the roles of adults in facilitating children's playful learning with technologies across different contexts, with particular emphasis on the types of engagement and facilitation.
- To identify the implications of the study for the toy/ children's media industry, for policy on parenting advice and guidance, and for the development of educational policy and practice, in particular identifying the balance and engagement children have with technologies.

The study addressed six key research questions, as follows:

- What is the relationship between children's use of technology and their play in everyday life?
- What skills and knowledge do children develop in their play with technology?
- What is the relationship between play, technology and creativity?
- How far does children's play with technology demonstrate the five characteristics of learning through play?
- How do parents and adults facilitate children's play with technology, and what are their views on this issue?
- To what extent is children's play with technology shaped by socio-cultural contexts?

1.3 Methodology

The study adopted a mixed-methods approach. Parents of 3–11-year-olds were invited to complete a survey, and 30 parents in each country then took part in telephone interviews in order to follow up themes from the survey in greater detail. Case studies with families were undertaken (Section 3 provides detailed pen portraits of each family). In the case studies, parents and children were interviewed and videoed. Parents also filmed their children using technologies, and they and their children were asked questions about the videos. Parents were invited to share images and videos with researchers using WhatsApp. Children in the families were also given diaries to record their use of social media and television, and used GoPro cameras to record their digital play. Further, children were invited

to build a toy they would like to be invented using LEGO bricks. Children were invited to create concept maps on a number of questions relating to play, technology and learning. In addition, the children were observed in schools using technology, and were also observed in a regular after-school club or community venue they visited. In each case, the child's class teacher and the community/ after-school club leader were interviewed. Finally, children in schools took part in focus group interviews in which they were invited to create collages, complete concept maps and build a toy they would like to be invented using LEGO bricks. Table 1 outlines the number of participants in each stage.

Table 1: Participants

	South Africa	UK
Survey respondents	1,286	2,429
Case study families	9	10
Case study children	10	17
Number of early years settings and primary schools involved	9	5
Focus group children	49	71
Telephone interviews with parents	30	30
Teachers and community members interviewed	14	24

The survey data were processed and analysed using the IBM SPSS 22 statistical package, focusing on an analysis of differences in relation to age, race/ ethnicity, gender and socio-economic status (SES). The qualitative data were analysed using a deductive coding framework which drew on the LEGO Foundation Learning Through Play Experience Tool (LTPET). The tool begins with an analysis of how far a playful experience is agentic.

When children's agency is facilitated, they are active in making choices about their play, and have a sense of self-efficacy in relation to their play experiences. The psychological scaffolding of the LTPET consists of the six stages of agency: Non-Play, Passive, Responding, Exploring, Owning, Recognising, Transferring (see Figure 1).

Figure 1: Learning through play experience tool (v. Jan 2020)

State of play	Joyful	Actively Engaging	Iterative	Meaningful	Socially Interactive
Non-play I am opting out of the experience					
Passive I am following instructions	I am neutral about the experience	I am following the play or instructions of others	I do not know how to respond to the experience	I am doing this because I have to	I am alone or in a group not by choice
Exploring I am considering possibilities	I am curious about the experience	I am interested in the environment and materials	I interact with the experience	I attend to the experience	I am aware of others
Owning I am choosing my own path	I am enjoying the process, even if it's challenging	I am focussed on the activity	I adjust my approach	I am developing my understanding	I play with others or let others approach me
Recognising I have new insight	I feel a sense of accomplishment	I am invested	I am deliberate about the changes I make	I show how the experience is relevant to me	I play with others collaboratively
Transferring After the experience I am reflecting on how this experience can influence the reality of my own life, and have confidence that it changes myself and others	I am enthusiastic about trying this again	I have tried this again after the experience	I seek out and explore new projects	I recall the experience and use it to understand	I cooperate with others to initiate new play

Non-play is when a child shows no interest in an activity. If a child has a minimum sense of agency, she or he will simply follow the instructions and be in the **Passive** stage. The next stage, **Responding**, is when the child responds to the design elements, a welcoming parent, peer, or facilitator and begins to form intentions. If the child's interest is piqued, she enters the **Exploring** stage and begins to explore different elements and set her own goals. Then, if the play experience reaches a high level of quality, the child enters the **Owning** stage where the experience and learnings are internalised. Following that stage, children may have new insights about the experiences, thus entering the **Recognising** stage. Lastly, with play experiences of the highest quality, the child becomes able to transfer the learning to other situations; this is what is meant by playful experiences of the highest quality. The **Transferring** stage can only happen after the playful experience in question. The quality of a play experience is based on five play characteristics, defined by the LEGO Foundation as 'meaningful', 'actively engaged', 'iterative', 'socially interactive' and 'joyful'.² These characteristics emerge from evidence developed by an international group of researchers to describe how children learn through playful experiences, when they are actively engaged in meaningful experiences they enjoy, and are empowered to test and try out things with others.

In this study, agency was conceived of as both distributed and individual in nature. Distributed agency occurs when multiple actors work together to create an outcome, such as occurs when children and parents play together on a game. Parents and other adults can also create the conditions for children's individual agency. In addition, devices, apps and games themselves can support or limit children's choices and independence of use. Garud and Karnoe (2005: 94) suggest that individual agency 'is defined by the intersection of opportunities and constraints that individuals confront as they engage with an emerging network of actors, material artefacts, rules and routines'.

The role of adults in the mediation of children's play was undertaken through the use of a range of theoretical tools which included the LEGO Foundation's framework (Jensen et al., 2019), Scott's (2018a) and Chaudron, Marsh, Navarette et al.'s (2017) work on parental mediation of young children's digital play, and research on adult questioning undertaken by members of the team (Rollins Gregory, Haynes & Murris, 2017).

Ethical issues were addressed throughout the study, in line with the BERA *Ethical Guidelines for Educational Research* (2018) and the research ethics regulations of the School of Education at the University of Cape Town. Parents of children in the case studies and focus group interviews signed consent forms, and all adult participants signed consent forms. The notion of informed consent underpinned the approach to the research, with an understanding that for young children, assent must be judged through ongoing assessments of the child's body language in addition to other potential markers of discomfort (Dockett & Perry, 2011). If children appeared to be tired, then the interviews/ video recording schedules were adjusted accordingly.

The methodology consisted of a number of elements, each intended to ensure that the studies conducted in South Africa and the UK were similar in nature, although it was recognised from the outset that, due to substantial cultural differences in the contexts, methods and procedures would need to be adapted accordingly. Appendix 1 provides a detailed overview of the methodological approaches used in each country. Further, all research tools, in addition to statistical data from the UK study, are hosted on the UK Open Data Repository.³

Section 2: South African and UK survey findings

In this section the findings from the surveys of parents of 3–11-year-olds are outlined, in order to provide a backdrop to the more in-depth insights gained into families’ daily lives in the subsequent sections. The surveys demonstrated a range of both similarities and differences in the way in which technology informed children’s play in both countries. The quantitative data are considered separately, with the summary offering a number of insights into key variances between the two datasets.

2.1 Children, technology and play: South African survey data analysis

As a general note regarding the presentation and analysis of the survey data below, the following rules have been applied. Unless otherwise noted, the results refer to the entire sample of survey respondents (N=1,286). However, to ease comparability across categories, ‘missing’ data (non-responses) were excluded from the analysis where appropriate. Whenever a comparison is based on a reduced sample, this is indicated with a small explanatory note at the bottom of the figure/table.

The profile of the sample is as follows:
While the majority of respondents only provided one response, several parents did not indicate any age (missing=14%), while others ticked multiple boxes for their children’s age (6%).

In South Africa, the concept of race and ethnicity, which has its historical roots in the Population Registration Act No. 30 of 1950 and which was introduced during the apartheid period, continues to be central in defining access to resources, infrastructure and general wealth distribution (see Figures 2 & 3, p. 10).

Table 4 compares the sample to the 2011 census. In the analysis we adopt the race classifications as they are still widely used and continue to be employed in official statistics.

Table 2: Age of child

Child age	
3–6 years old	44%
7–11 years old	36%
More than one child	6%
Missing	14%

Table 3: Gender of child

Child age	
Girl	43%
Boy	46%
Other	2%
Prefer not to say	2%
Missing	7%

Table 4: Ethnicity/race of parent in City of Cape Town

Race (of parent)	Census	Sample
Black African	42.6%	46%
Coloured	39.3%	32%
White	16.6%	15%
Indian/Asian	1.1%	6%
Other		1%
Missing		6%

Table 5: Socio-economic group by total annual household income

Socio-economic group (of family)	
R500,000 (£26,546) or more	10%
R250,000–R499,999 (£13,273–£26,546)	15%
R100,000–R249,999 (£5,309–£13,273)	19%
R50,000–R99,999 (£2,655–£5,309)	14%
R20,000–R49,999 (£1,062–£2,655)	15%
Less than R19,999 (£1,062)	12%
Receive government social grant	5%
Missing	10%

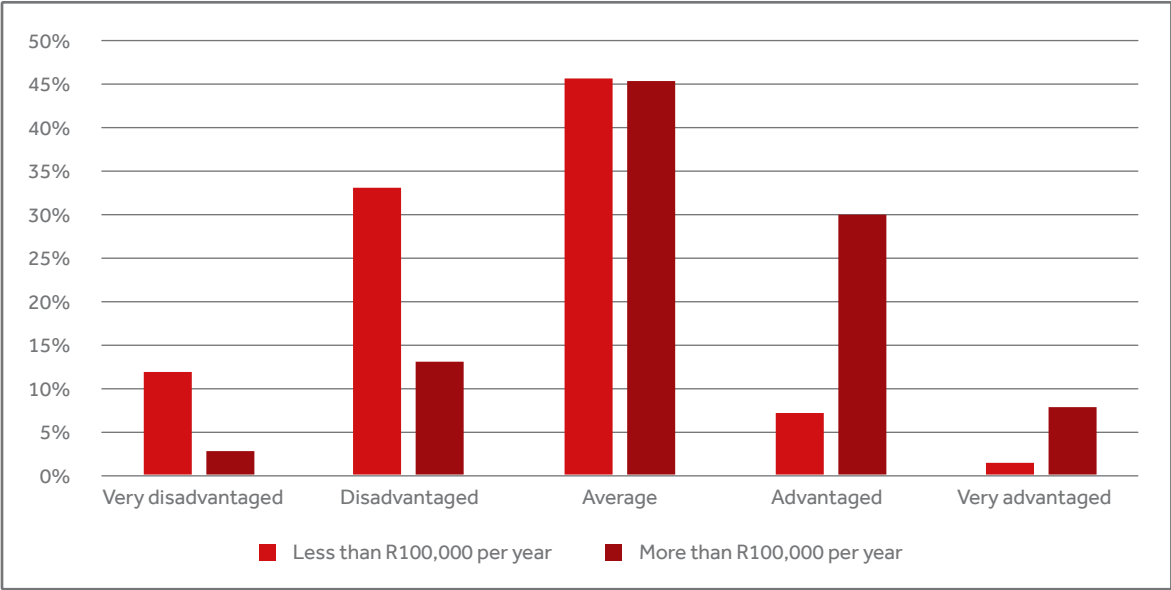
Table 6: Socio-economic group by relative self-assessment

Socio-economic group (relative)	
Very advantaged	4%
Advantaged	18%
Average	42%
Disadvantaged	22%
Very disadvantaged	7%
Missing	6%

Because asking respondents about their financial situation in face-to-face interviews can be sensitive, the survey also included a second measure of socio-economic status. As can be seen from the graph in Figure 2, the two measures relate to each other in an

expected way. Those respondents who have a total household income of less than R100,000 are more likely to describe themselves as disadvantaged, while those that earn more are more likely to describe themselves as advantaged.

Figure 2: Comparison of respondents by socio-economic background

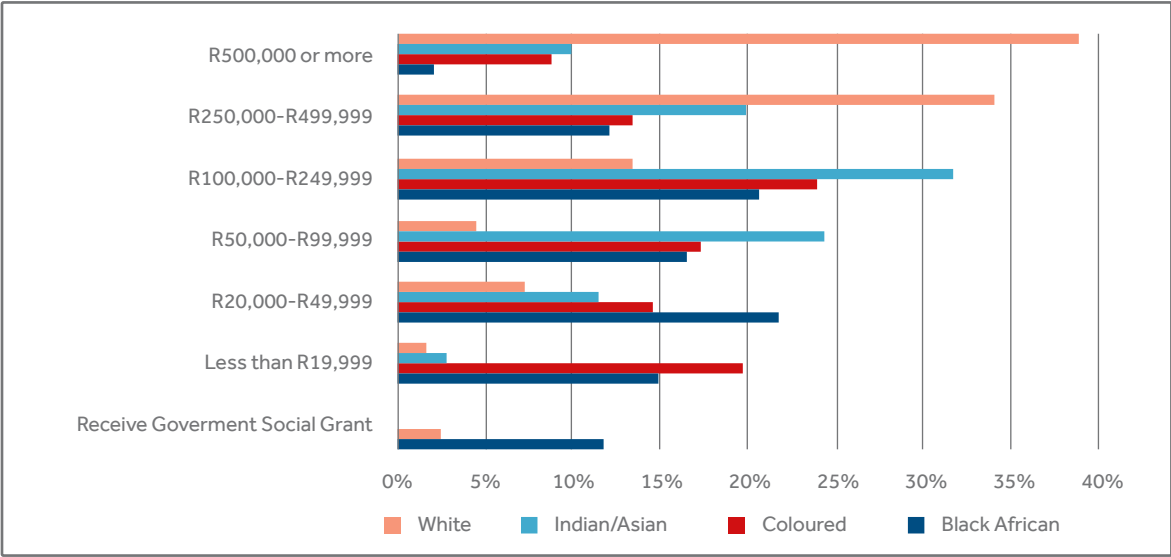


Note: For this comparison, all missing cases were excluded

To illustrate the legacy of apartheid-era segregation policies, the graph in Figure 3 illustrates the distribution

of income across racial groups. The majority of White South Africans fall into the top income categories.

Figure 3: Comparison of respondents by race and socio-economic background



2.1.1 Access to technology

Children's access to technology at home and elsewhere varies substantially depending on the device. Figure 4 indicates that the majority (74%) of children in the sample either have access to, or own, a standard television (65% access at home + 9% of children own one). In contrast, far fewer children have access to, or own, a smart/mobile phone (41%), tablet (34%), laptop (28%), Smart TV (26%), electronic toy (21%), or a desktop PC (12%). Newer forms of technologies (e.g. game console, smart speaker, handheld, etc.) are available to less than 10% of children in the sample.

Whenever children do have access to these devices, it is mostly because they are available in their home, rather than through friends and family (Figures 5 & 6A–7F). Among the different technologies, children are most likely to own a tablet, smart/mobile phone or an electronic toy rather than a TV or laptop.

Figure 4: Children's access to technology

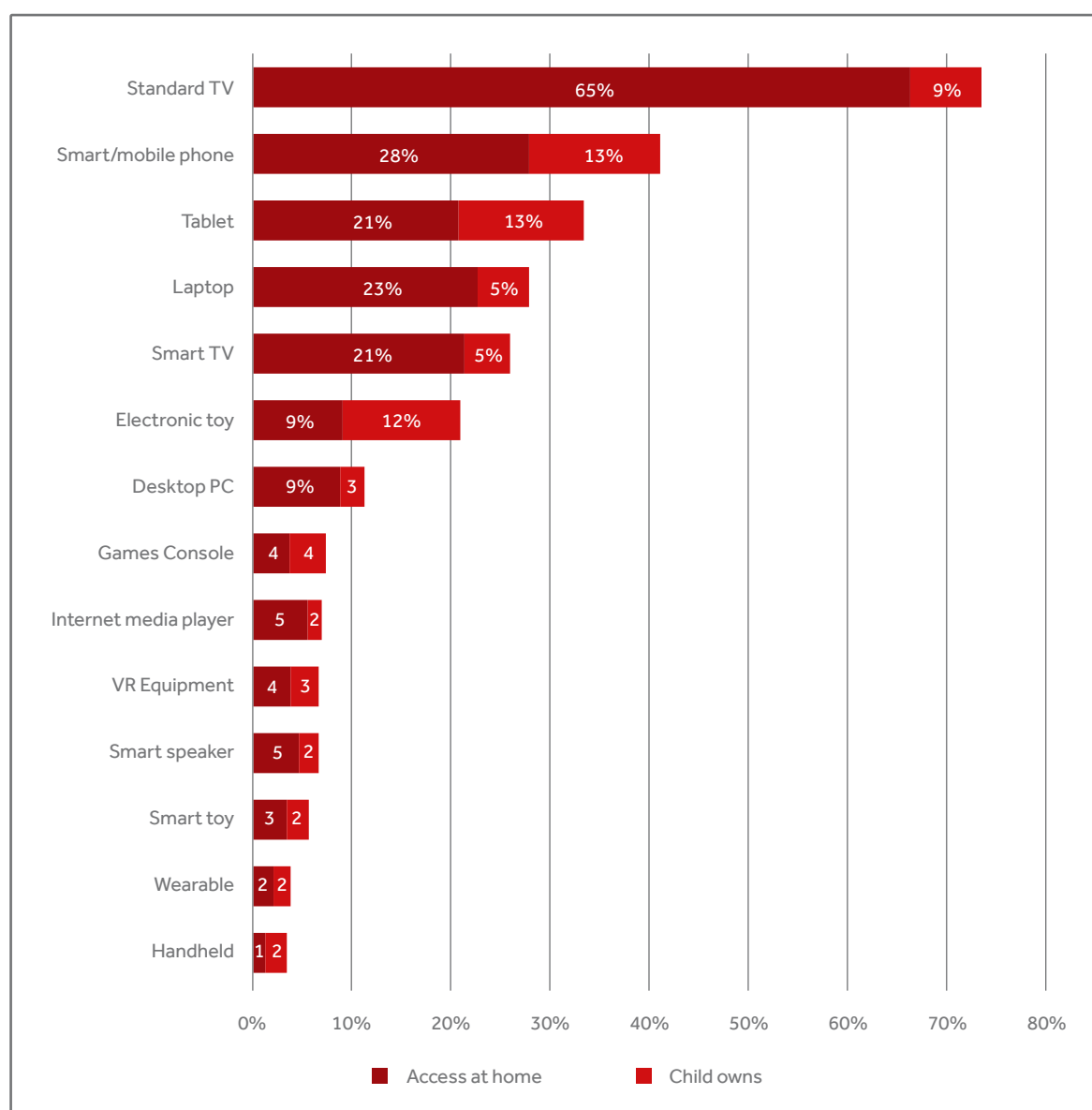
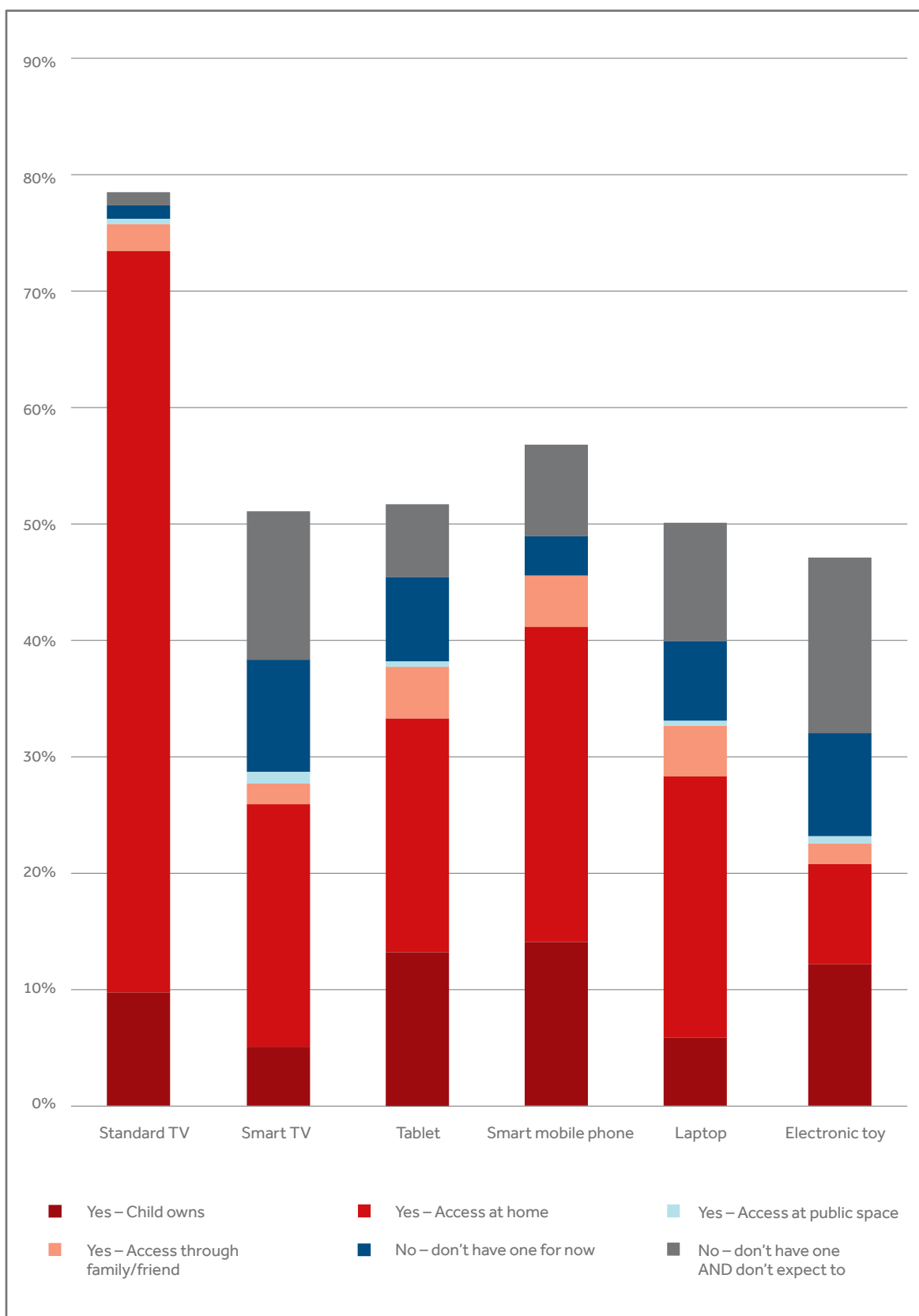


Figure 5: Children's access to technology (most common in South Africa)

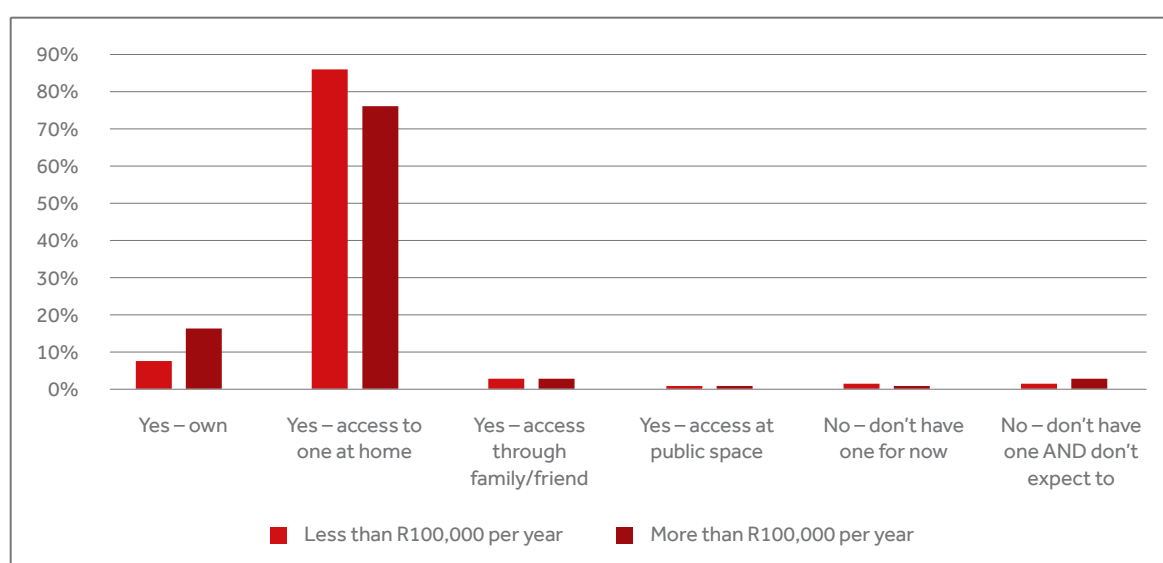


2.1.1.1 Access to technology and the role of socio-economic background

With the notable exception of smartphones, children from families with higher socio-economic backgrounds are approximately twice as likely to own a device (i.e. standard TV, smart TV, tablet, laptop and electronic toy) compared to their peers who live in households with an annual income of less than R100,000 (Figures

6A–6F). However, these differences are drastically reduced for standard TVs, tablets and electronic toys when considering whether a child has access to these technologies in the household. Unsurprisingly, fewer parents from poorer households expect to buy a smart TV, laptop or tablet than their better-off peers. In South Africa this divide runs along racial lines as the majority of the poorer households are Black South Africans.

Figure 6A: Children's access to standard TV by socio-economic background



Note: Missing cases were excluded for this part of the analysis (same applies for all types of technology)

Figure 6B: Children's access to smart TV by socio-economic background

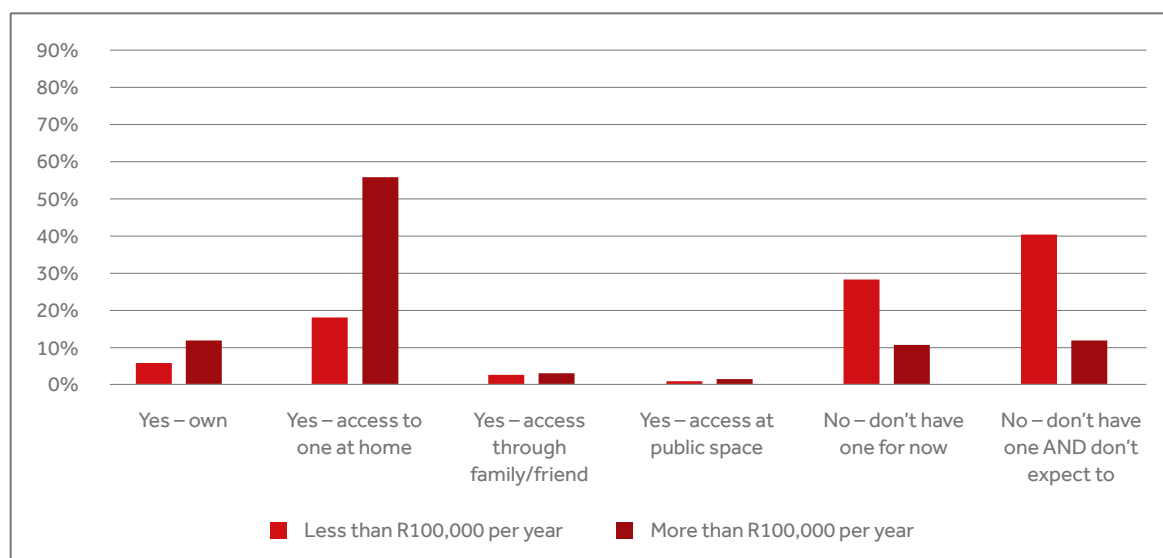


Figure 6C: Children's access to tablet by socio-economic background

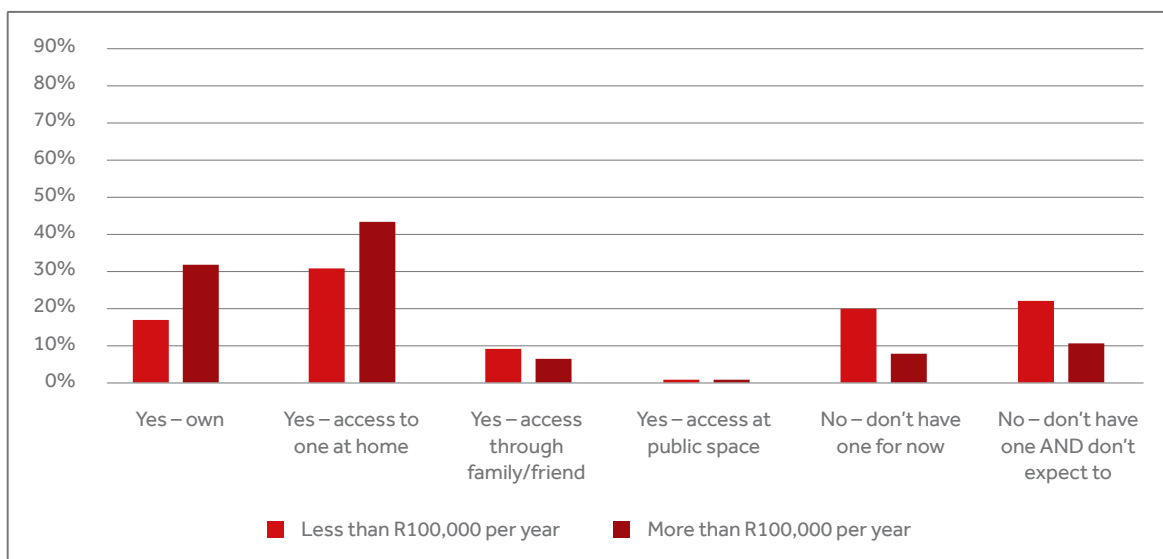


Figure 6D: Children's access to smart/mobile phone by socio-economic background

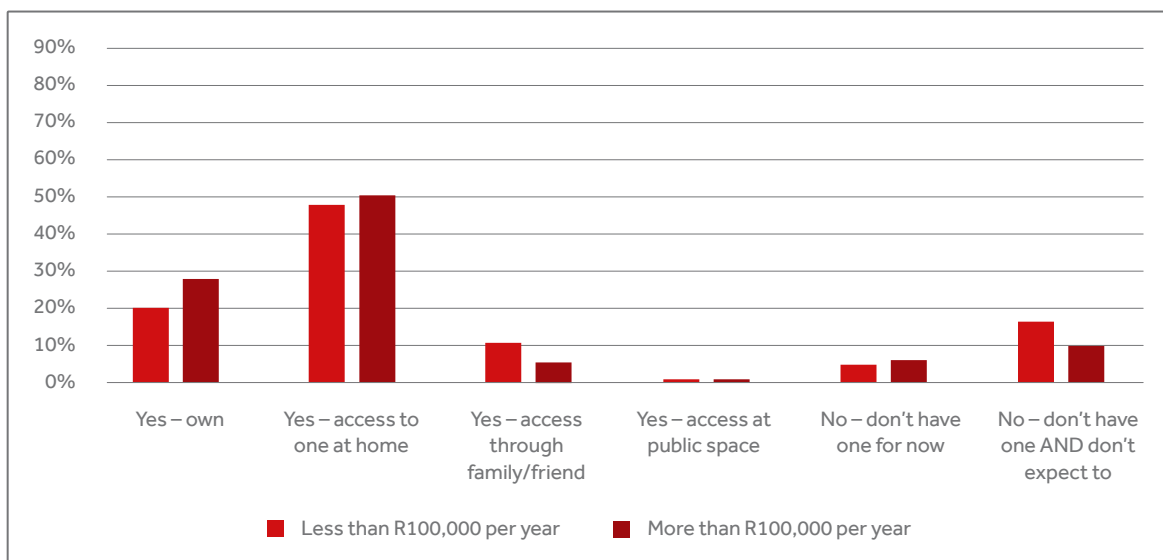
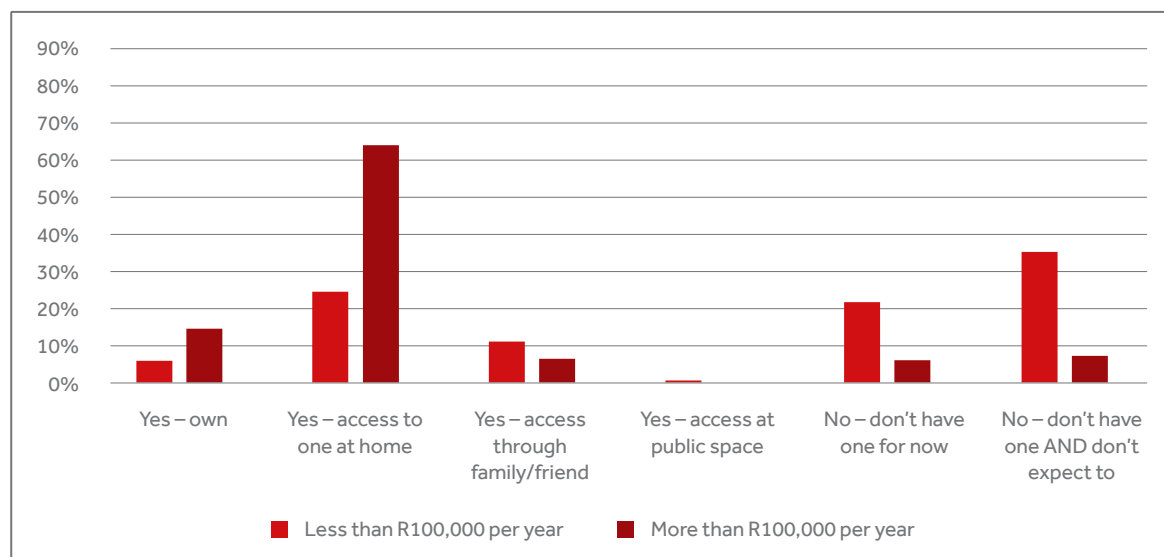
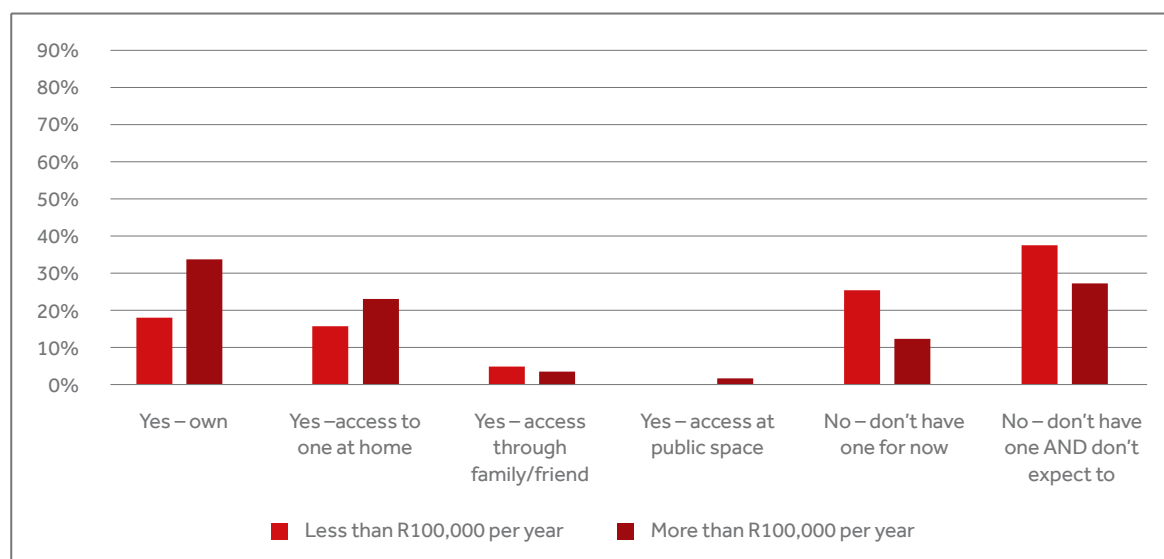


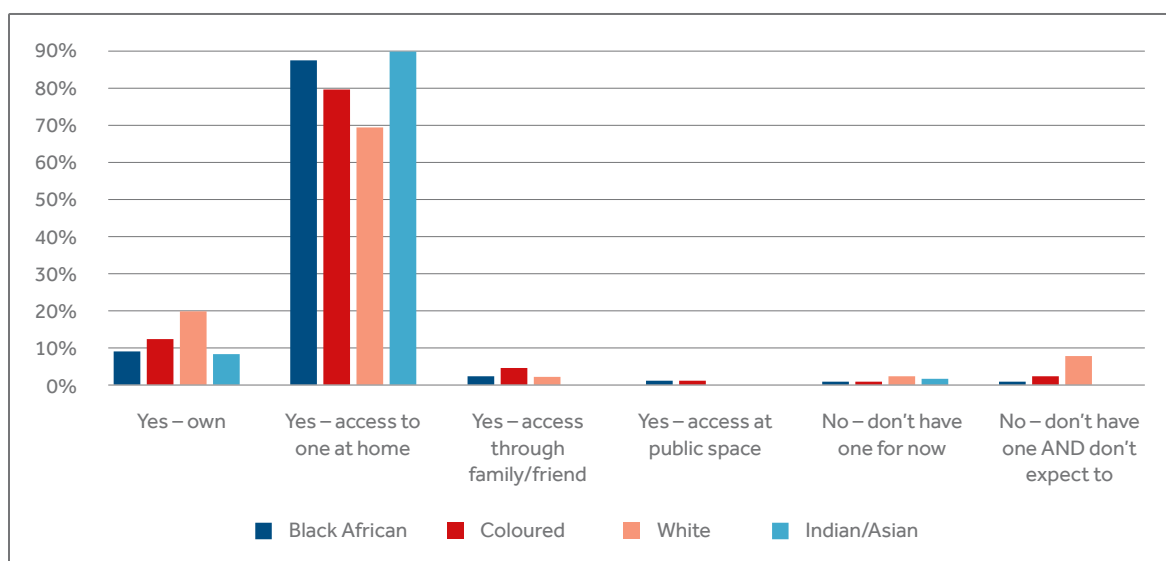
Figure 6E: Children's access to laptop by socio-economic background**Figure 6F: Children's access to laptop by socio-economic background**

2.1.1.2 Access to technology and the role of race

Despite the end of the apartheid regime in South Africa more than 25 years ago, one of the enduring legacies is the continuing economic disparities along racial lines. Thus, as the graphs in Figures 7A–7F show, the historically most advantaged group of White South

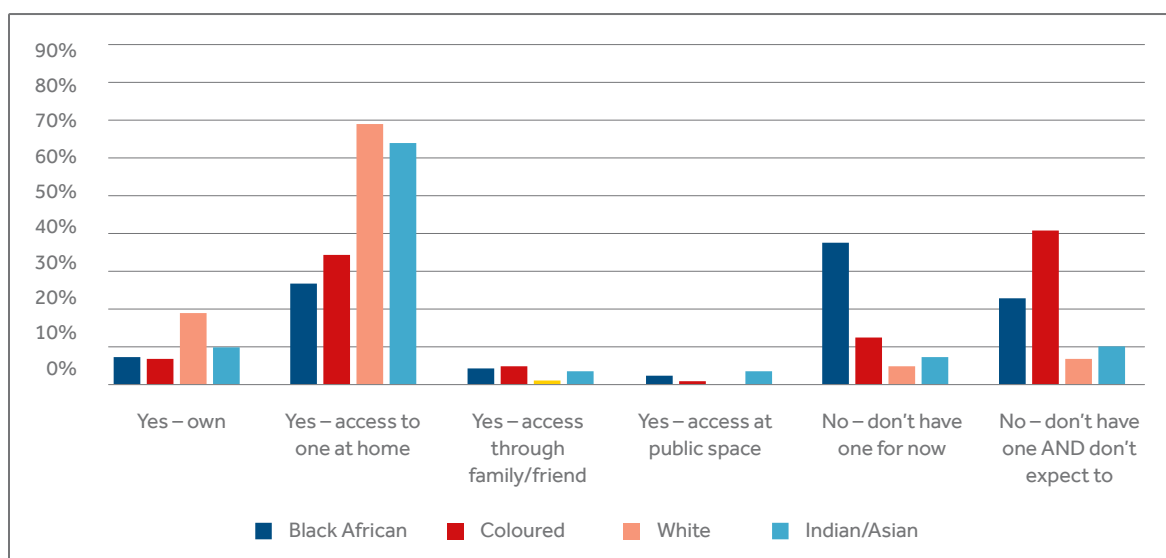
Africans are more likely to own the various devices (especially the more expensive ones such as smart TVs and laptops), while the least privileged group (Black South Africans) are least likely to own any of the devices. Similar differences can be observed across the 'access at home' category.

Figure 7A: Children's access to standard TV by race group

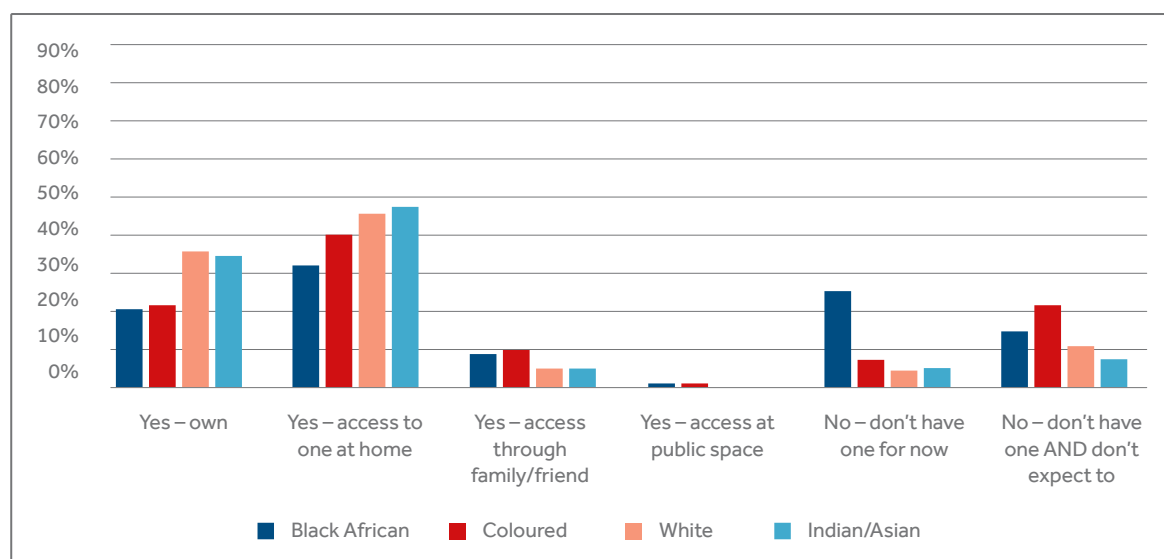


Note: Missing cases were excluded for this part of the analysis (same applies for all types of technology)

Figure 7B: Children's access to smart TV by race group



Note: Missing cases were excluded for this part of the analysis (same applies for all types of technology)

Figure 7C: Children's access to tablet by race group

Note: Missing cases were excluded for this part of the analysis (same applies for all types of technology)

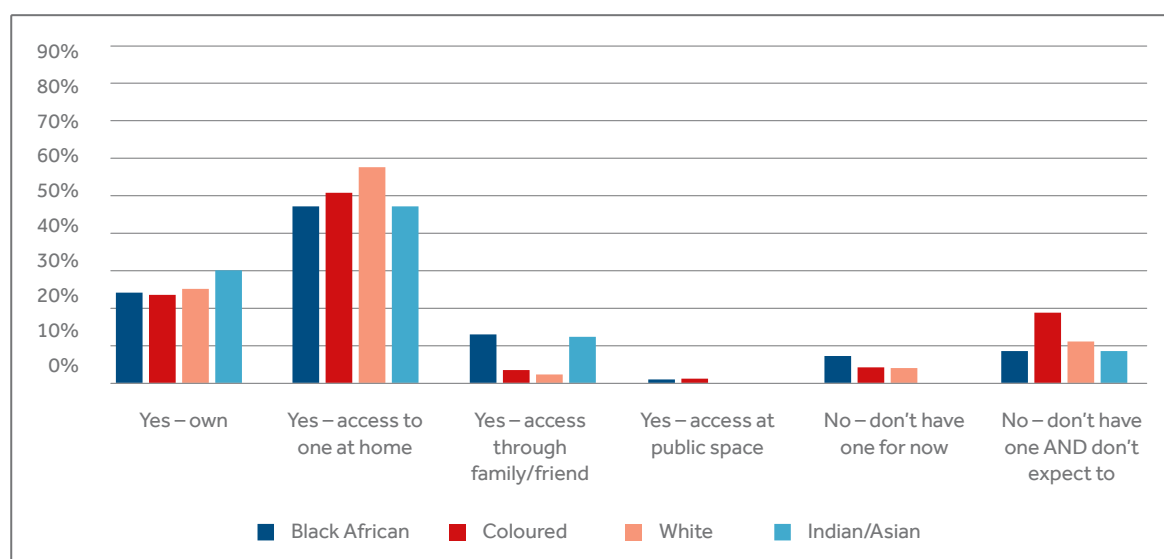
Figure 7D: Children's access to smart/mobile phone by race group

Figure 7E: Children's access to laptop by race group

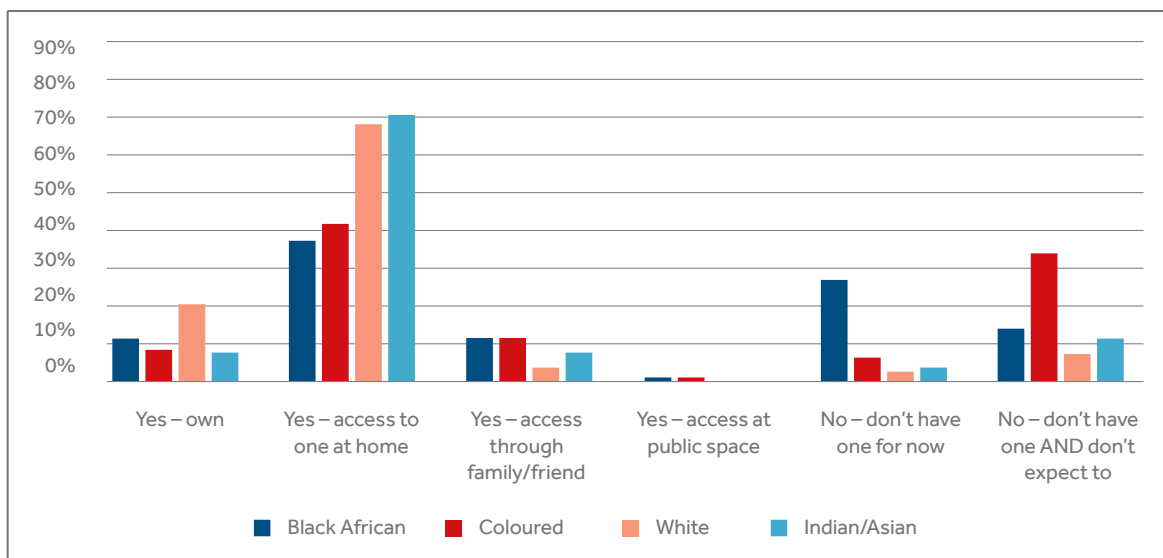
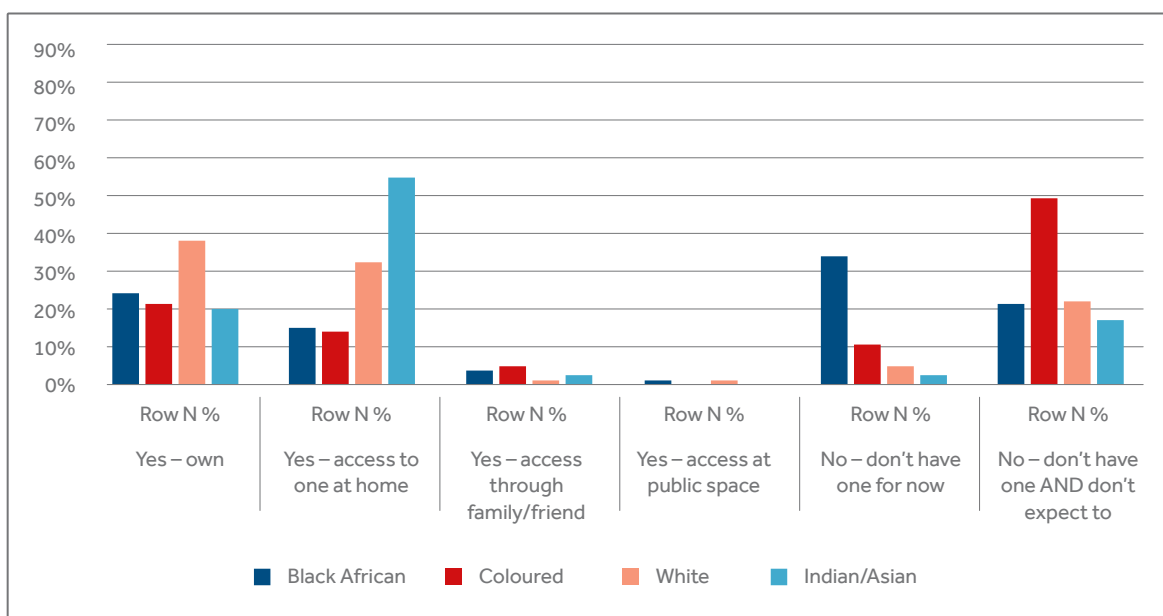


Figure 7F: Children's access to electronic toy by race group



2.1.2 Children's play

The extent to which children play with technology varies substantially depending on the type of device. According to parents, time spent watching television (83%) is the only type of technology that is greater than play with non-digital games and artefacts (59%). By comparison, only 26% of children spend time playing with a PC/laptop, and 22% play with an electronic toy during the week (Figure 8A).

It is perhaps not surprising that the above pattern changes depending on the day of the week. For example, on a weekday 83% of children play with a TV for at least a few minutes, with 15% playing for more than three hours per day. However, on the weekend about one in three children spends three or more hours per day playing with a TV (Figure 8B).

Figure 8A: Time spent playing with technology on weekday

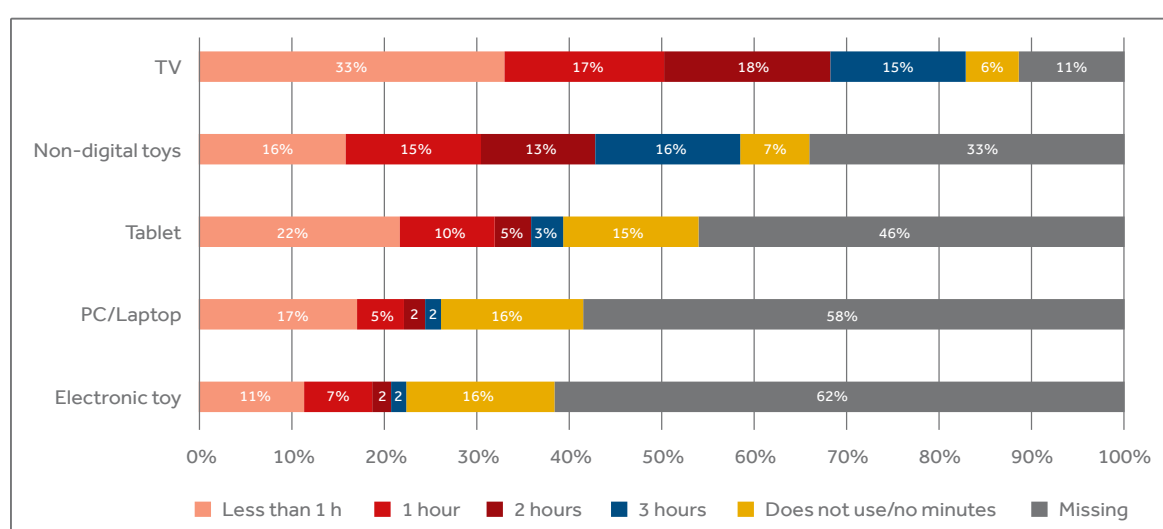
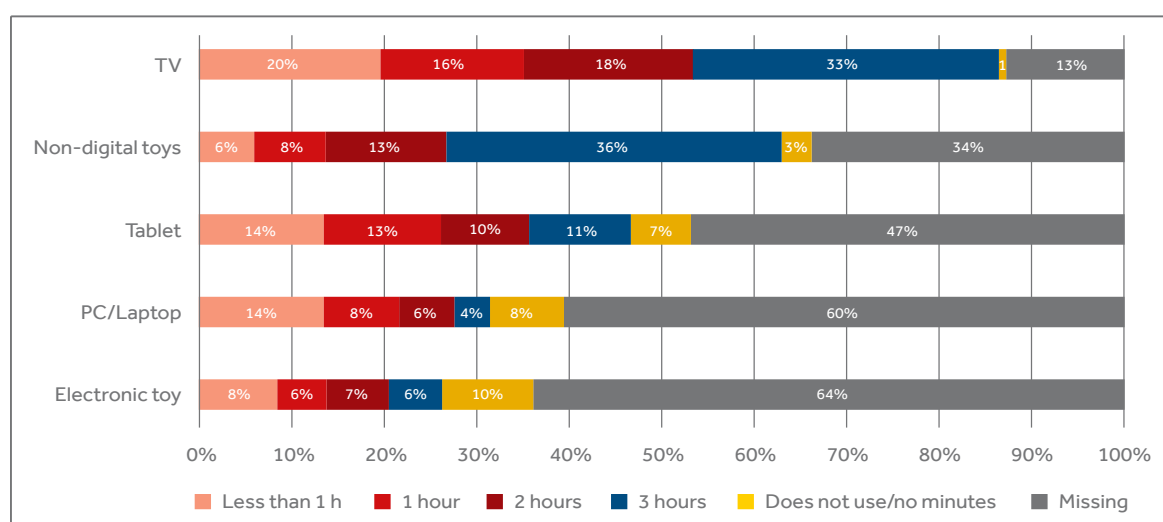


Figure 8B: Time spent playing with technology on weekend day



Note: Given the survey structure, the 'missing' responses are most likely capturing parents who do not have such a device in the household.

When comparing how much time children spend playing with non-digital devices as well as technology according to socio-economic background, the difference is smallest for electronic toys. In contrast, the percentage of children who spend two or more hours per day playing with a TV and non-digital play is higher in households

with an annual income of less than R100,000/year (Figure 8C). Meanwhile, children from a more affluent background spend more time playing with a tablet. The differences according to the gender of the child are negligible (Figure 8D).

Figure 8C: Time spent playing with technology on weekdays by socio-economic background

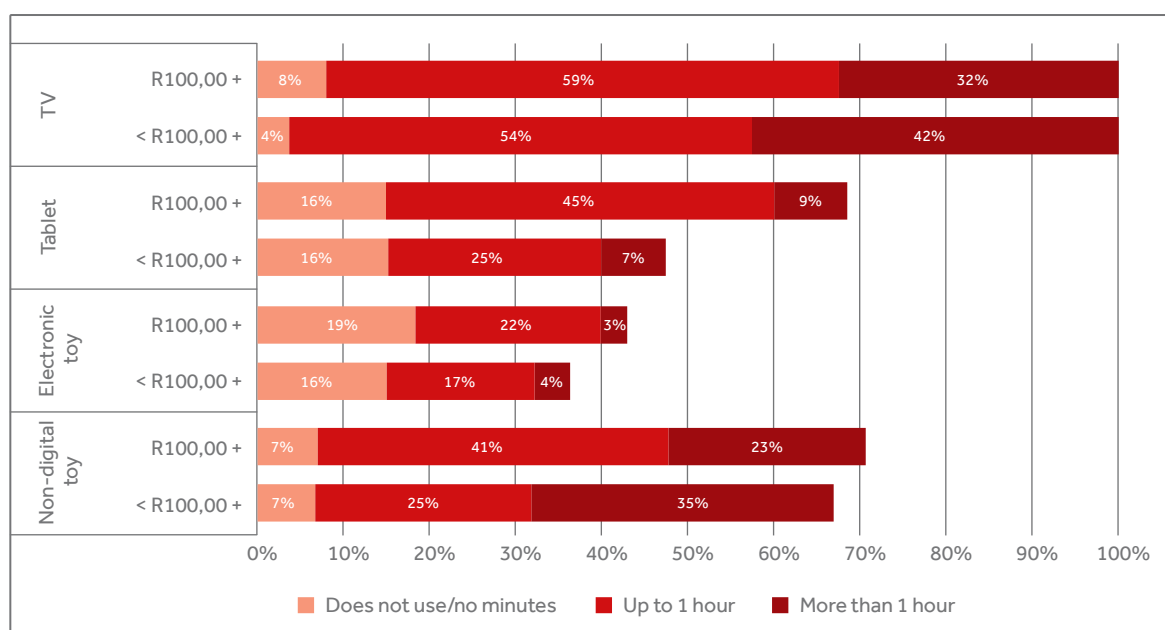
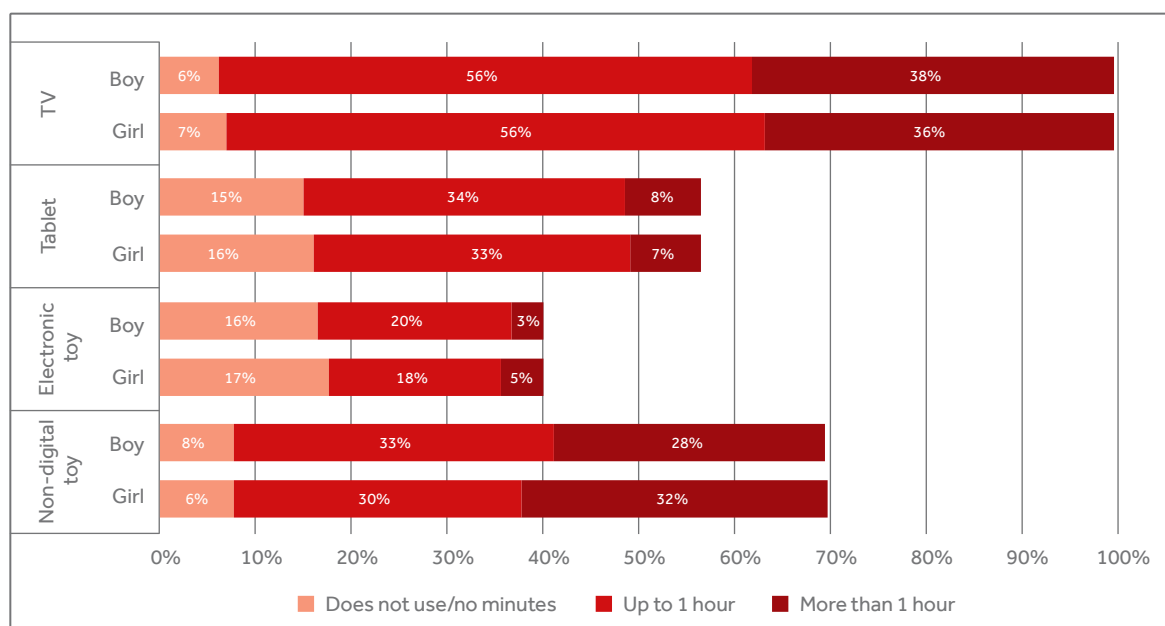
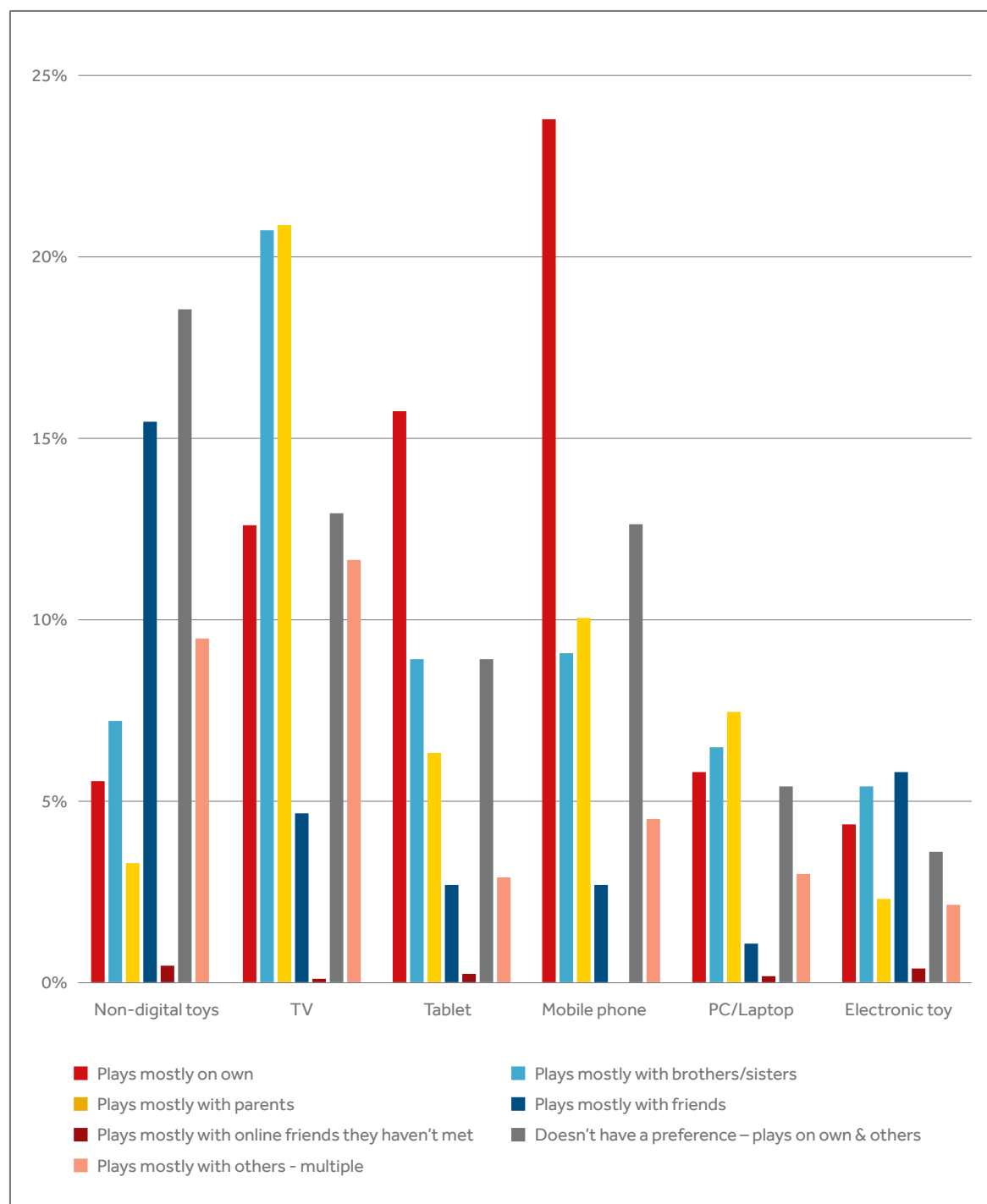


Figure 8D: Time spent playing with technology on weekdays by gender



Across all types of toys, children are most likely to play by themselves with a tablet as well as a mobile phone. In contrast, children are more likely to engage with others (e.g. parents and siblings) when using non-digital toys and TV (Figure 9).

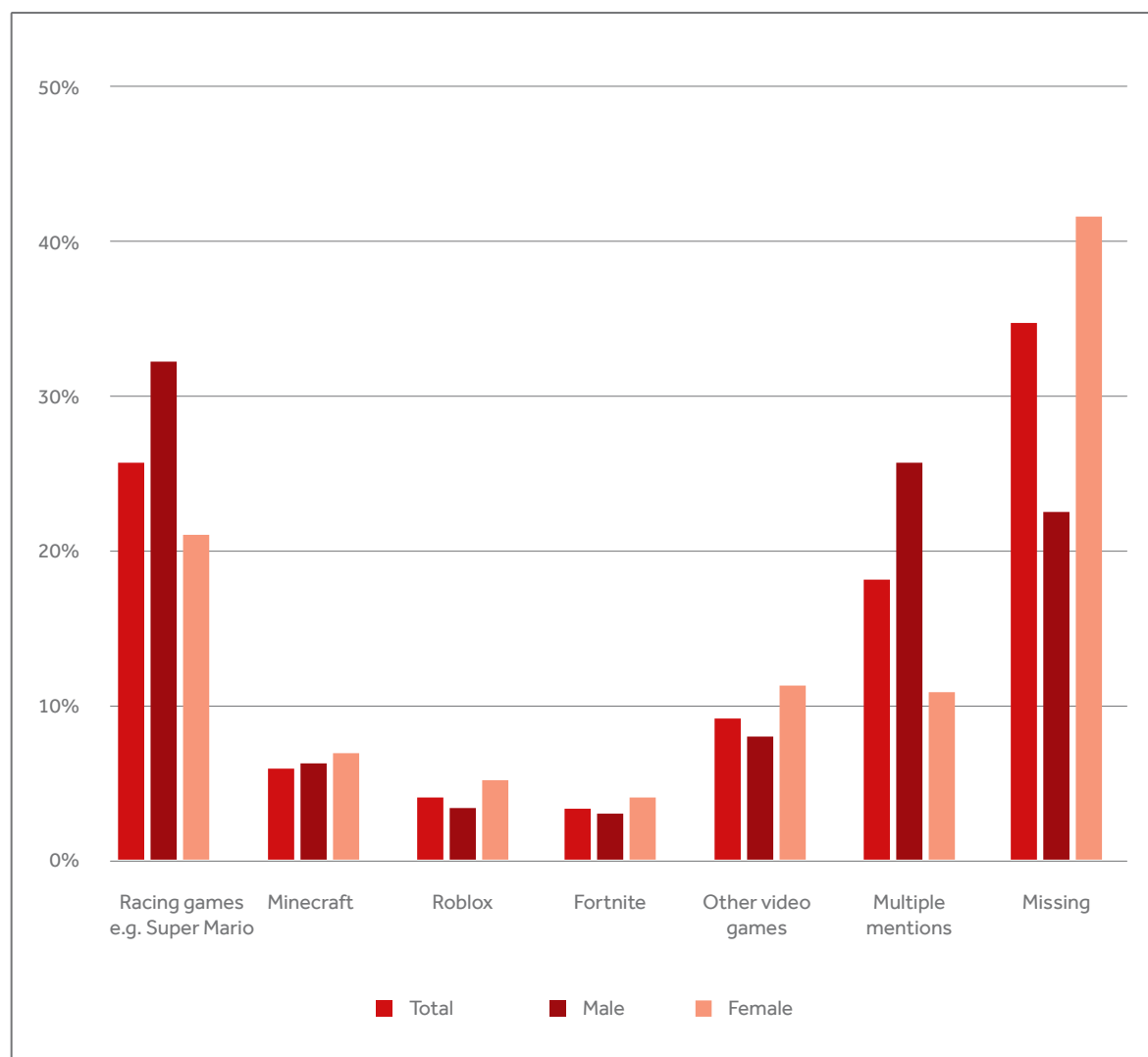
Figure 9: Who do children play with?



In terms of genres of games played with, Figure 10A shows that racing games are by far the most popular games, while Minecraft, Roblox and Fortnite are either less well known, or less popular. Interestingly, boys are more likely to play racing games as well as several other

types of games, while the gender difference is negligible for the other games. Instead, girls are much more likely not to play any of the listed games (assuming that 'missing' can be counted as not playing).

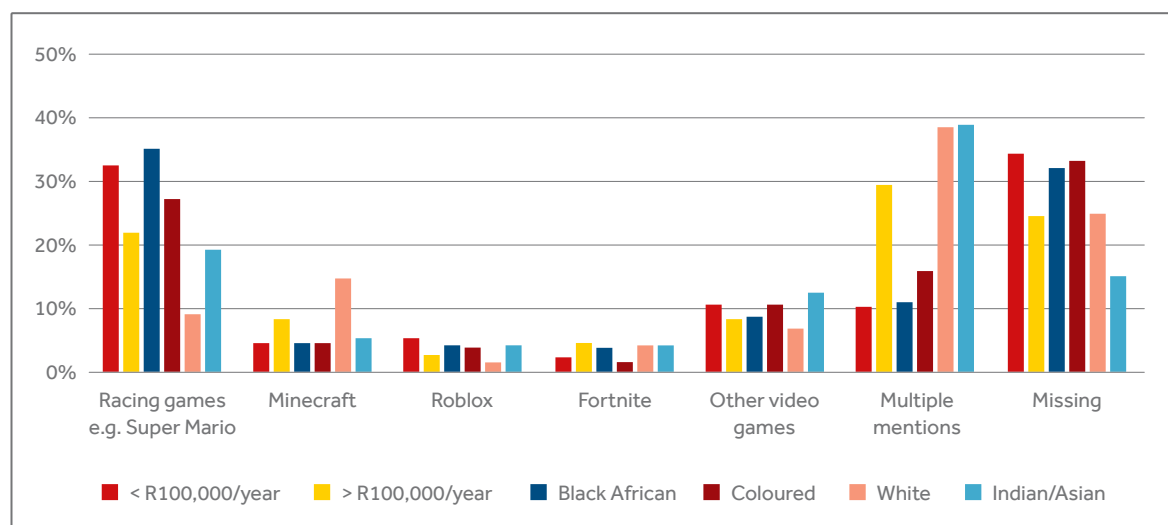
Figure 10A: Brands/genres of games child plays with



Note: Total is lower than both the male and female columns because the total column also includes the 'prefer not to say', 'other' and 'missing' categories for the gender variable.

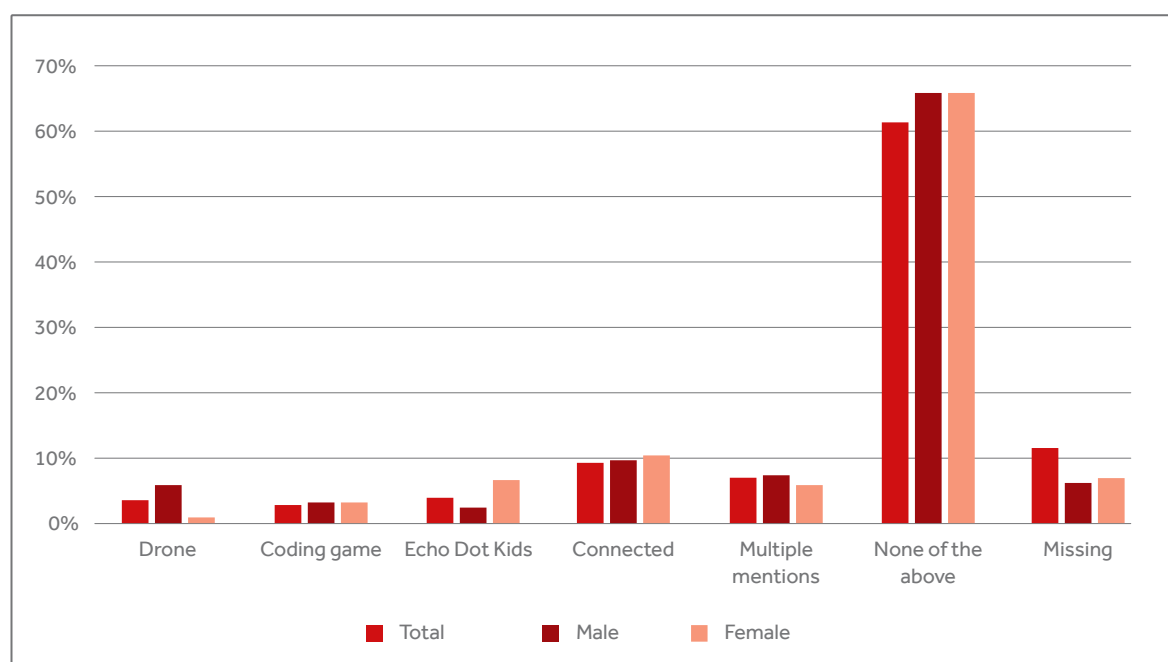
Following a similar pattern to what was observed previously, the data reveal substantial similarities between affluent households and White South Africans, on the one hand, and poorer and Black South Africans, on the other (Figure 10B). Specifically, children living in

the latter types of households are more likely to play racing games but are less likely to play multiple games (and have a higher rate of 'missing', here interpreted as not playing any of the games).

Figure 10B: Brands/genres of games child plays with by socio-economic background and race group

The survey findings in Figure 11 show that only very few children play coding games, such as Fisher-Price Think, or play with an Echo Dot for Kids, or with drones. Approximately 1 in 10 children plays with connected

toys such as Furby Boom. However, at least two-thirds of boys and girls do not play with any of these types of technology. These proportions are roughly similar to those found in the UK sample.

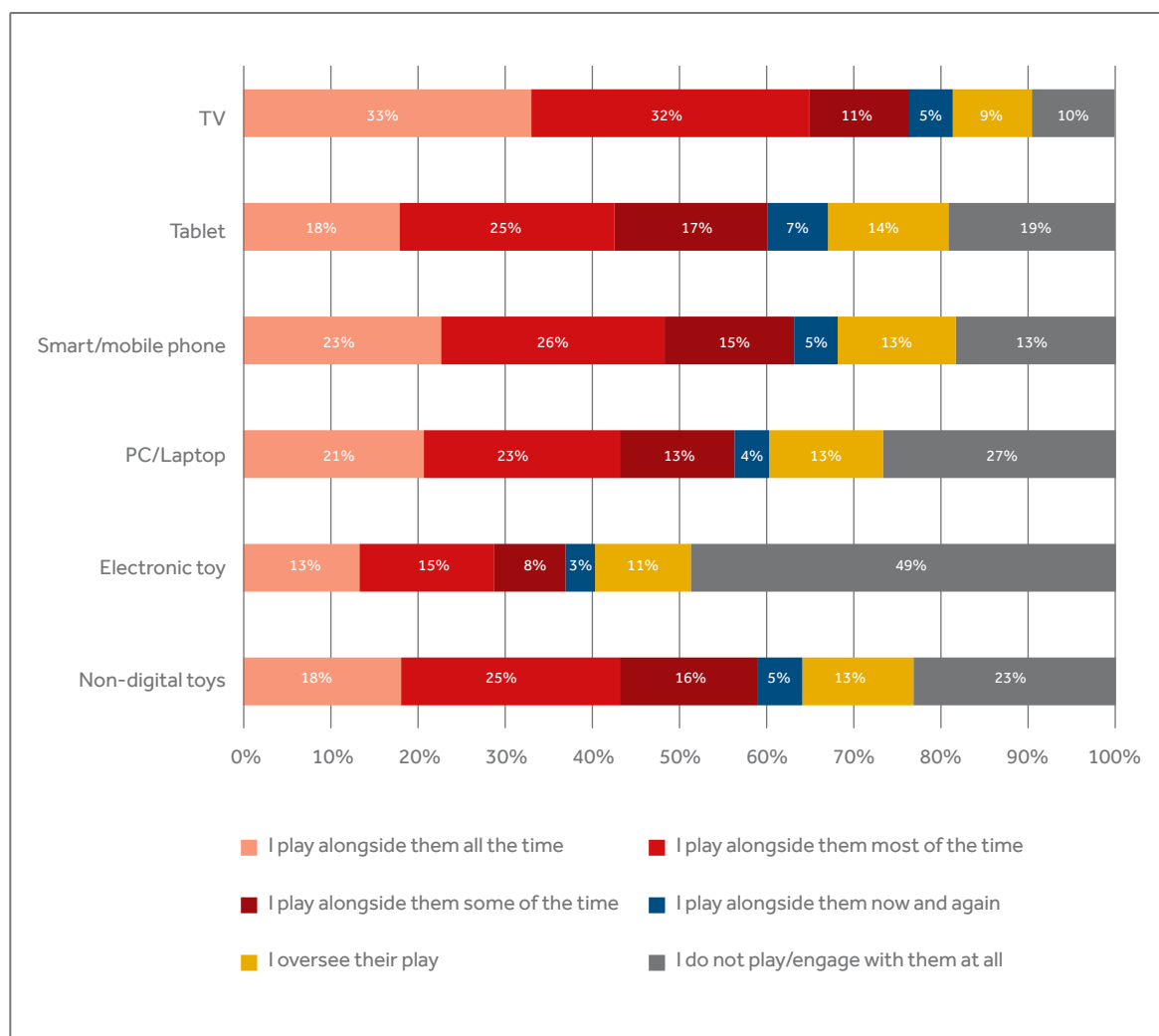
Figure 11: Technologies children play with

Note: Total is lower than both the male and female columns because the total column also includes the 'prefer not to say', 'other' and 'missing' categories for the gender variable.

Figure 12 shows that more than 60% of parents who responded to the question said that they participate in play involving television at least once a week. Moreover, between 40% and 50% of parents join their children when they play with tablets, smart/mobile phones and

PC/laptops, as well as non-digital toys. By contrast, for the category of electronic toys, 50% of parents who responded said that they do not engage with their child at all.

Figure 12: Parents' co-play with different technologies

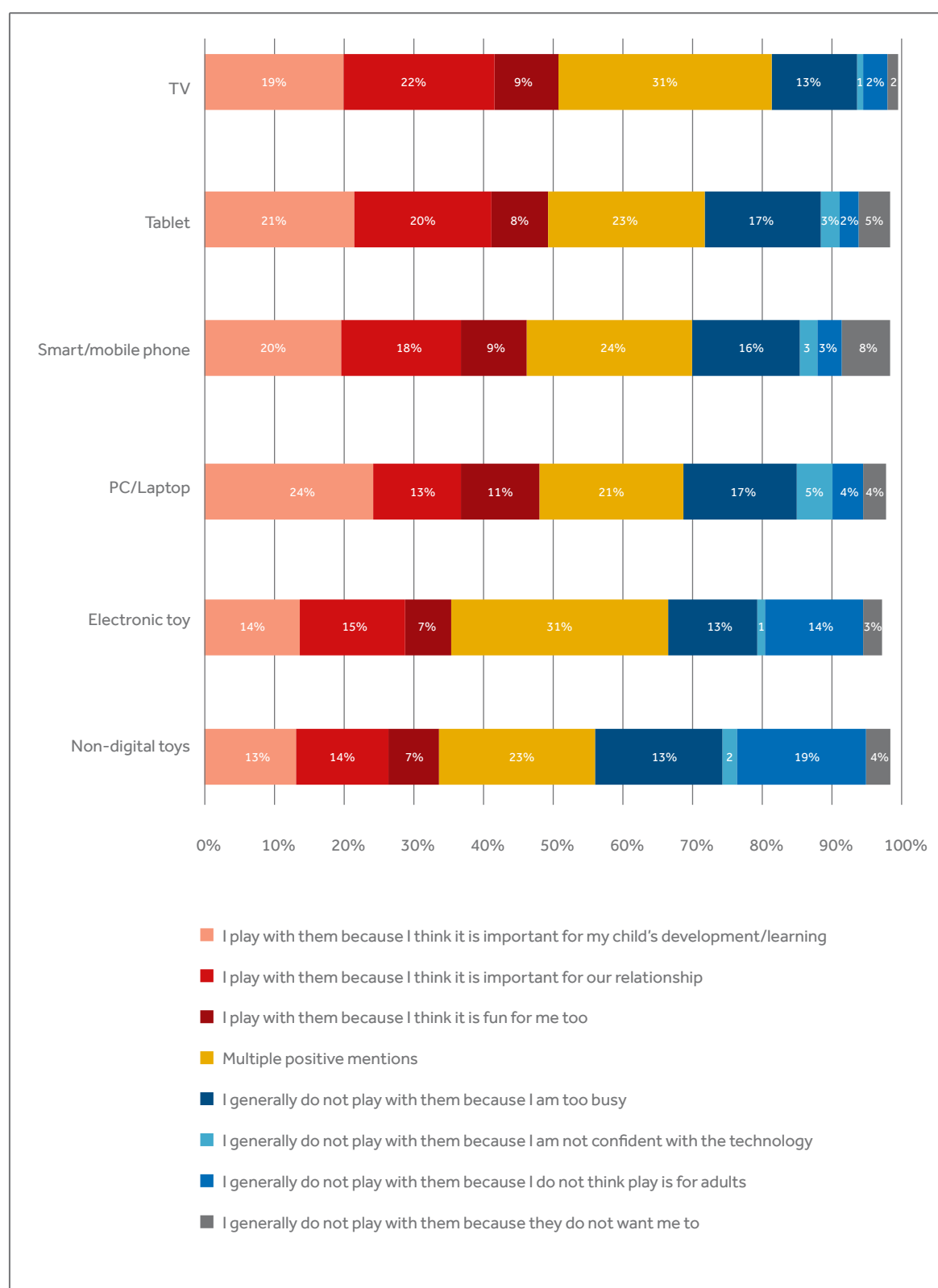


Note: According to the questionnaire, the terms referred to the following frequencies: most of the time =at least once a week; some of the time=at least once a month; now and again=every few months or less.

Across all categories, most parents said that they would join their child in play. The most frequently cited reason is the child's development/learning, followed by the parents' perceived importance of play for their relationship with their child (Figure 13). Interestingly, a significant minority of respondents mentioned multiple reasons for joining their child. By contrast, the most

frequent reason why parents do not join their children is a lack of time. Depending on the type of technology, between 13% and 18% of parents said that they do not play with them because they are too busy. The only toys for which a substantial percentage of parents said that they are not for adults are electronic toys (14%) and non-digital toys (19%).

Figure 13: Reasons for/against joining with play



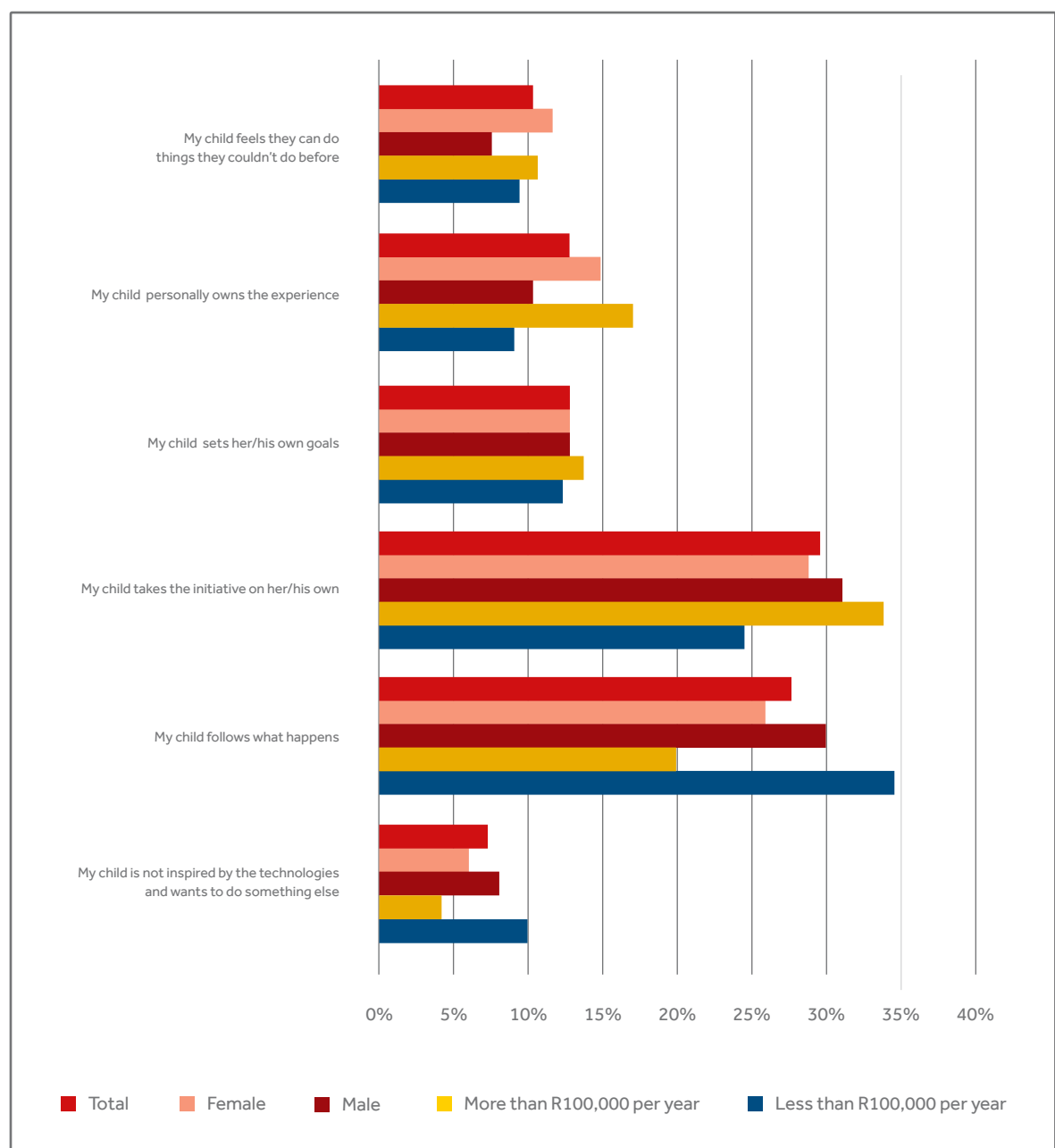
Note: Two categories were excluded ('Multiple negative' as well as 'Positive and Negative') due to small response rates and to make responses easier to analyse. Each category had less than 2% of responses.

2.1.3 Learning through play with technology

The survey used a range of questions that related to the LEGO Foundation's *Learning Through Play Experience Tool* (LTPET). The first question explored the extent to which children demonstrate agency and independence in play with technology. The results are interesting in that approximately equal proportions of parents said that their child is taking the initiative (30%), and that a child merely follows what happens (27%). While these

results are fairly consistent irrespective of the children's gender, they differ according to the socio-economic background of the household (Figure 14). Parents in more affluent homes report that their children are taking the initiative more often than their less well-off peers. This could partly be a function of the type of technologies that children engage in (see above). Importantly, the data show that children's disinterest in technology is low across both gender and SES divides.

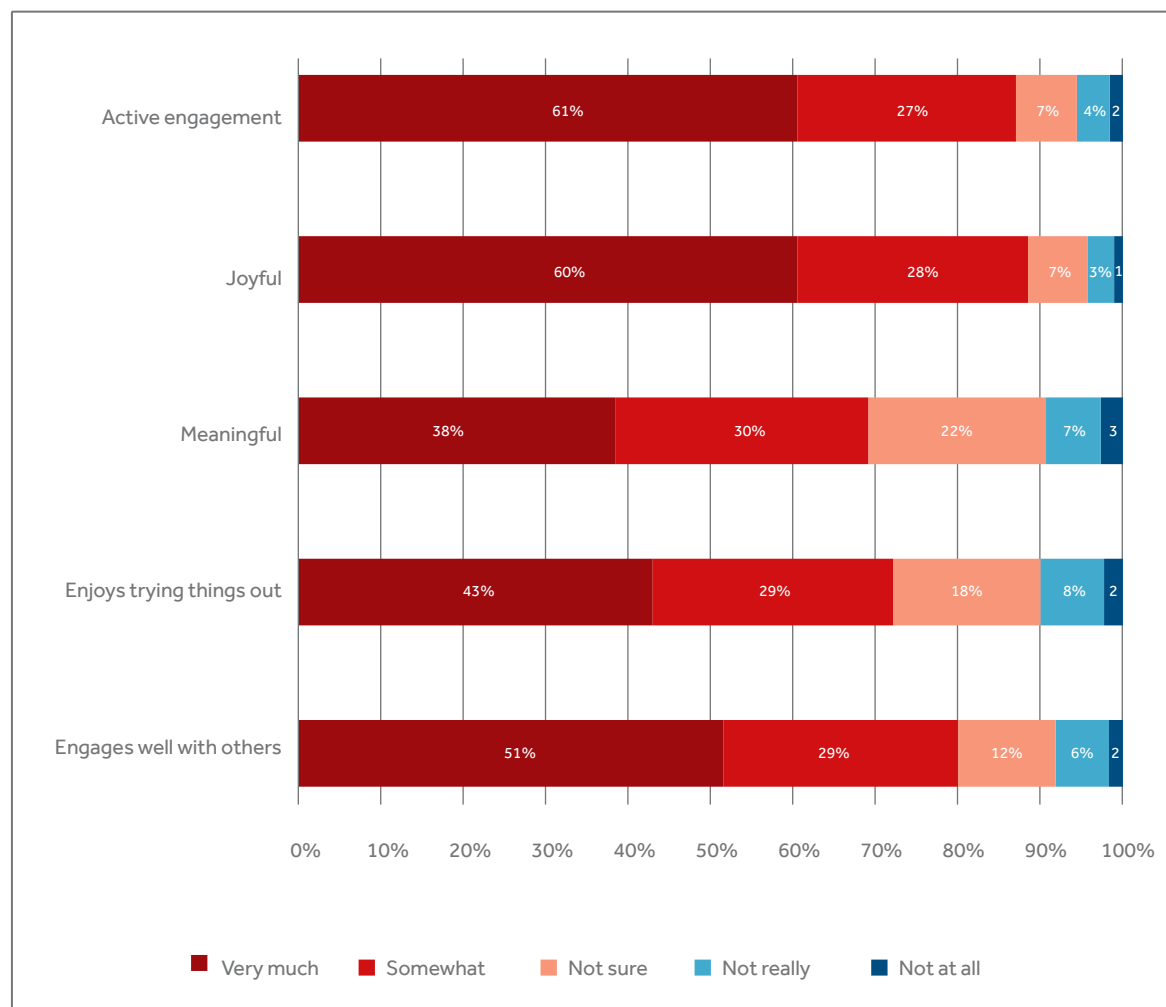
Figure 14: Levels of agency in play with technology



As outlined previously, the LEGO Foundation's LTPET is based on the work of Zosh et al. (2017), who identified that playful learning is joyful, involves active engagement, is iterative, meaningful and socially interactive. Parents were asked about the extent to

which children demonstrated these characteristics in their play (Figure 15). Only two of these characteristics – active engagement and joyful play – were observed by a clear majority of parents.

Figure 15: Playful learning characteristics

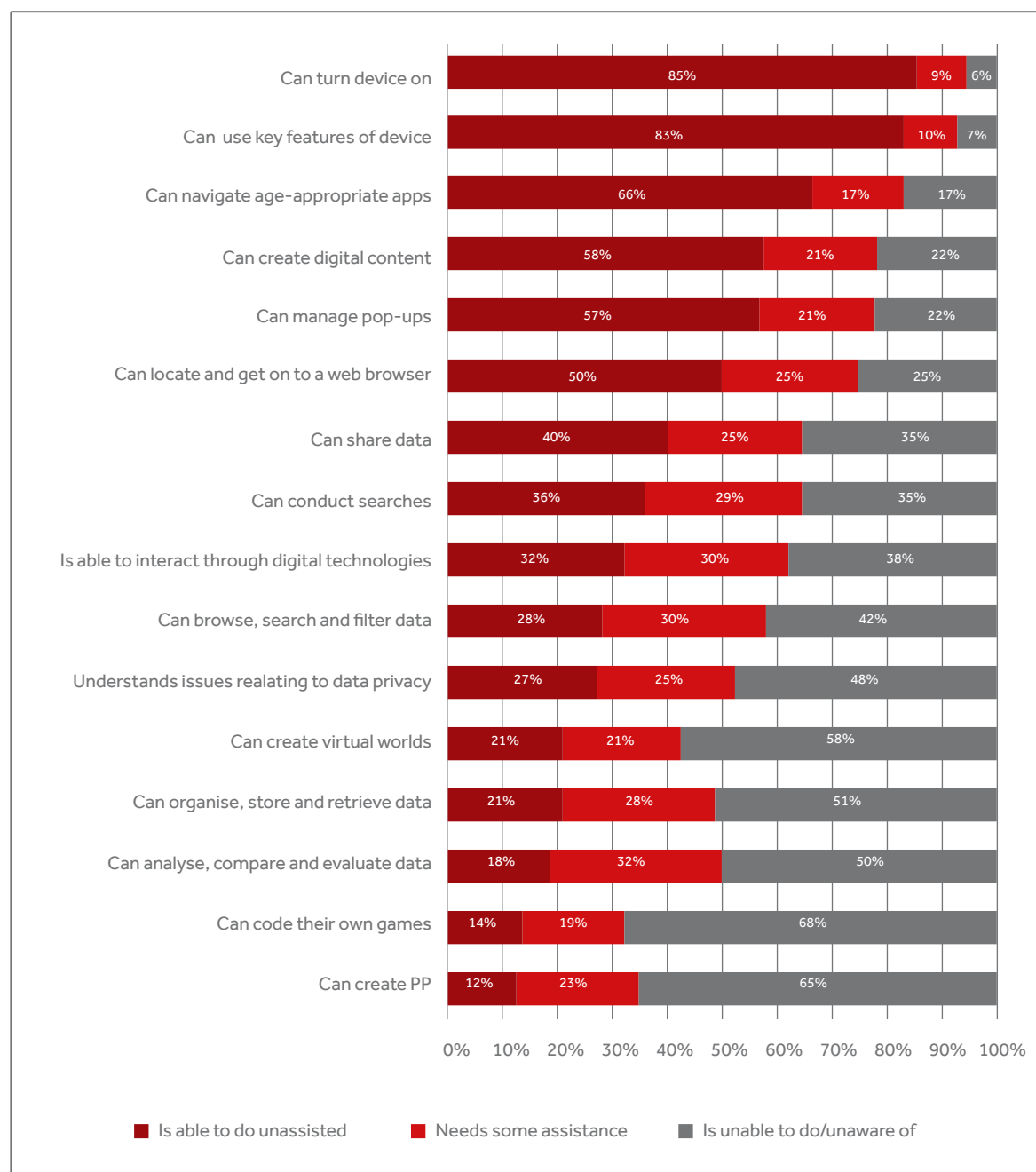


Parents were able to identify a range of skills developed by children as they played with technology (see Figure 16). The majority of children can perform basic tasks such as turning on a device (85%), use key features (83%) and navigate age-appropriate apps (66%).

Perhaps more surprisingly, more than half of children can create digital content (58%) and a substantial minority (40%) can share data without assistance. In comparison, fewer children can conduct searches and manage data/

information, and only one in four (27%) understands issues related to data privacy. In comparison to the UK data, similar proportions of children are able to conduct basic tasks; however, fewer South African children seem able to accomplish more complex undertakings, such as coding games and creating PowerPoint presentations. Yet, this does not apply to sharing data and creating digital content. This could be a result of the type of technology that children have access to.

Figure 16: Children's digital skills

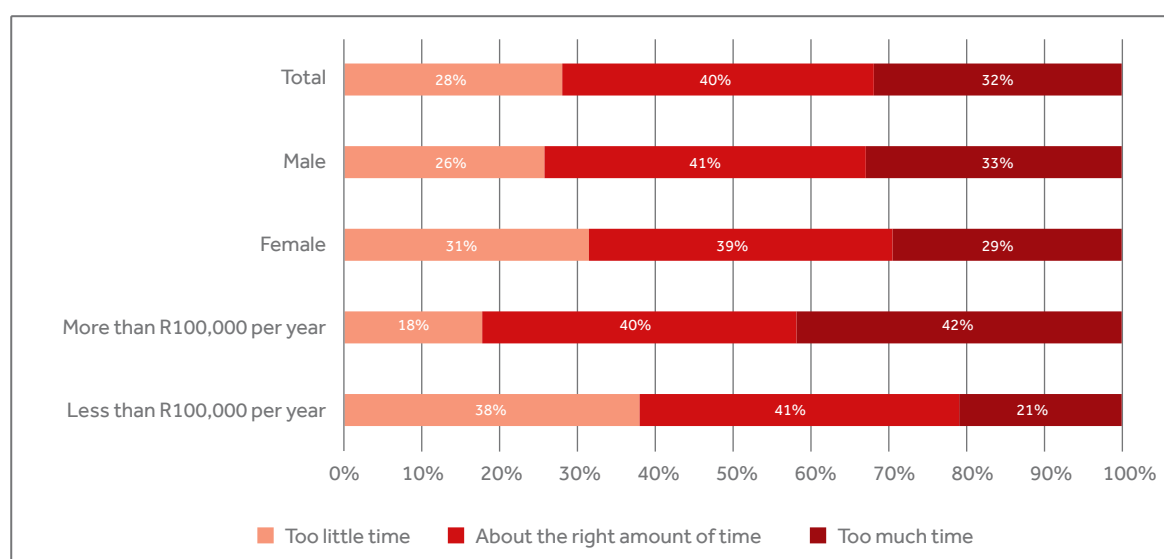


Note: For many of these questions, about 20% of the data were missing. Nevertheless, it should be a sufficiently large number of cases to draw conclusions from the table.

2.1.4 Parental views and practices

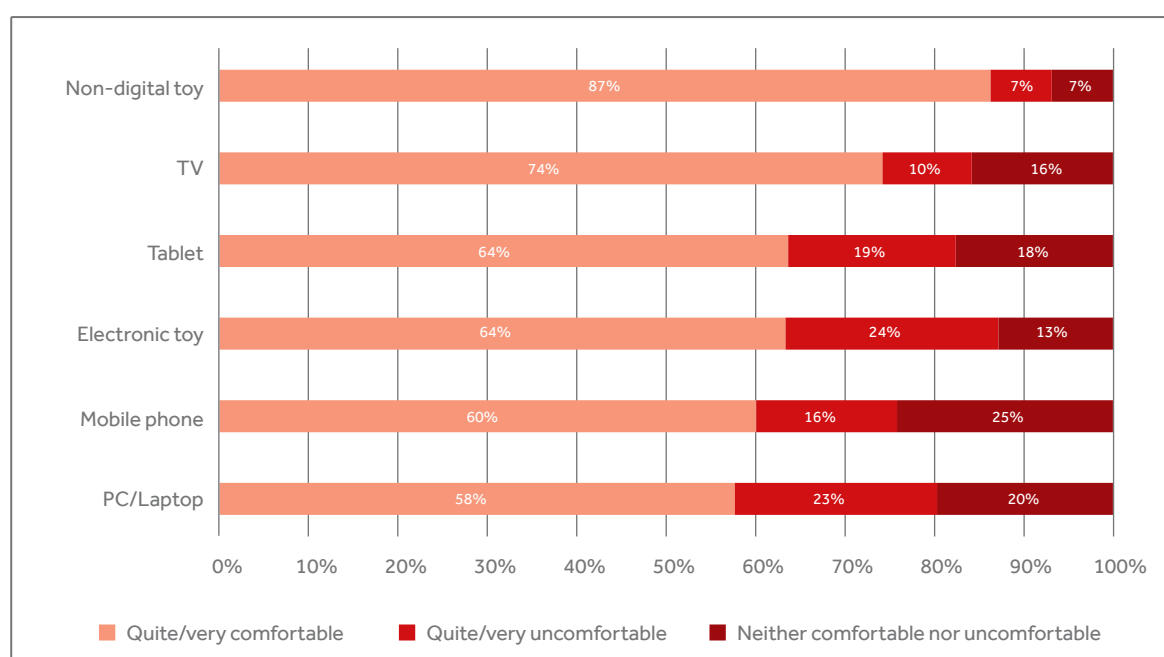
Only about 40% of parents say that their children spend about the right amount of time playing with technology (Figure 17). This is markedly different to the finding in the UK, where about 60% of parents are of

the same opinion. What is more, a substantial number of respondents say that their children do not spend enough time with technology. Here the difference compared to the finding in the UK is even bigger, as virtually none of the parents in the UK held that view.

Figure 17: Parental views on time spent on technology

Parents' level of comfort differs in relation to different technologies. While it is unsurprising that almost 90% of parents are comfortable using non-digital toys, 75% of parents are also comfortable with television (Figure 18). Parents show the highest level of discomfort

with mobile phones and PC/laptops. Together with tablets, these devices tend to have the best internet connectivity, making it potentially more difficult to assess what exactly children do with these devices compared to TVs and electronic toys.

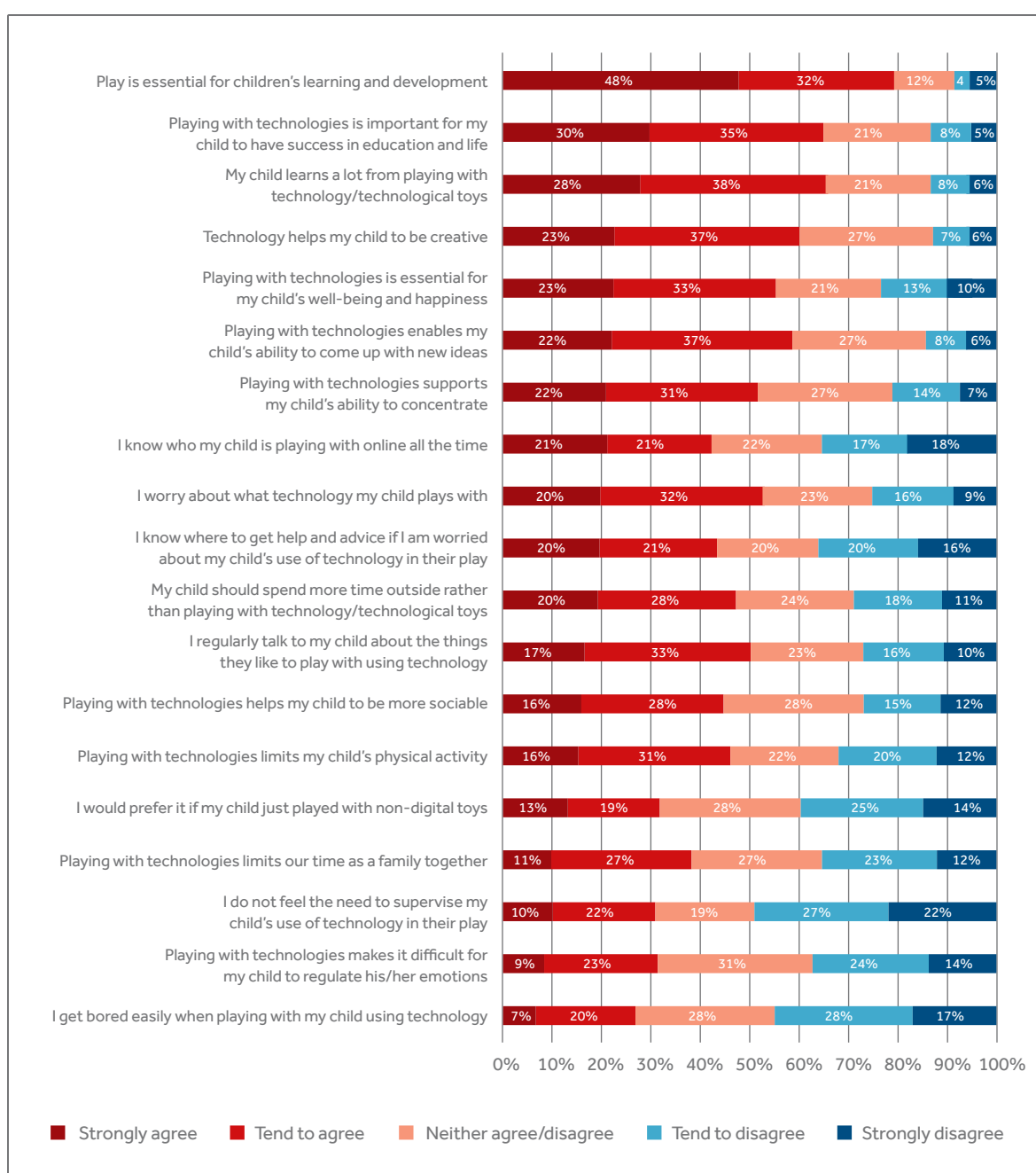
Figure 18: Parents' comfort levels in relation to technologies

Note: Other devices were excluded from this analysis due to the lower case numbers.

While parental attitudes and practices varied in relation to technology, several key trends can be observed (Figure 19). Overall, a majority of parents agree that it is essential for children's learning and development (80%), success in education and life (65%), and that children can learn a lot from playing with technology (66%). However, far fewer parents always know who their children play with and know where to get help

and advice if they are worried about their child's use of technology. Moreover, while technology does not seem to help children to be more sociable, the use of technology also does not seem to have a large negative effect on family time. What is more concerning is that only about half of parents regularly talk to their children about the use of technology.

Figure 19: Parental attitudes and practices



Although slightly lower than in the UK sample, the majority of parents who are confident in playing with technology (63%) were also more inclined to help their children play with it (64%). (Figure 20A & 20B)

Figure 20A: Parental confidence levels in using technology

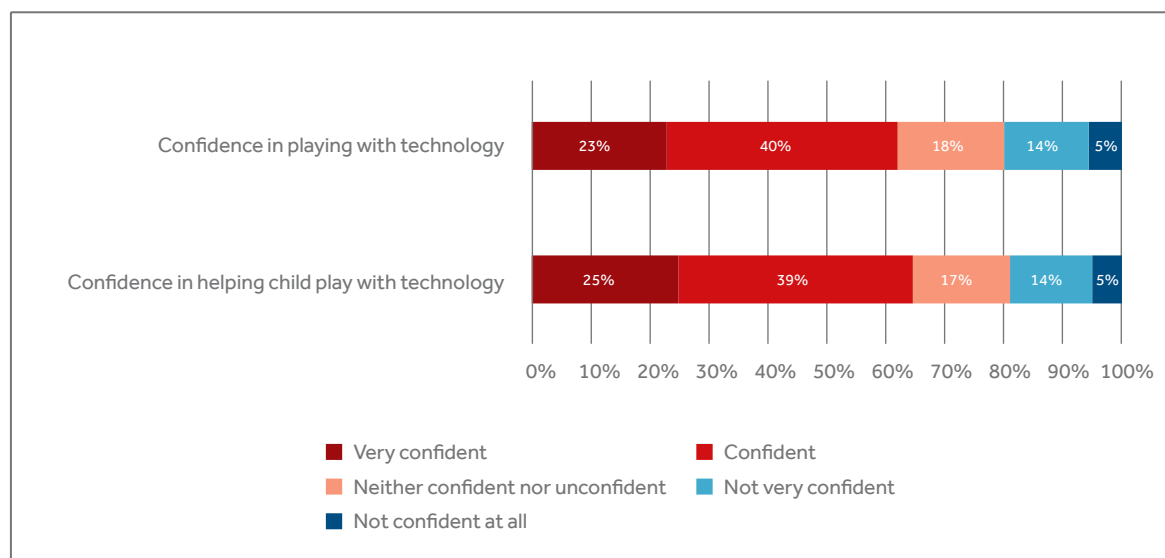
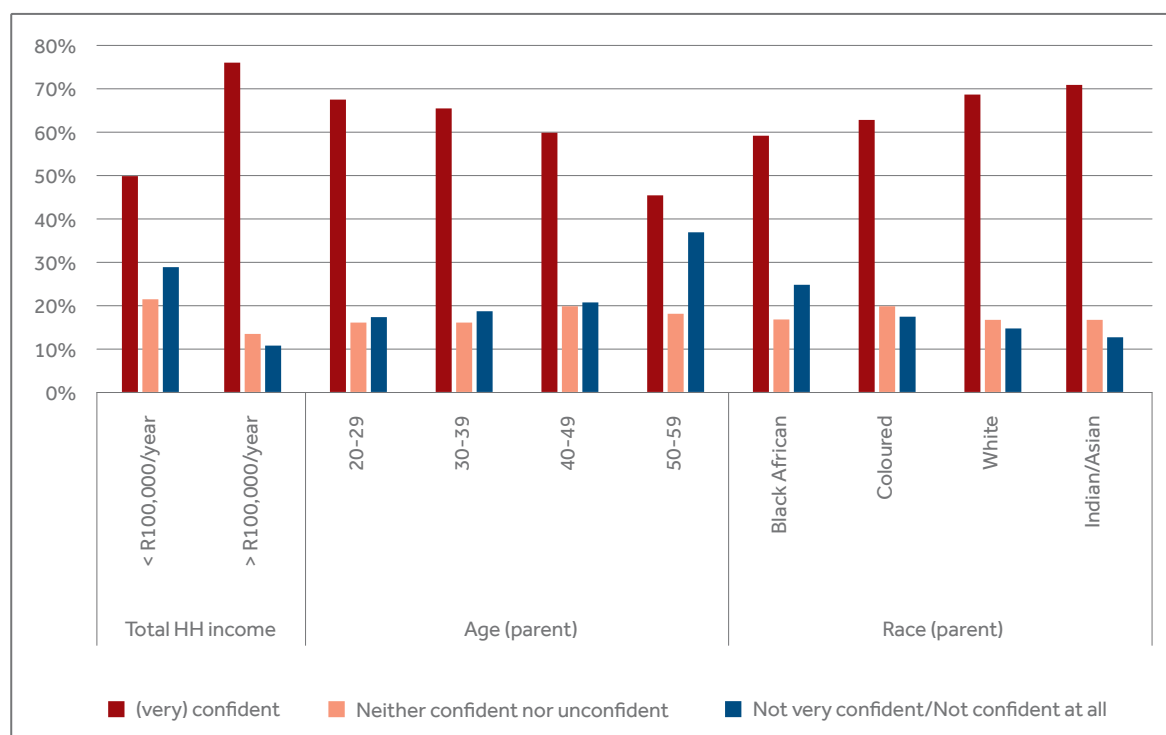
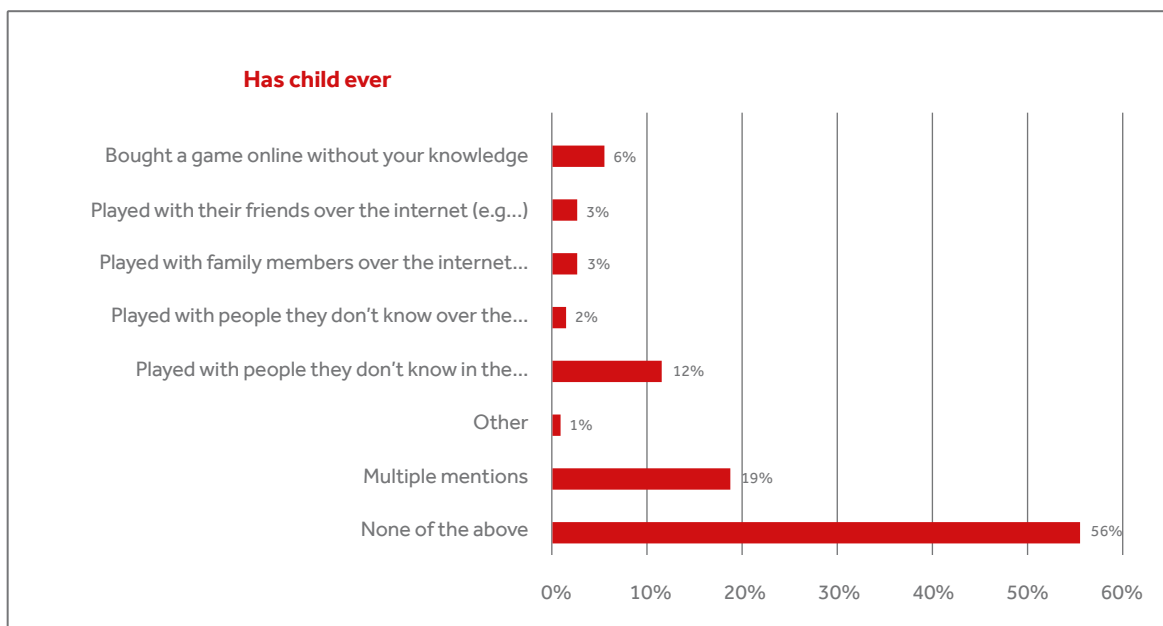


Figure 20B: Parental confidence levels in using technology compared to friends in same age group



Note: This part of the analysis excludes 'missing' cases

Figure 21: Children's online activities



Although a majority of parents make use of parental control and safety features at least sometimes, a substantial minority of parents are not aware of parental control or safety features. On average, fewer parents in the SA sample are aware of them than in the UK sample. Yet, a similar proportion make use of

them. This suggests that once parents are aware of them, they consider them to be a good idea and do make use of them. The general lack of parental control awareness when children play with a smartphone, such as turning a location finder feature on or off, could have policy implications.

Figure 22A: Use of parental controls and safety features

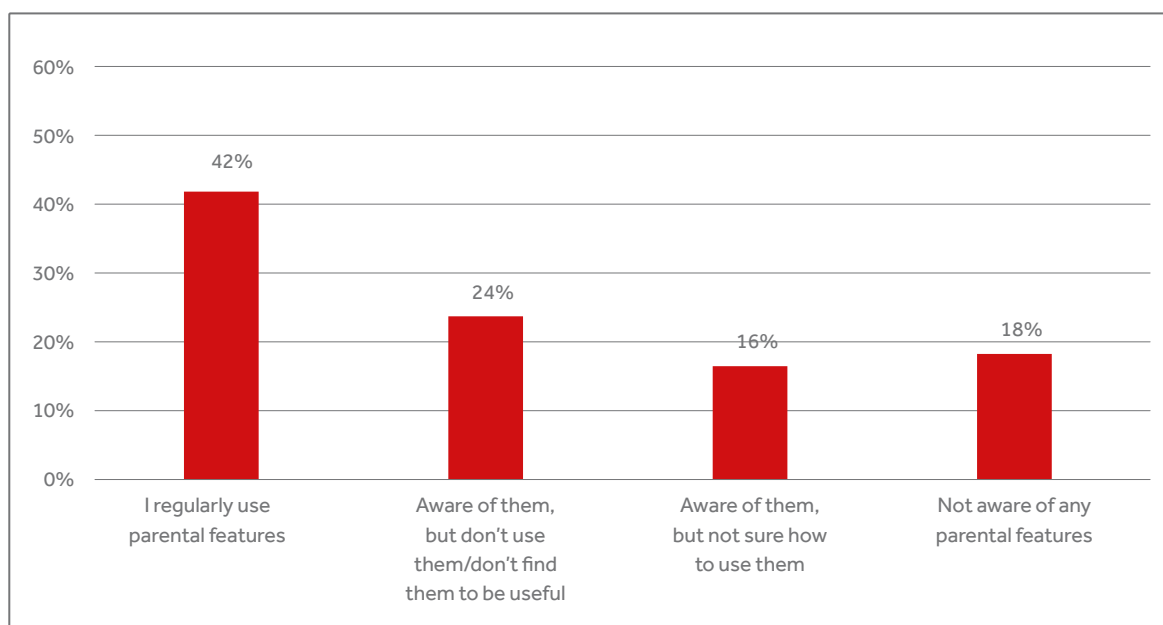
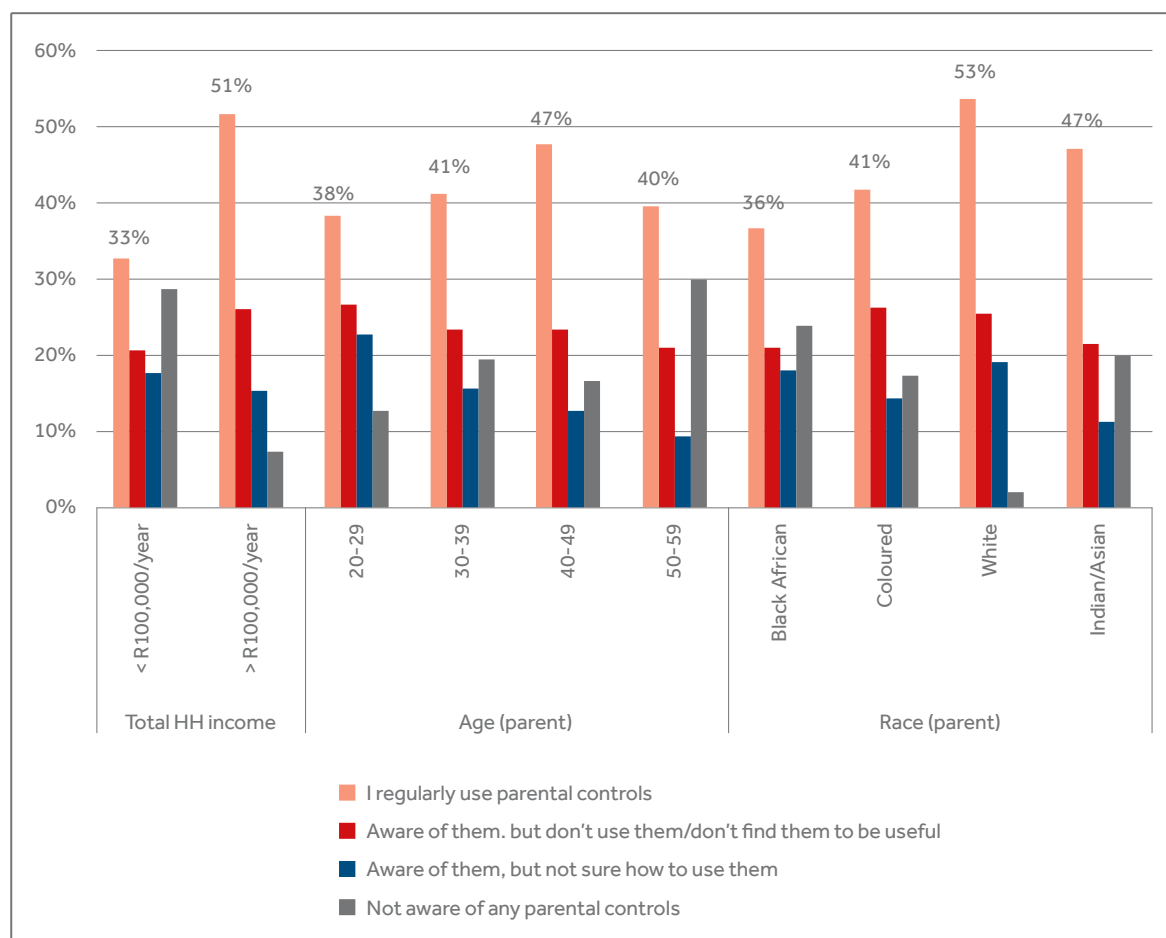
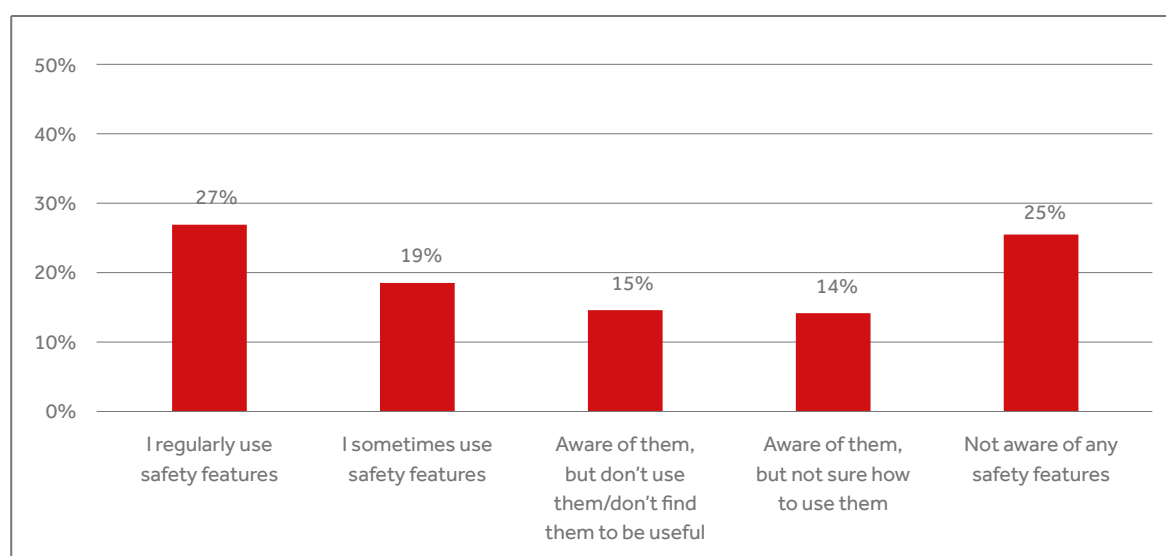


Figure 22B: Use of parental controls and safety features



Note: This part of the analysis excludes 'missing' cases

Figure 22C: Use of parental controls and safety features



Overall, a majority of parents have privacy concerns regarding hidden advertising, access of third parties, and on how children engage with the devices (Figure 23).

Figure 23: Parental levels of concern about data privacy



Note: Comparison with UK data is only partially possible, as the SA data do not have a 'My child does not use' category, only a 'missing' category, which is not necessarily the same.

Note: For this comparison, all 'missing' cases were excluded

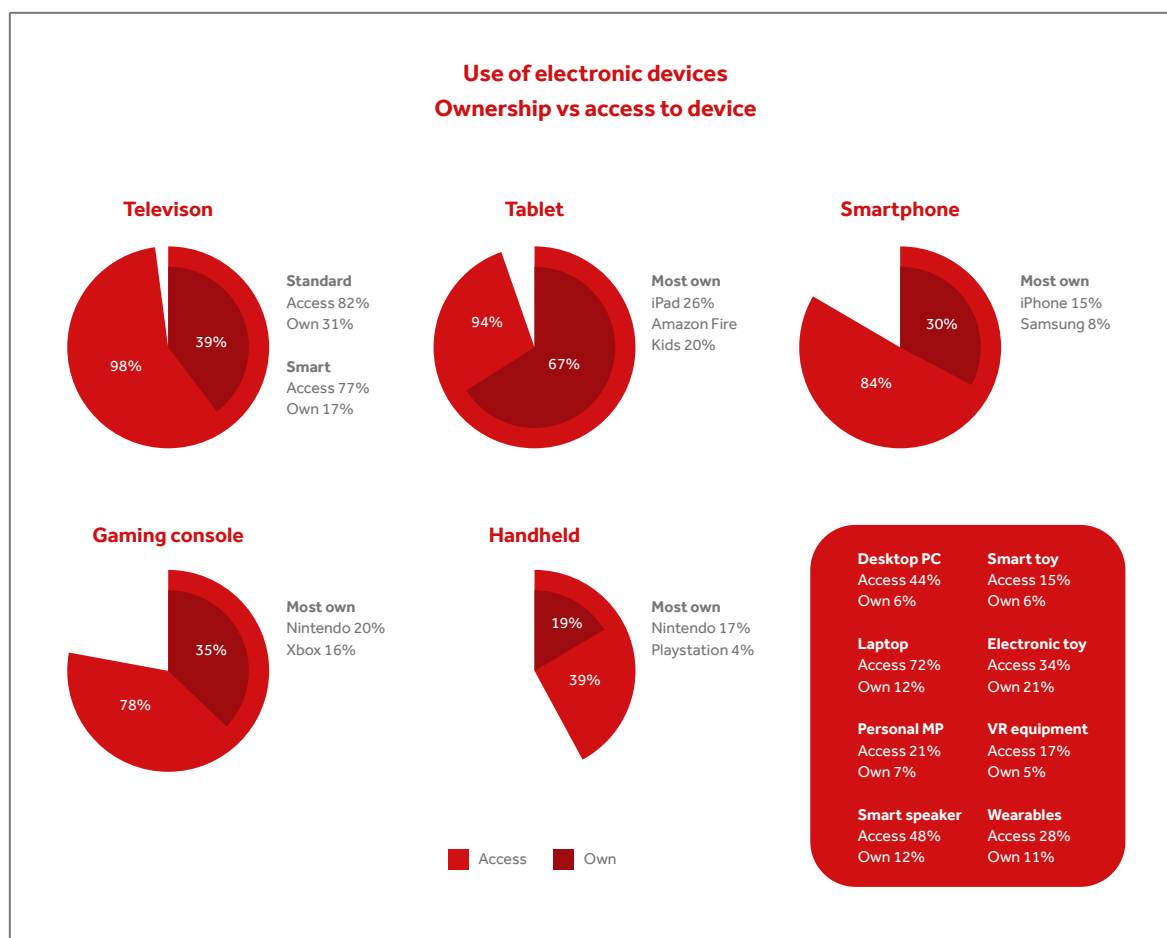
2.2 Children, technology and play: UK survey data analysis

2.2.1 Access to technology

Children in the UK have access to a wide range of technologies at home and elsewhere (e.g. grandparents' home) that they can use. Figure 24 indicates that the majority of children in the sample have access to standard televisions (82%), smart TVs (77%), tablets (94%), smartphones (84%), laptops (72%) and games consoles (78%).

Overall, 30% of children own their own smartphone, but there are age differences in that older children are more likely than younger ones to own a phone. Gender differences are most pronounced in relation to ownership of games consoles, with boys more likely to own PlayStation and Xbox consoles, but with a less significant difference in relation to ownership of a Nintendo console. Sixty-seven percent of the children whose families took part in the survey own their own tablet but this figure increases with age, so 71% of 8–11-year-olds own tablets, in comparison with 63% of 3–7-year-olds.

Figure 24: Ownership versus access to devices

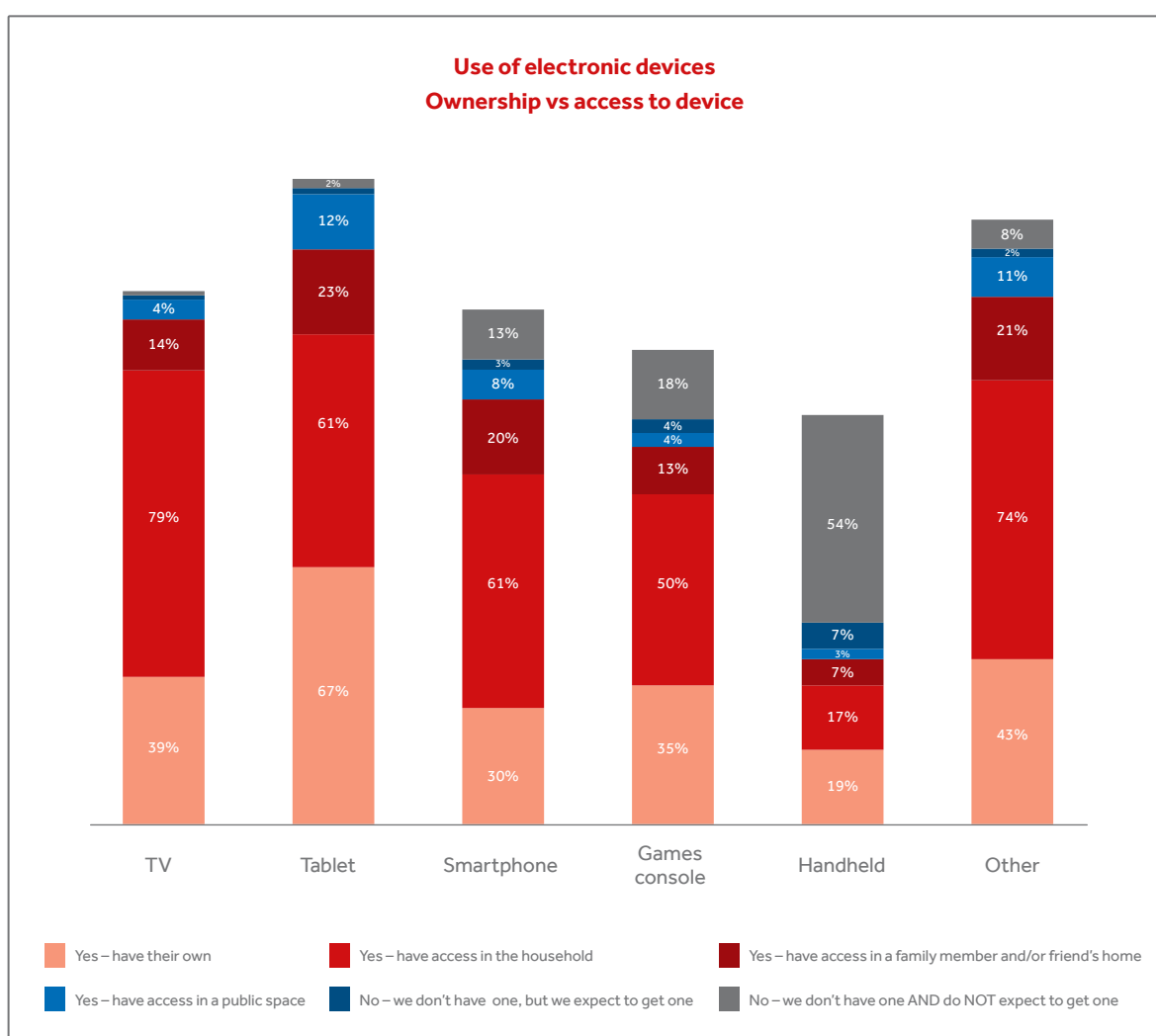


Source: Dubit/University of Sheffield - November 2019. AQ1 Which of these does your child have access to? (Base: n=2429)

There is evidence of newer forms of technology being adopted by families. For example, 48% have access to a smart speaker, such as Amazon Echo, Apple HomePod or Google Home, 28% have access to a wearable technology, 17% of children have access to virtual reality (VR) equipment and 15% have access to a smart toy. There were gender differences here, with boys more likely to own electronic toys such as drones and VR equipment than girls.

Most children have access to these devices in their home (see Figure 25). There were differences in relation to Black, Asian and Minority Ethnic (BAME) and White families in that children from BAME families were more likely to have access to some devices outside of the home. Tablet ownership is greater than television ownership for children, as the presence of televisions in children's bedrooms continues to reduce in the UK (Ofcom, 2019).

Figure 25: Ownership versus access to devices

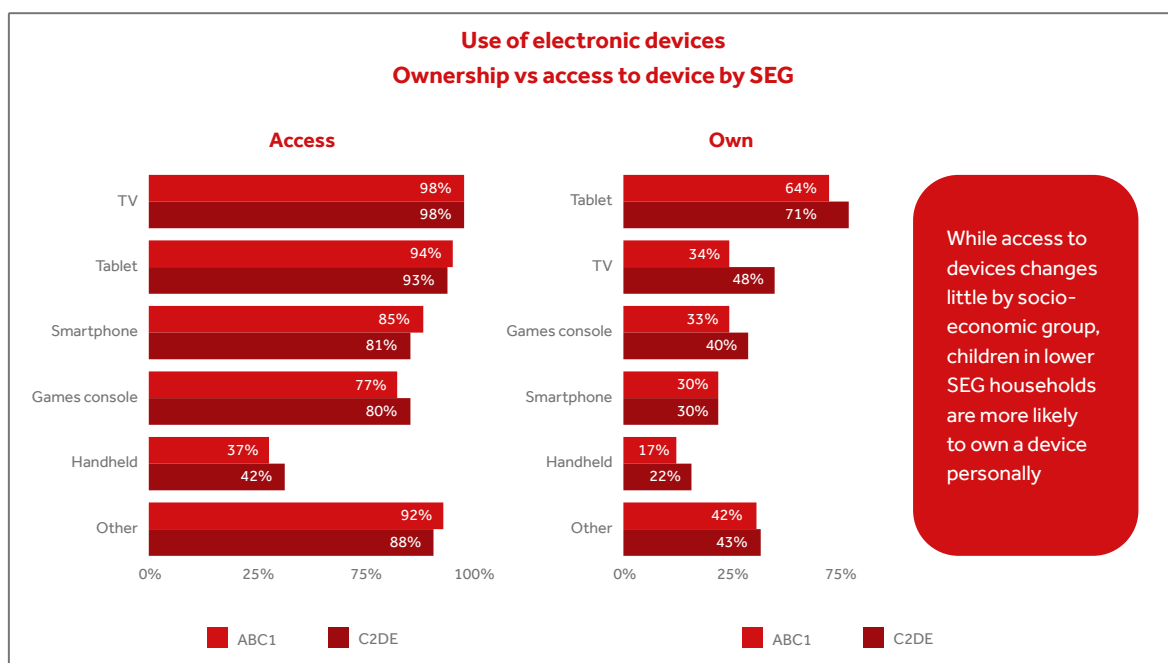


Source: Dubit/University of Sheffield - November 2019. AQ1 Which of these does your child have access to? (Base: n=2429)

Tablets are the most favoured technology of children. Sixty-seven percent own their own tablet, far more than the number of children who have their own TV (39%) or

smartphone (30%). Children in lower socio-economic groups are more likely to own their own devices than children in higher socio-economic groups (see Figure 26).

Figure 26: Ownership versus access by socio-economic group



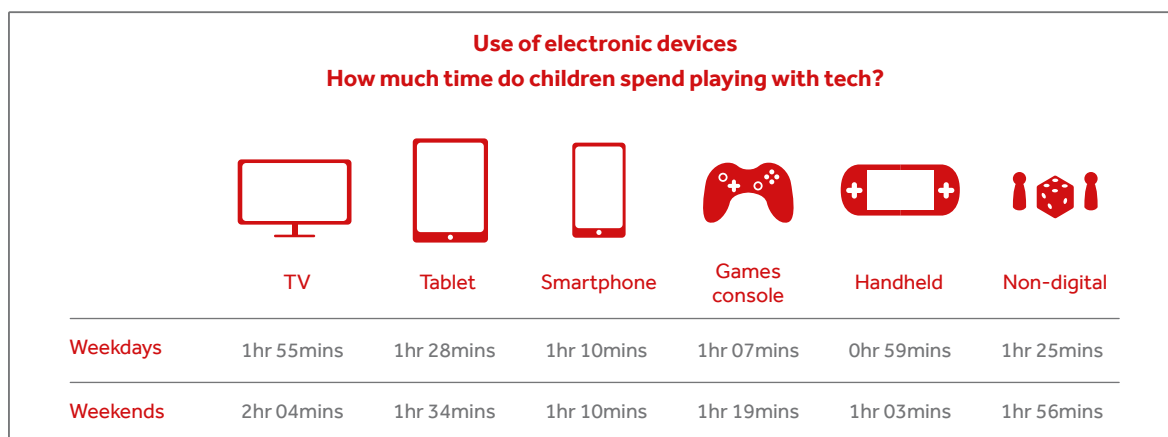
Source: Dubit/University of Sheffield - November 2019. AQ1 Which of these does your child have access to? (Base: n=2429) ABC1 / C2DE refer to NRS Social Grades in UK as per <http://www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade/>

2.2.2 Children's play

Children who own devices spend time daily using them, alongside engaging in non-digital play. Time on all types of play increases at the weekend, although play on smartphones is the same across weekdays and weekend days (see Figure 27). According to parents, time spent watching television and playing on tablets is

greater than play with non-digital games and artefacts during the week, but on weekends, only time spent viewing television exceeds time on non-digital play. It is important to note the continued significance of television in young children's lives, and it is clear that children are now accessing television across a range of devices.

Figure 27: Time spent playing with technology



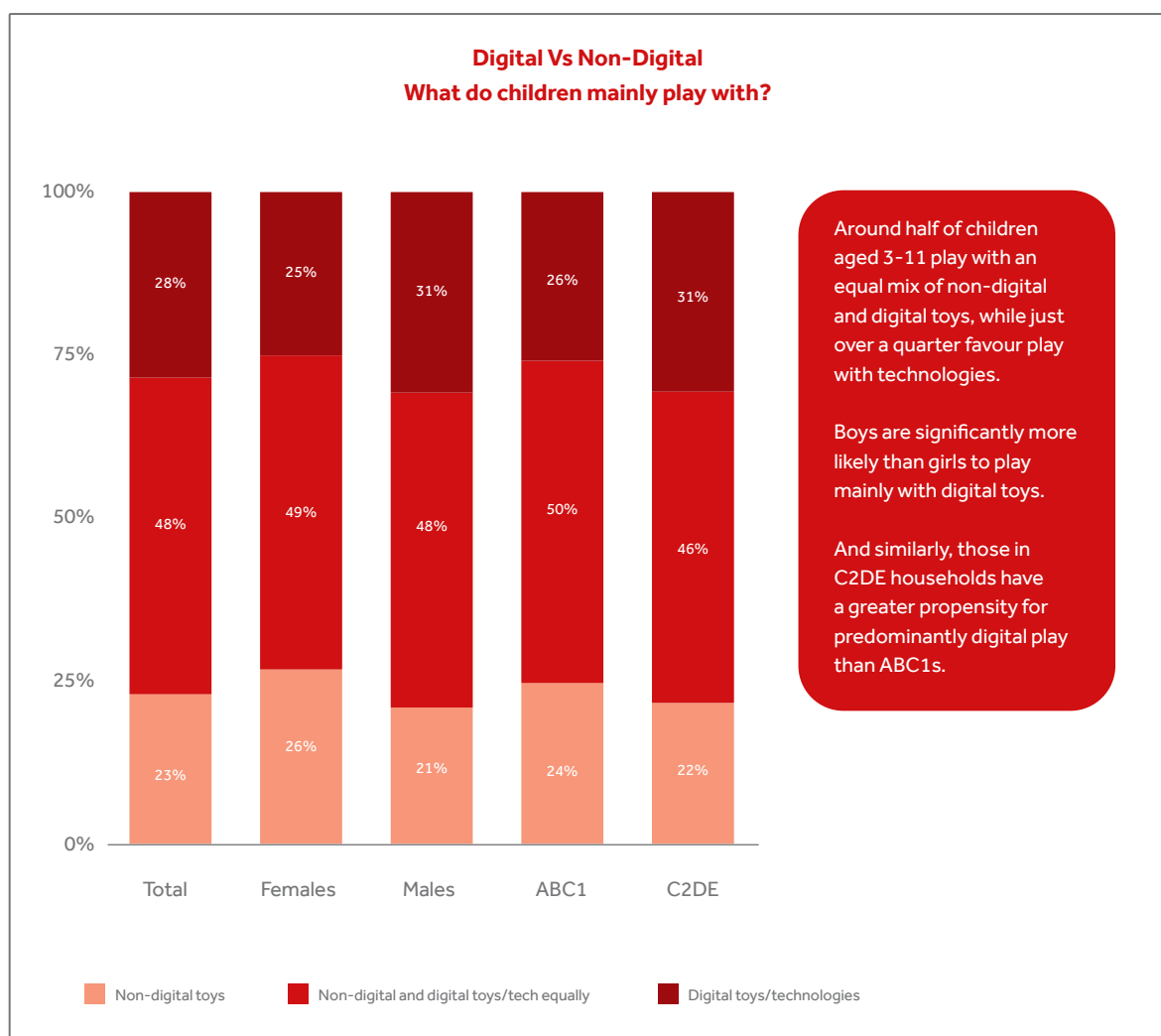
Source: Dubit/University of Sheffield - November 2019. AQ2/3 On a normal weekend/weekday, how much time does your child spend playing when using the following technologies? (Base: n=2429)

Further statistical analysis revealed that those children who were identified by parents as being 'less interested in technology than their friends' are more likely to spend fewer hours on all activities than those 'more interested', both at weekends and during the week. For example, on weekdays 29% of those less interested in technology spent less than four hours using it, compared to 19% of those more interested. Those reported as being 'more playful than their friends' spend fewer hours on all activities than those 'less playful than their friends' both at weekends and during the week;

e.g. on weekdays, 22% of those described as less playful spent 20+ hours using devices compared to 9% of those more playful.

Further, there was some evidence that those who play in shared rooms spend less time on all activities compared to those who play in their own room, both on weekends and during weekdays. Additional analysis indicates that 18% of those who play a handheld console in a shared room spend less than four hours (weekdays) playing it, compared to 8% of those who play in their own room.

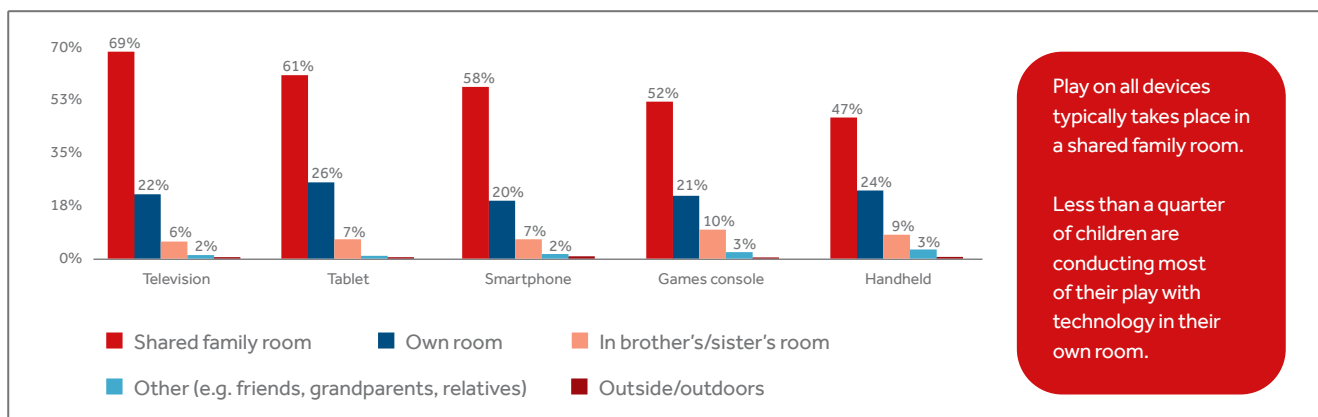
Figure 28: Digital versus non-digital play



Source: Dubit/University of Sheffield - November 2019. BQ16. My child plays mainly with... (Base: n=2429)

Play in the majority of cases takes place primarily in shared rooms in the family home (see Figure 29).

Figure 29: Where do they mostly play?



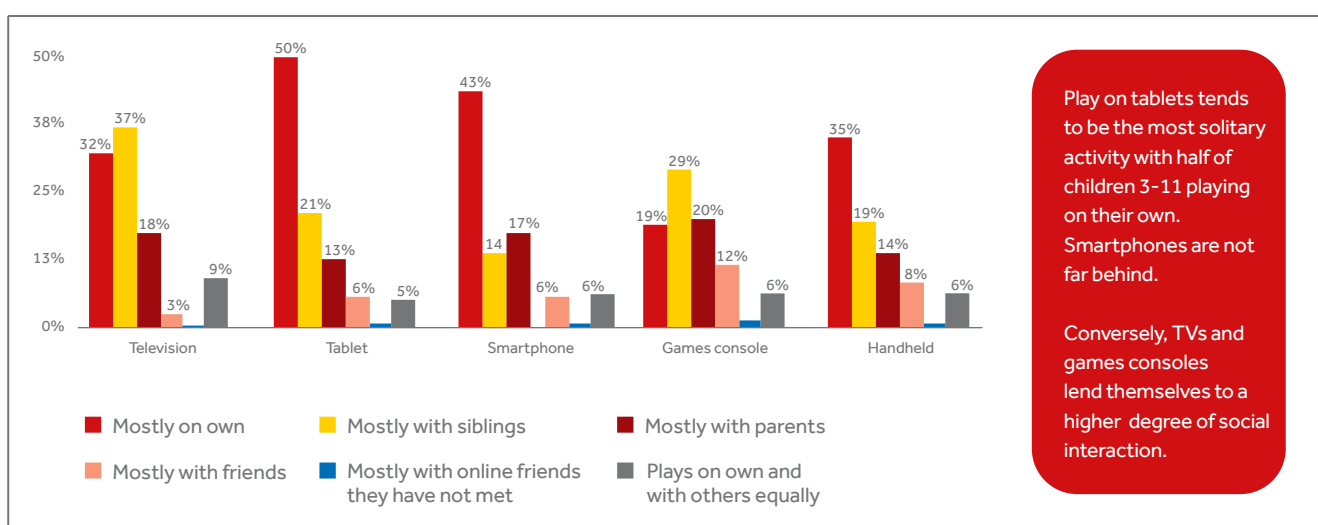
Source: Dubit/University of Sheffield - November 2019. BQ15 Where does your child play with technology, mainly? (Base: n=2429)

Children play most frequently with tablets and smartphones on their own, while play with television and console games is more social in nature (see Figure 30). However, it is worth noting that parents may not be aware of social play when their child is using a tablet or smartphone and thus assume that it is always solitary play. Further statistical analysis indicated that when children played with some devices in shared rooms, parents were less likely to say that they spent too much time using technology (e.g. 40% of parents who stated that children mainly played with a tablet in their own room felt that their child spent too much time using

technology, compared with 28% who reported children playing with a tablet in a shared room).

It is of interest that the children of parents who regularly use parental controls (as discussed later) are more likely to play in a shared room than those children whose parents are not aware of parental controls (e.g. 81% of those parents who regularly use parental controls have children playing in a shared room, as opposed to 63% of those who are not aware of parental controls). Therefore, spatial as well as technical restrictions are important for parents who are more concerned about safety issues.

Figure 30: Who do children play with?

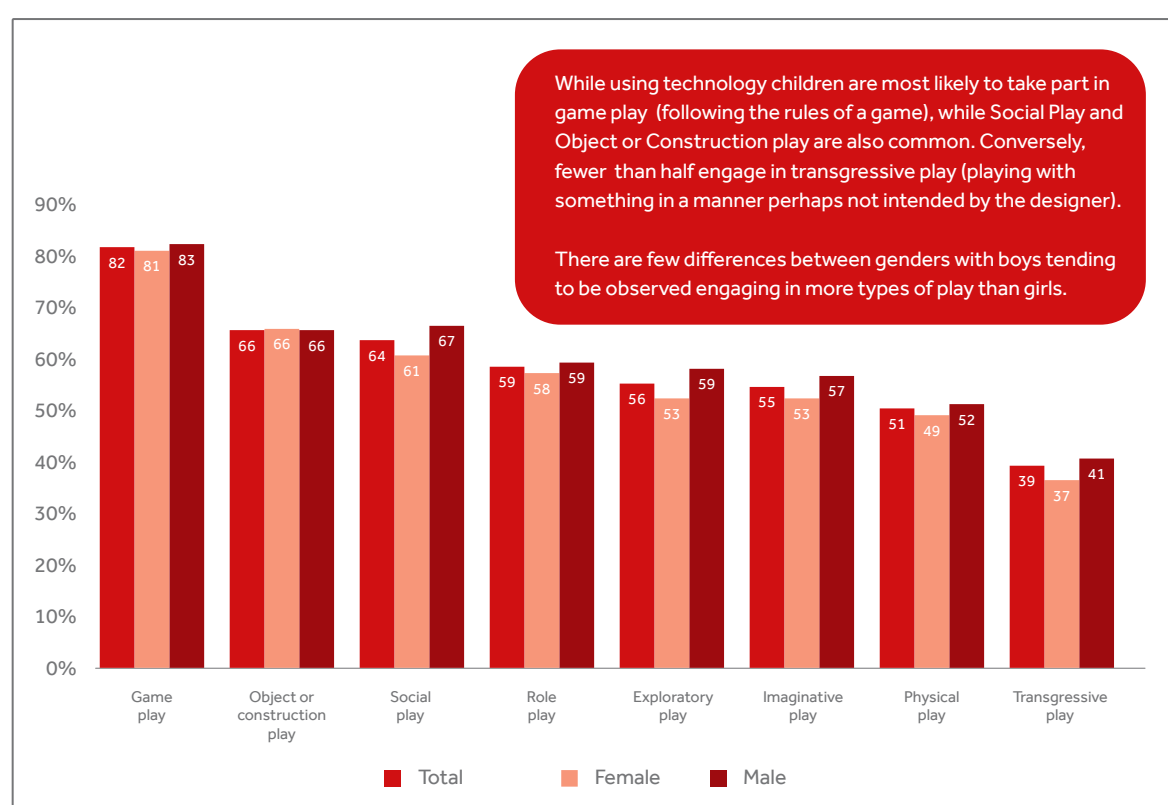


Source: Dubit/University of Sheffield - November 2019. BQ14. Who does your child play with mostly when using technologies? (Base: n=2429)

We asked parents about the types of play children engaged in when using technology, using the classifications introduced by Hughes (2002), and subsequently developed for digital play contexts by Marsh, Plowman, Yamada-Rice, et al. (2016). Game play was the most frequent, and social play and object and construction play were common (see Figure 31). Parents reported that fewer than half of children played with technology in a transgressive manner, i.e. playing with objects in a manner perhaps not intended by designers. This could reflect parents' reluctance to

report on such play or could suggest that the majority of children play with technological hardware and software in line with producers' intentions. A higher proportion of BAME parents reported that their child engaged in transgressive play. This may be due to the fact that games frequently lack diversity so children may wish to play with them in ways not intended by the producer in order to make them more relevant to their lives. Figure 31 indicates that the play categories observed in non-digital play can also be observed in digital play.

Figure 31: Types of play observed when children use technology



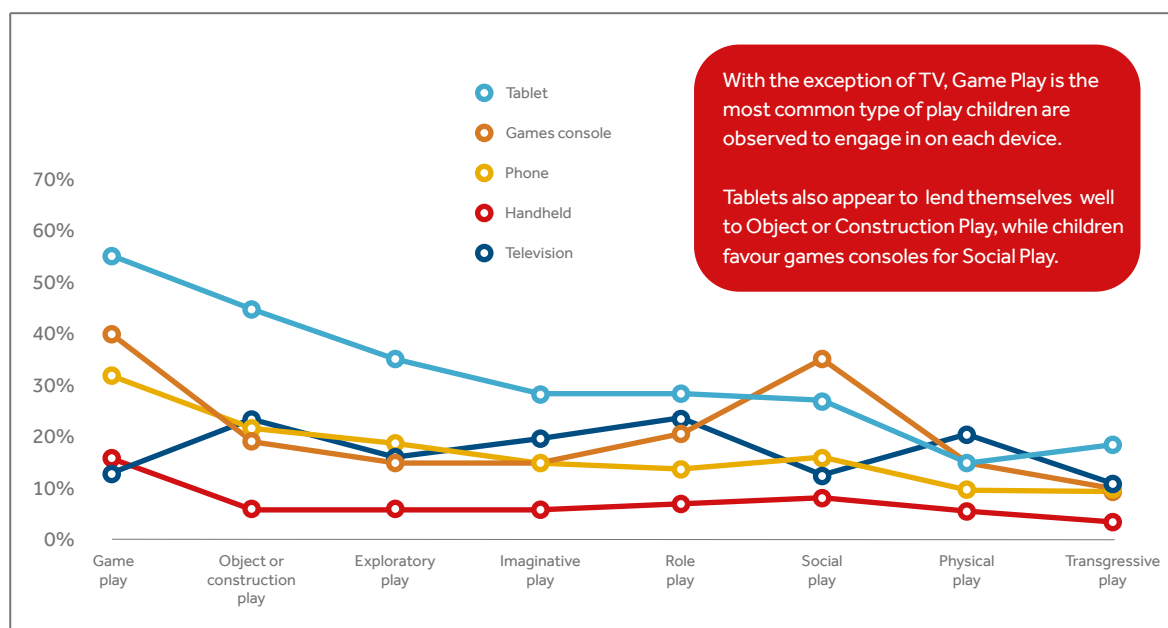
Source: Dubit/University of Sheffield - November 2019. BQ1. On which technologies have you observed your child engaging in following types of play? (Base: n=2429)

Further statistical analysis demonstrated a significant relationship between the extent to which children play with others, their access to devices, and their engagement in a range of types of play. Children are more likely to have fewer devices and engage in fewer types of play if they play mostly on their own when compared to if they play with friends. For example, in relation to wearable technology, 85% of those who play mostly with friends engage in 6+ different types of play

compared with 53% of those who play on their own. From this, it can be concluded that social play broadens children's digital play experiences.

With the exception of TV, game play is the most common type of play that children are observed engaging in on each device. Games consoles lead most frequently to social play (see Figure 32).

Figure 32: Types of play by the device

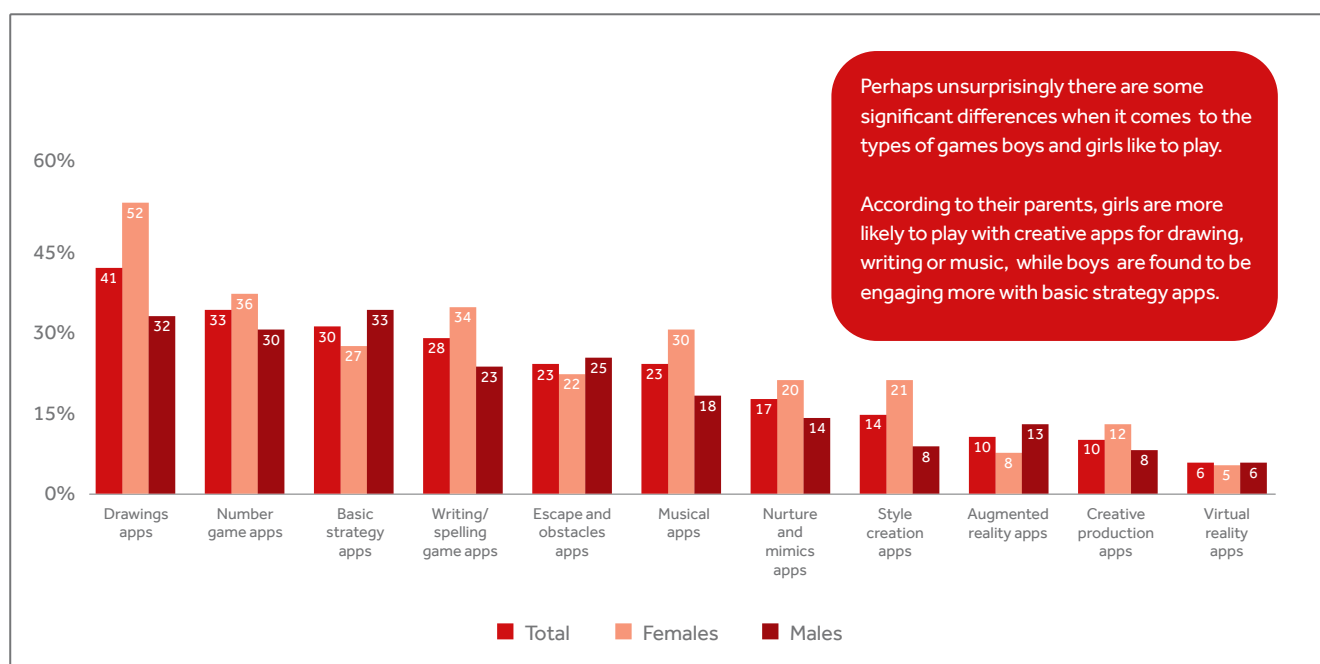


Source: Dubit/University of Sheffield - November 2019. BQ1. On which technologies have you observed your child engaging in following types of play? (Base: n=2429)

As found in the Technology and Play (TAP) study (Marsh et al., 2015), children enjoy playing on a wide range of types of apps on smartphones and tablets. In this study,

gender patterns similar to those in the TAP study were identified, with more girls than boys using drawing, writing and/or music apps (see Figure 33).

Figure 33: Types of apps played with

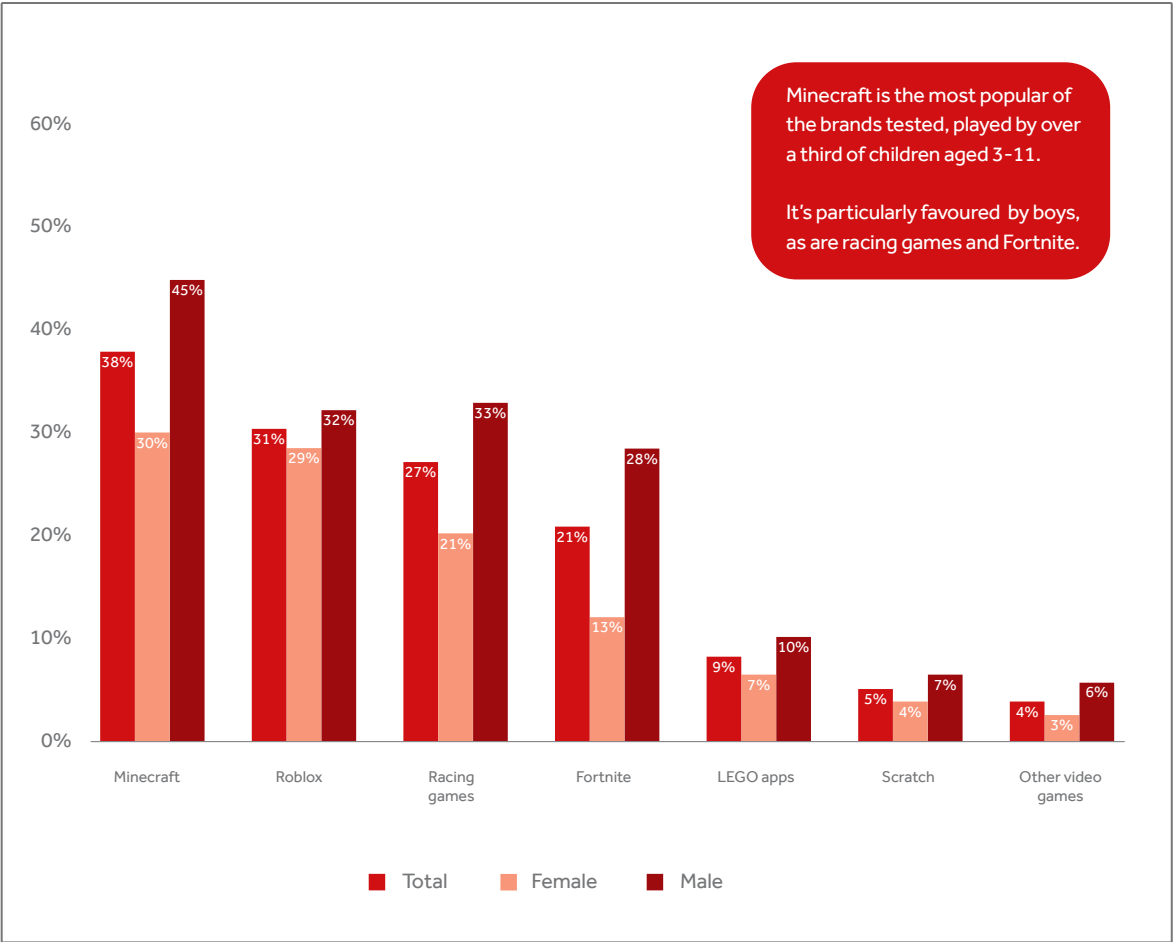


Source: Dubit/University of Sheffield - November 2019. BQ2. Which of the following does your child play with or play on? (Base: n=2429)

Children from BAME communities were more likely than others to play with creative production apps. This is of interest in that this may provide them with more opportunities to explore their own cultures and identities, given that many apps are restricted in terms of diversity (Marsh et al., 2015). There were also age differences, with 3–7-year-olds more likely than older children to play with drawing and educational apps.

Younger children were also more likely to play with number than literacy apps, although this difference was not observed in relation to older children. In terms of brand/genres of games played with, Figure 34 indicates that over a third of children aged 3–11 play Minecraft.⁴ Roblox⁵ is also popular, with Roblox having a more even gender balance in players than Minecraft. Super Mario is also more popular with boys (see Figure 34).

Figure 34: Brands/genres of games played with

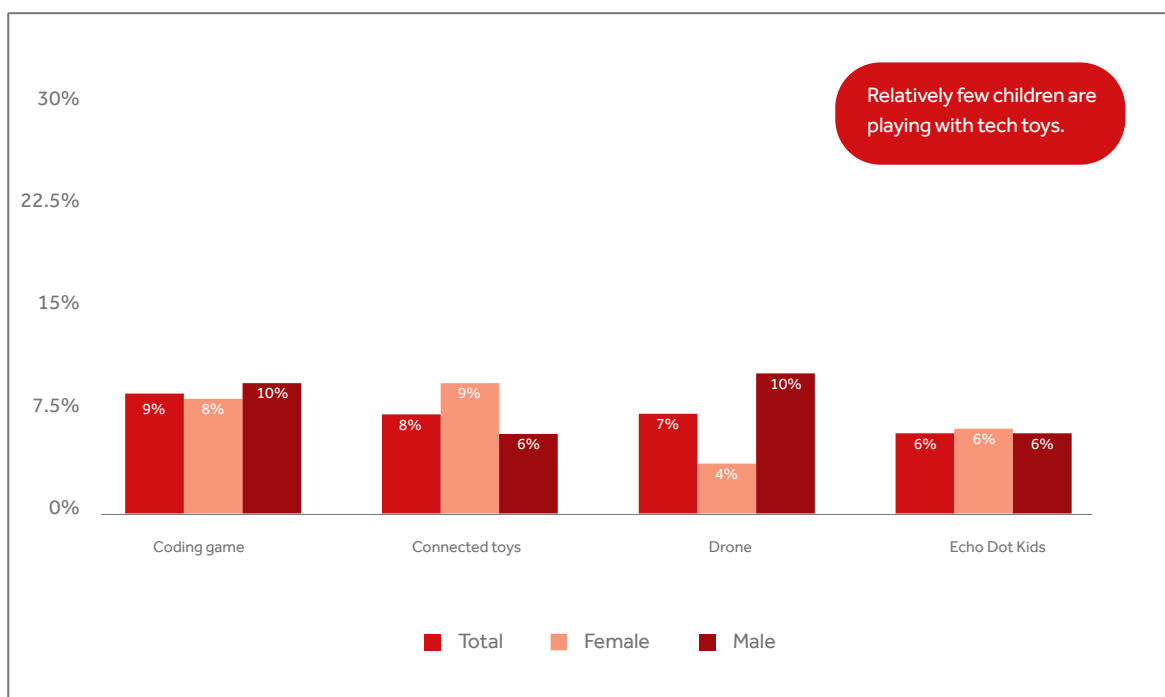


Source: Dubit/University of Sheffield - November 2019. BQ2. Which of the following does your child play with or play on? (Base: n=2429)

Tech toys, such as drones and toys connected to the internet, are less popular, as they are currently played by fewer than 1 in ten 3–11-year-olds (see Figure 35). There is a significant difference between the percentage of girls and boys playing with drones but a smaller gap in terms of the use of coding toys, which may be explained by the presence of a coding curriculum in English schools.

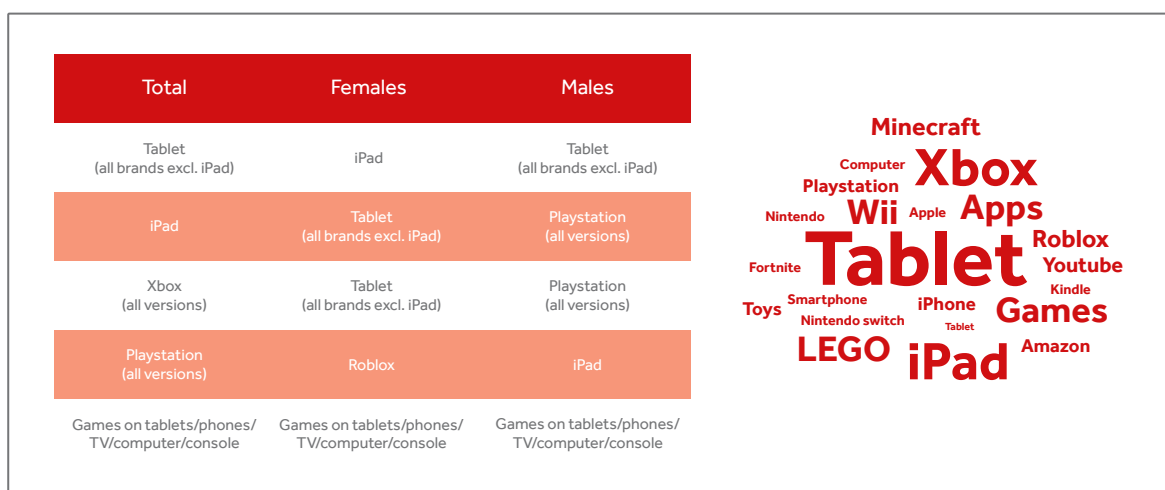
Parents reported that tablets were the technology that promoted most play, with games consoles such as Xbox and PlayStations also enabling children to be playful, although there were gender differences, with parents of girls more likely to say that smartphones fostered play (see Figure 36).

Figure 35: Tech toys played with



Source: Dubit/University of Sheffield - November 2019. BQ2. Which of the following does your child play with or play on? (Base: n=2429)

Figure 36: Technologies that foster play

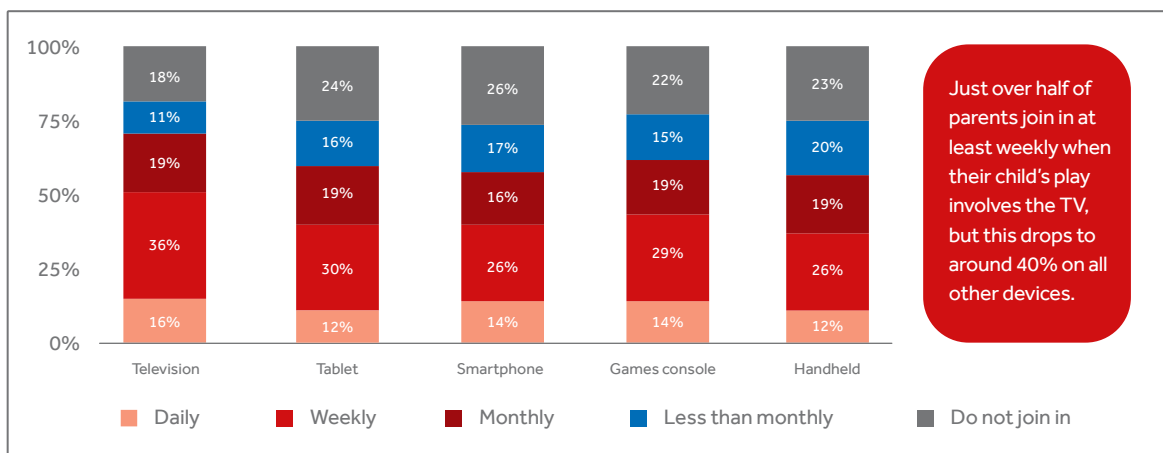


Source: Dubit/University of Sheffield - November 2019. BQ12. Please name any technologies that your child is particularly playful with. (Base: n=2429)

Figure 37 indicates that just over half of parents participate in play involving television and a sizeable minority (around 40%) play with their children on other devices per week. This may indicate something of a generation gap between parents and children in relation to comfort with play on different technologies. It also

emphasises the importance of favourite television programmes and films for fostering family play. A higher proportion of parents from BAME communities stated that they played with their children than White parents. All parents were more likely to say they played with younger children than older children.

Figure 37: Parents' co-play with different technologies

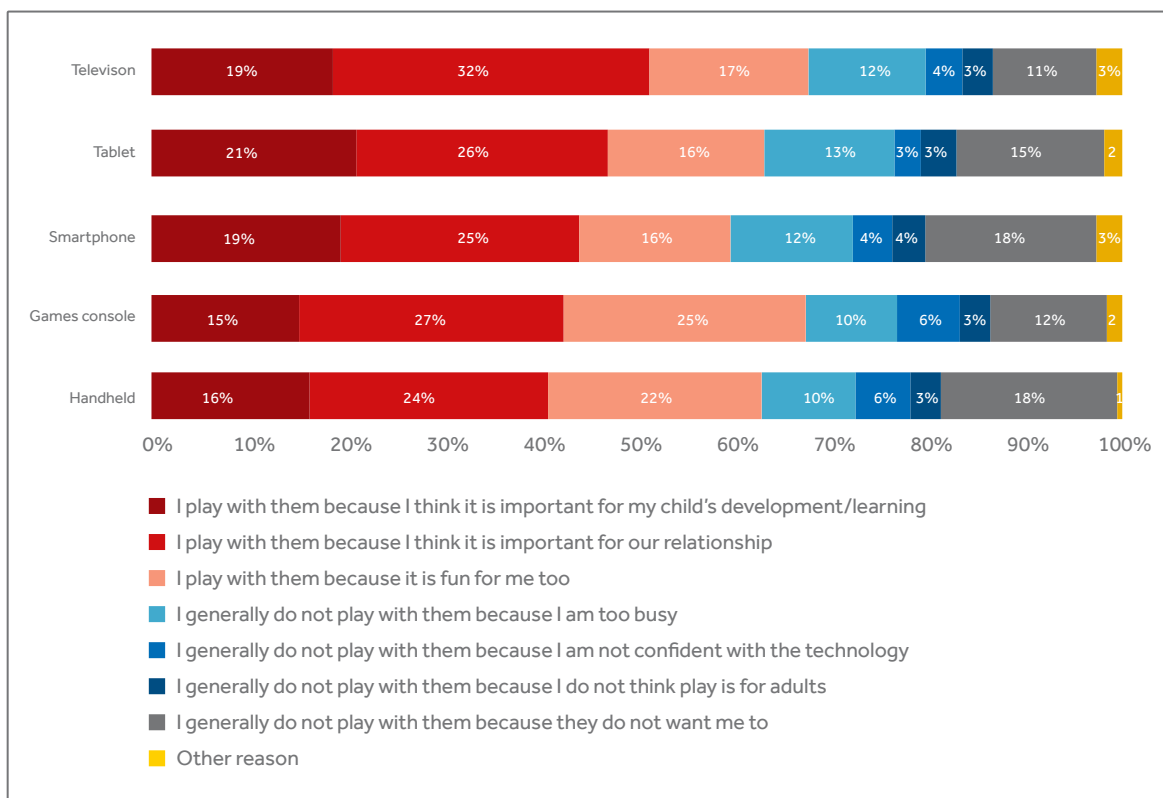


Source: Dubit/University of Sheffield - November 2019. BQ4. Do you tend to join in when your child plays with the following? (Base: n=2429)

Reasons for and against participating in play with children varied but more frequently parents suggested that they played with children because it was important for their relationships, and also because it supported

children's development and learning (see Figure 38). Parents of children aged 3–7 were more likely to state that they co-played for educational reasons.

Figure 38: Parents' reasons for and against co-play with children

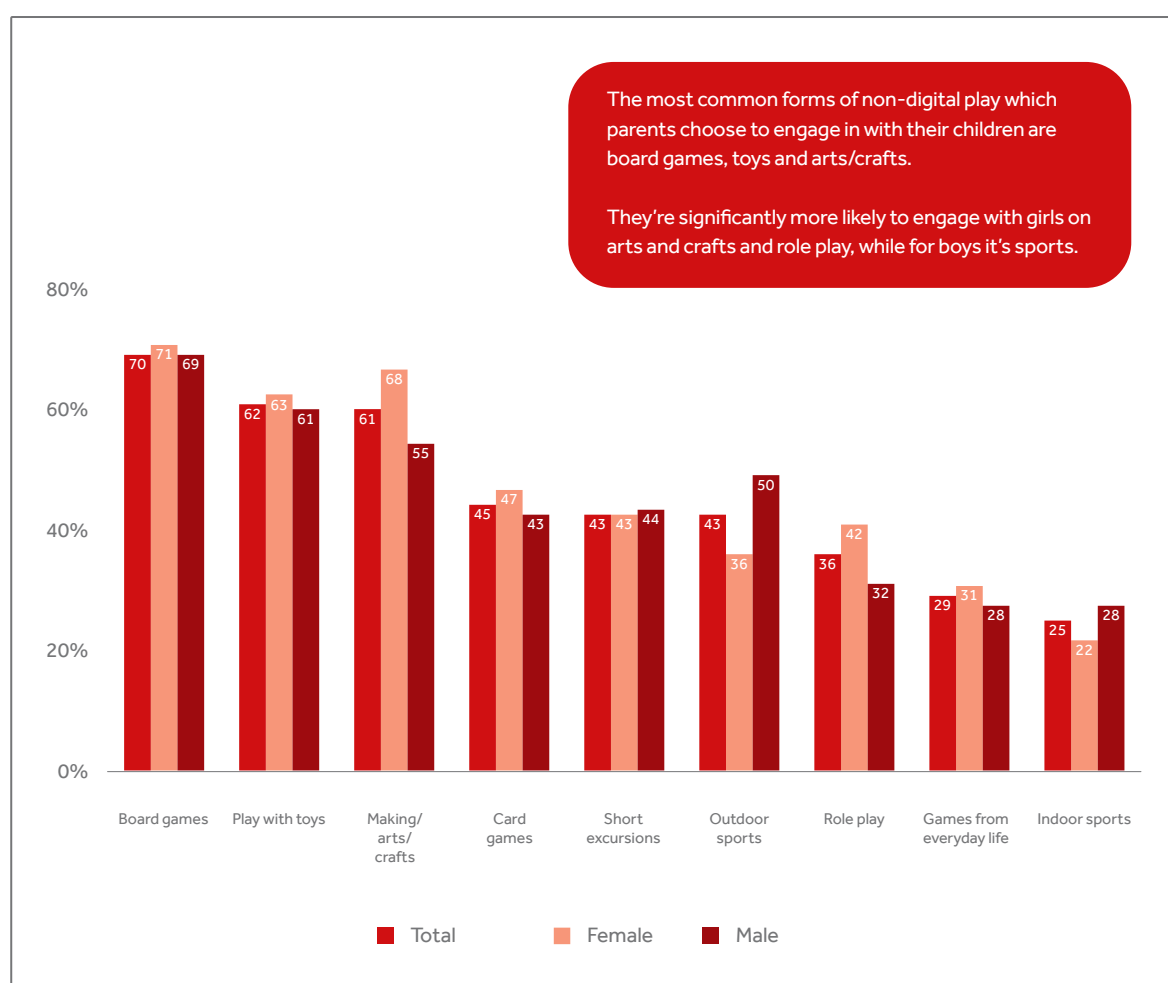


Source: Dubit/University of Sheffield - November 2019. BQ5. What is the main reason you do or do not join in with play with your child (Base: n=2429)

Parents also engaged in a range of non-digital play with their children. Figure 39 demonstrates that the most common forms of non-digital co-play are board games, play with toys, and art and craft. There were gender differences, parents being more likely to undertake arts and crafts activities with girls and sports with boys. Parents from social class groups ABC1 were more likely than parents from social class groups C2DE to report

that they engaged with their children in indoor and outdoor sports and were more likely to go on short excursions. Given that there are frequently additional costs involved in these activities, this is to be expected. Parents from BAME communities were less likely to play board games with children, which may reflect the frequent lack of diversity embedded in such resources.

Figure 39: Parents' non-digital co-play with children



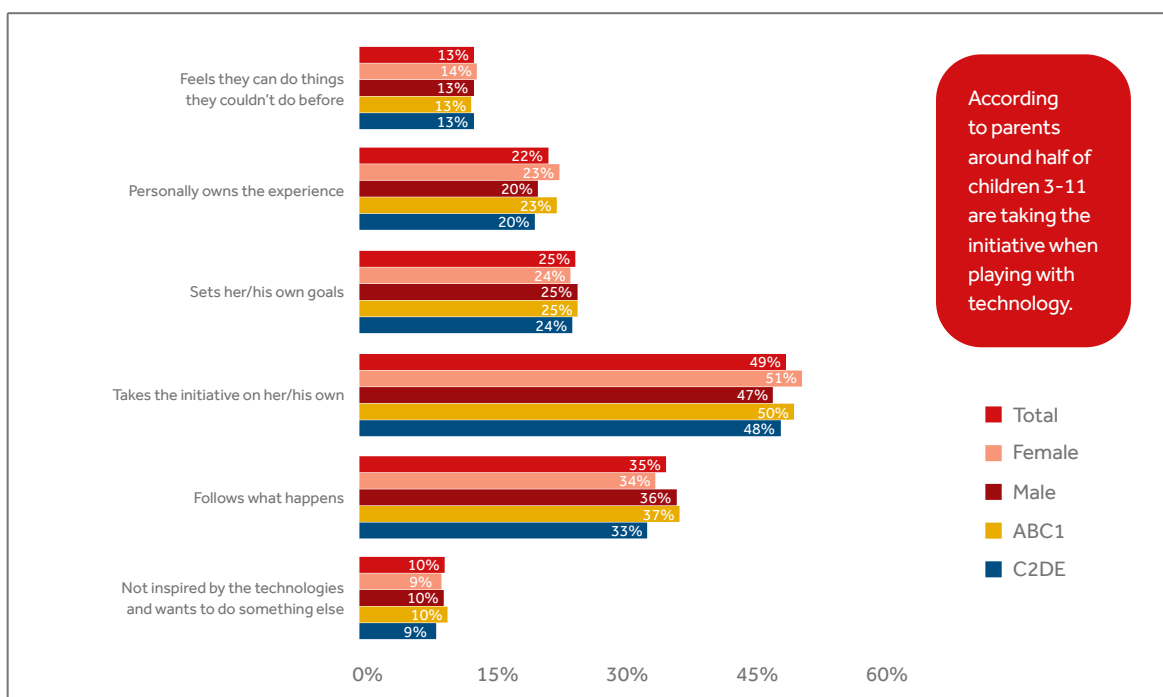
Source: Dubit/University of Sheffield - November 2019. BQ6. Which of the following types of non-digital play do you engage with your child on a regular basis (e.g. once a month or more) (Base: n=2429)

2.2.3 Learning through play with technology

As outlined above, the survey used a range of questions that related to LEGO Foundation's *Learning Through Play Experience Tool* (LTPET). The first question explored the extent to which children demonstrate agency and independence in play with technology. It was recognised that children might display different levels of agency in

different contexts and so parents could choose more than one category in their response. Parents felt that, most often, children demonstrated that they could take initiative, although approximately a third of parents also stated that their child followed what happens, which is often the case with game play using structured games (see Figure 40).

Figure 40: Levels of agency in play with technology

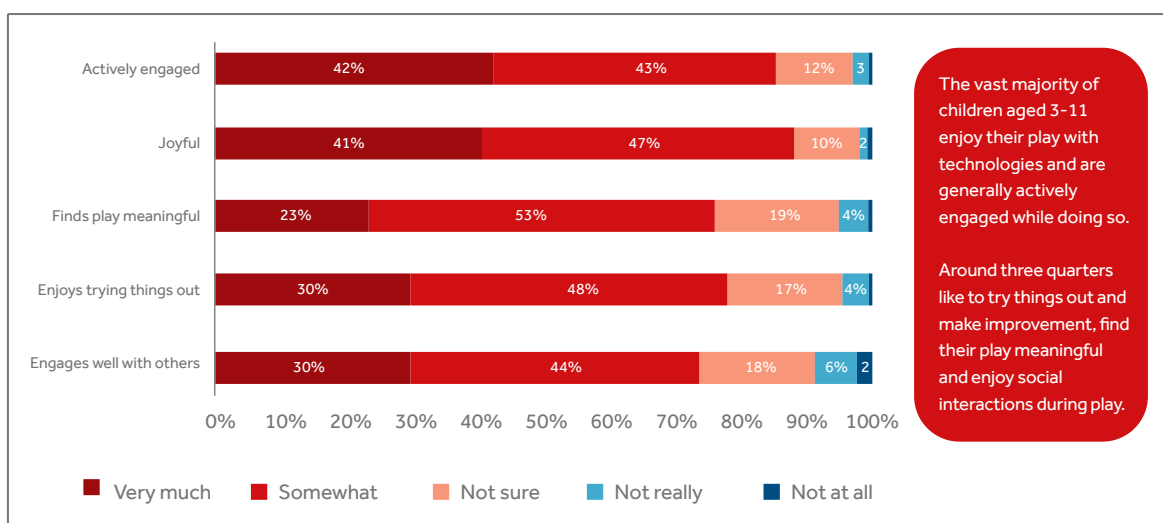


Source: Dubit/University of Sheffield - November 2019. BQ13. When your child plays with technologies, how far are they taking an independent approach? (Base: n=2429)

Parents were asked how far children demonstrated the five characteristics of learning through play in their play. The majority of children are observed demonstrating all of these characteristics when engaged in digital play

(see Figure 41), with joy and active engagement the strongest characteristics. Older children were more likely to demonstrate that they adopted an independent approach in digital play.

Figure 41: Playful learning characteristics

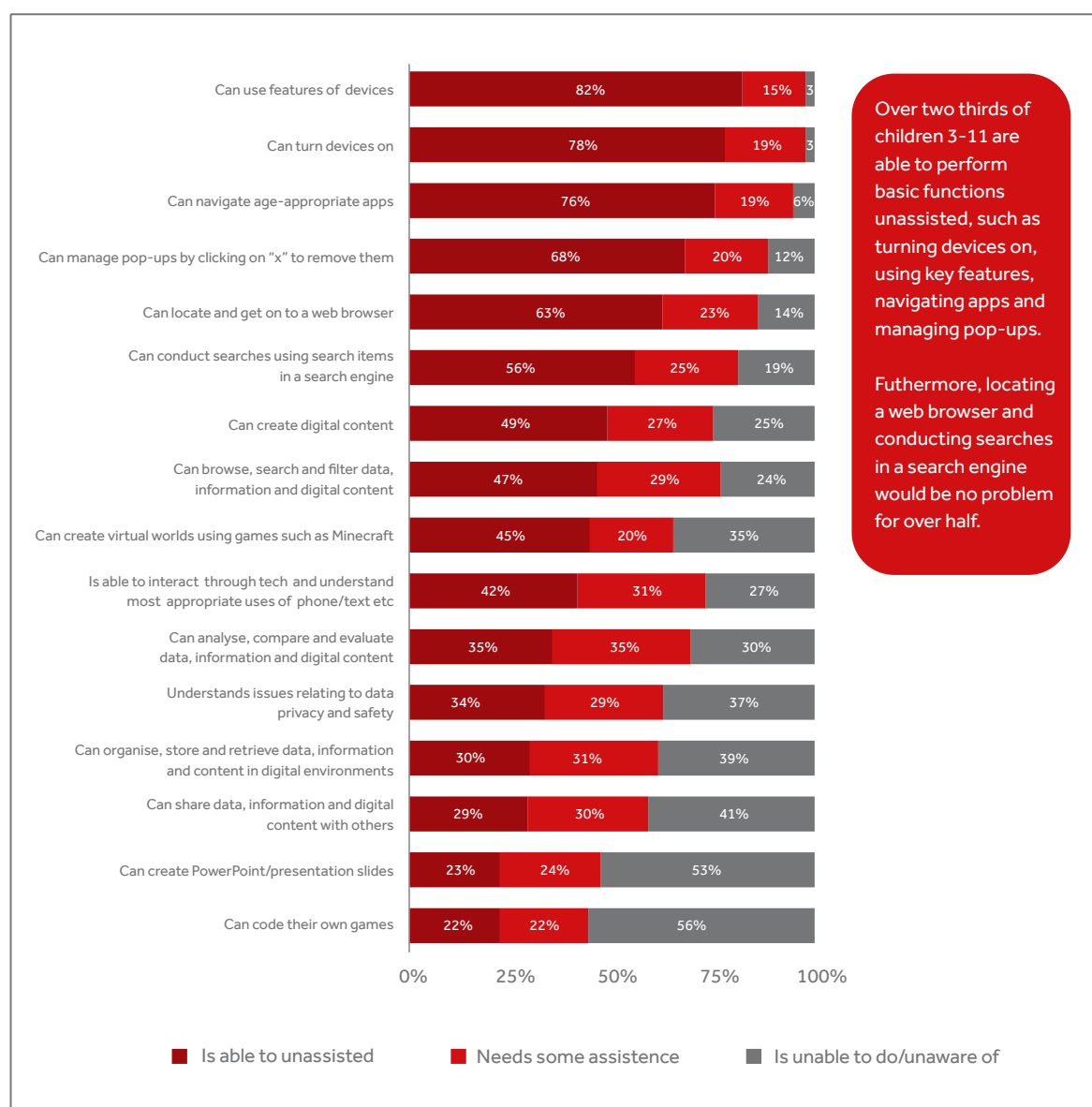


Source: Dubit/University of Sheffield - November 2019. BQ7-11. We are interested in children's active engagement with technology in play. When playing with technology, is your child... (Base: n=2429)

Further statistical analysis demonstrated that the range of play children engage in impacts on their learning through play. Those who engage with more types of different play are more likely to 'very much' engage, be happy, experiment and mix with others than those who engage in fewer activities (e.g. 31% of those engaging in 6+ types of play find the play to be 'very much' meaningful compared to 14% with 2 or fewer types of play).

Parents were able to identify a range of skills developed by children as they played with technology (see Figure 42). Unsurprisingly, the majority of children can perform basic technical skills unassisted, such as turning devices on and navigating apps. Almost half are able to share data, information and digital content with others unassisted. Approximately a third can undertake more complex tasks unassisted, such as creating presentations and coding their own games. Forty-nine percent of parents report that their child can create digital content.

Figure 42: Children's digital skills



Source: Dubit/University of Sheffield - November 2019. CQ3. We want to know about what skills you feel your child has when playing with technology (Base: n=2429)

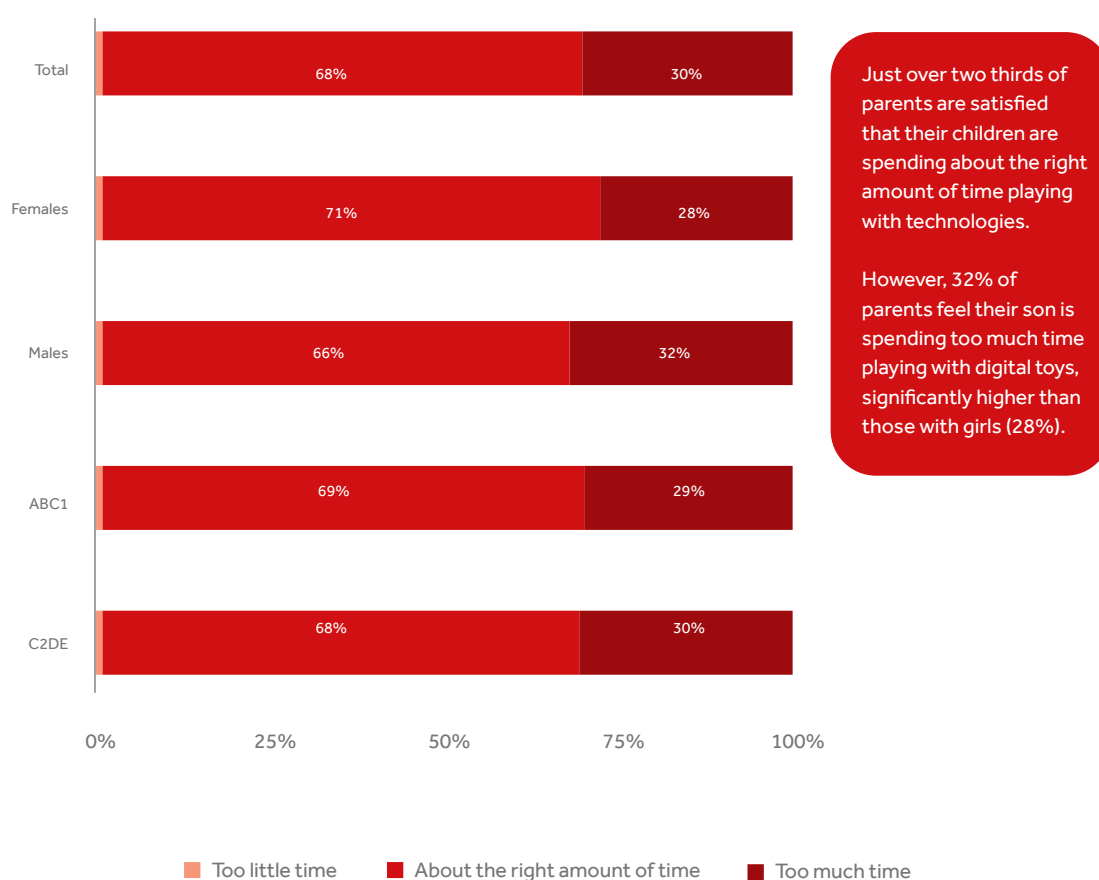
Further statistical analysis demonstrated that the more interested the child is in technology compared to their peers, the larger the number of unassisted skills they can perform (e.g. 31% of those more interested have 12+ unassisted skills compared to 13% of those less interested). The data were also analysed in relation to the time children spent using technology. The more time children spent using technology, the greater the number of skills they were reported to have developed. For example, those who spend up to 4 hours on all activities (36% weekday) are more likely to be able to undertake fewer tasks unassisted than those spending 11+ hours (25% weekday). This pattern was the same for weekend use. In addition, the more playful the child is compared to their peers, according to parental report, the larger the number of unassisted skills they can perform (e.g. 21% of those less playful have 4 or less unassisted skills compared to 35% of those more playful).

The analysis also identified that children who play mostly with parents were less likely to be able to undertake tasks independently (e.g. with regard to the use of a tablet, 42% of those who play mostly with parents have 4 or less skills compared with 15% who have 12+ skills). This may be because those who play mostly with parents are likely to be younger children who are still at an early stage of skill development.

2.2.4 Parental views and practices

The majority of parents feel that their children are spending about the right amount of time on technology (see Figure 43). However, parents are more concerned about the time that boys spend with technology than girls.

Figure 43: Parental views on time spent on technology

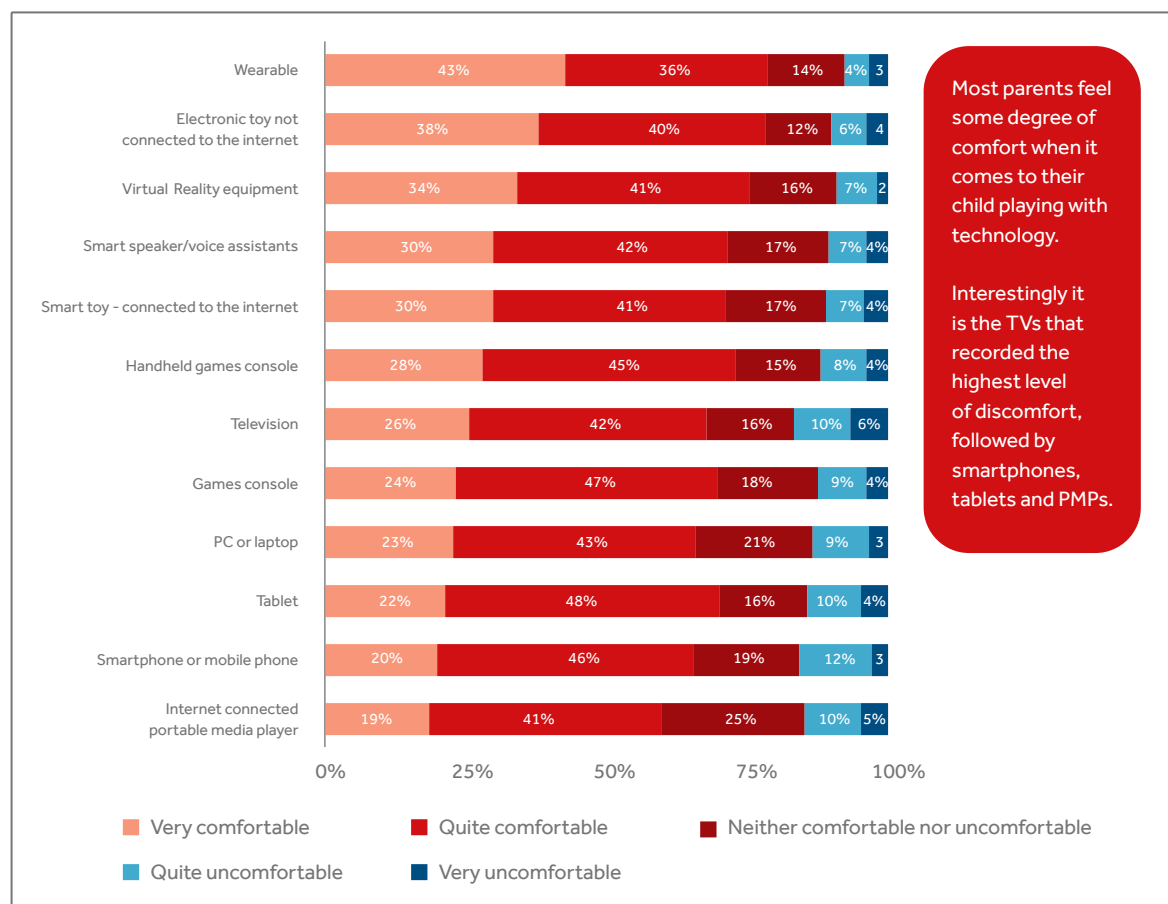


Source: Dubit/University of Sheffield - November 2019 BQ17. In my opinion, my child plays with technologies for: (Base: n=2429)

Levels of comfort differ in relation to different technologies, with wearable technologies (perhaps as a means of engaging in monitoring and surveillance) and devices not connected to the internet providing the highest levels of comfort (see Figure 44). Levels of discomfort were highest in relation to television, which may reflect the fact that children's television viewing is very visible to parents as it often occurs in shared family spaces. In addition, given that television is a dominant media form for young children, parents may have more concerns about this than other devices. Parents may also feel more able to use the parental controls available on tablets than televisions.

Seventy-one percent of parents stated that they felt some level of comfort in relation to smart toys, which contrasts somewhat to concerns about the data privacy of these toys, identified in Figure 44. As the earlier data indicate, many parents report that their children do not use these newer forms of toys and so concerns about data privacy are generalised rather than specific to their child.

Figure 44: Parental comfort levels in relation to technologies

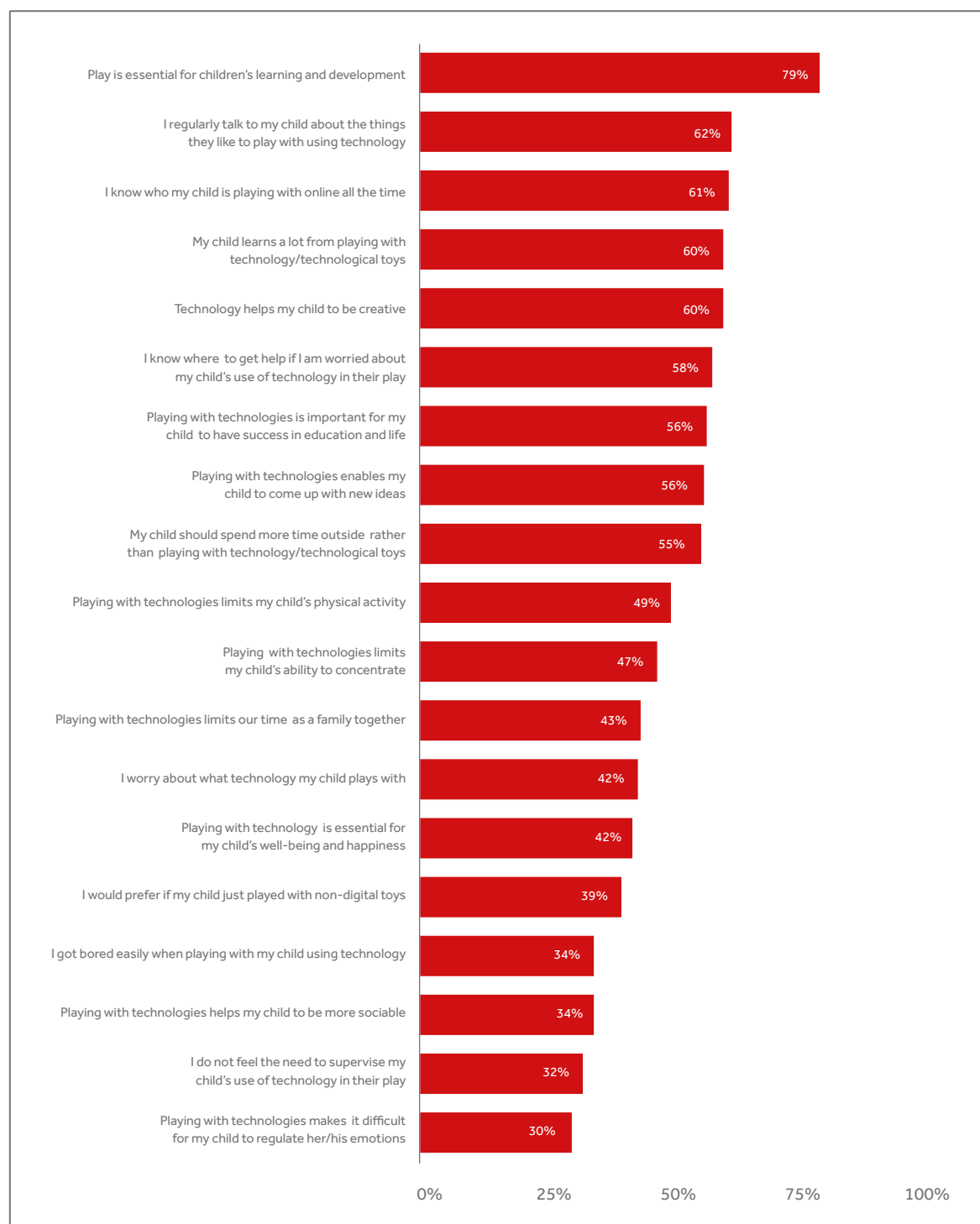


Source: Dubit/University of Sheffield - November 2019. DQ2. We want to understand how comfortable or uncomfortable you are with your child using these technologies (Base: n=2429)

Parental attitudes and practices varied in relation to technology but the majority of parents felt that play is essential for learning and development, with 60% agreeing that children learn a lot from playing with

technological toys (Figure 45). Only 42% of parents felt that play was important for well-being, however. Further, a significant minority – 43% – feel that the use of technology limits family time.

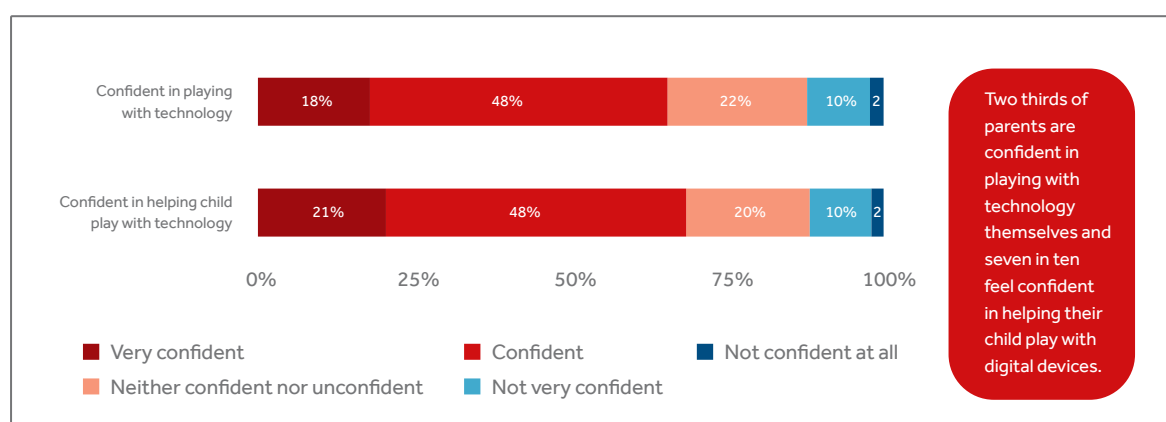
Figure 45: Parental attitudes and practices



Source: Dubit/University of Sheffield - November 2019. DQ1. Please indicate how much you agree or disagree with one of the following statements. (Base: n=2429)

There were higher levels of parental confidence in technology expressed than in previous studies (e.g. Marsh et al., 2015), with 7 in 10 parents stating that they

felt confident in helping their child play with digital devices (see Figure 46).

Figure 46: Parental confidence levels in using technology

Source: Dubit/University of Sheffield - November 2019. CQ1. We want to know how confident you (not your child) are in playing with technology compared to your friends in your age group/CQ2. We want to know about how confident you are in helping your child play with technology (Base: n=2429)

It was of interest that parents who reported that they were confident about their own use of technology were more likely than other parents to state that they engaged in digital play 'at least once a week' with their child. For example, 38% of those who were very confident played with a tablet with their children all of the time or at least once a week, compared with 26% of those who were not confident at all. There was also a strong positive correlation between number of non-digital and digital items for which parents reported play with a child, i.e. the more non-digital items they play with, the more digital items they play with. For example, 48% of those who play with 7+ digital items play with 5+ non-digital items, compared to 30% who play with 2 or fewer digital items and play with 5+ non-digital items. It is notable that a similar pattern could be found in relation to those parents who reported that they were confident about helping their child to use technology – these parents were more likely than other parents to play with their child both digitally and non-digitally. This suggests the notion of a 'playful parent', who enjoys co-play with children regardless of medium/domain.

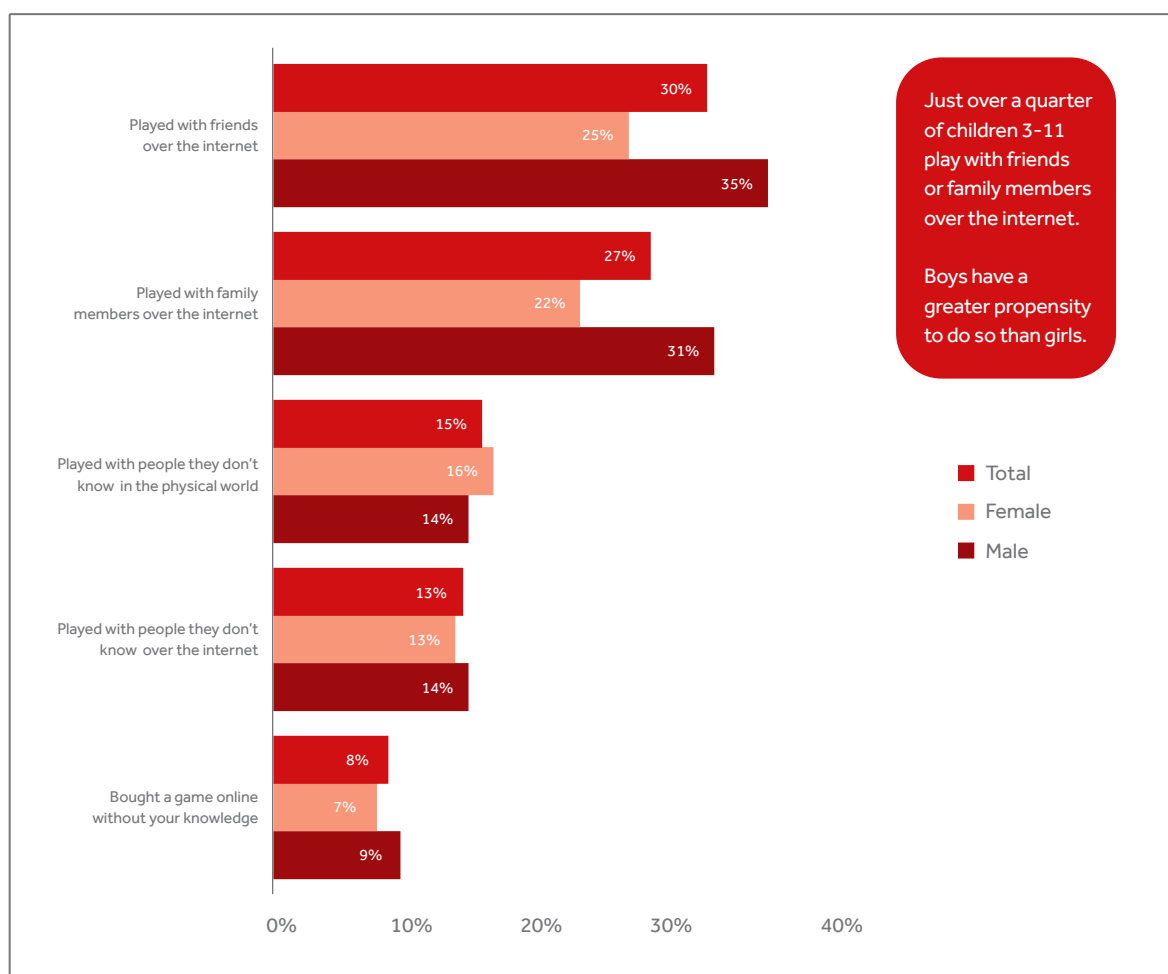
There was also evidence that, in relation to the use of a tablet, those children whose parents were not at all confident were more likely to play on their own (60%) than those who were very confident (50%). This pattern was also evident in relation to games consoles. For example, children of parents who stated that they were not at all confident about helping their child use technology were more likely to play on their own (31%) than those who were very confident (13%).

Further, parents who are not confident at all in their own use of technology are more likely to think their child spends too much time playing with technologies (50%) than those who are very confident (33%). This may be because the less confident parents have more anxieties about digital play. However, those not confident at all (48%) had children who were more likely to play mostly with digital toys than those who were very confident (36%), so this may have raised their levels of anxiety about children's time on technology. It also suggests that parents who are more confident using technology feel more able to manage their children's use of it. Further, the more confident parents are, the more they agree that their child mainly integrates the digital and non-digital when playing (41% of those confident vs 22% not very confident). This may be because confident parents are more likely to make judgements about the nature of integration in relation to digital technologies, having a greater understanding of devices. In addition, the more confident the parent is in the uses of technology, the happier, more creative, more playful and more interested they reported that their child is compared with other children their age (e.g. 28% not confident at all are less interested versus 9% of those very confident). This may reflect a general optimistic viewpoint on life for that group of parents, or it may be that the additional attention paid to children by the confident parents has impacted positively on their children.

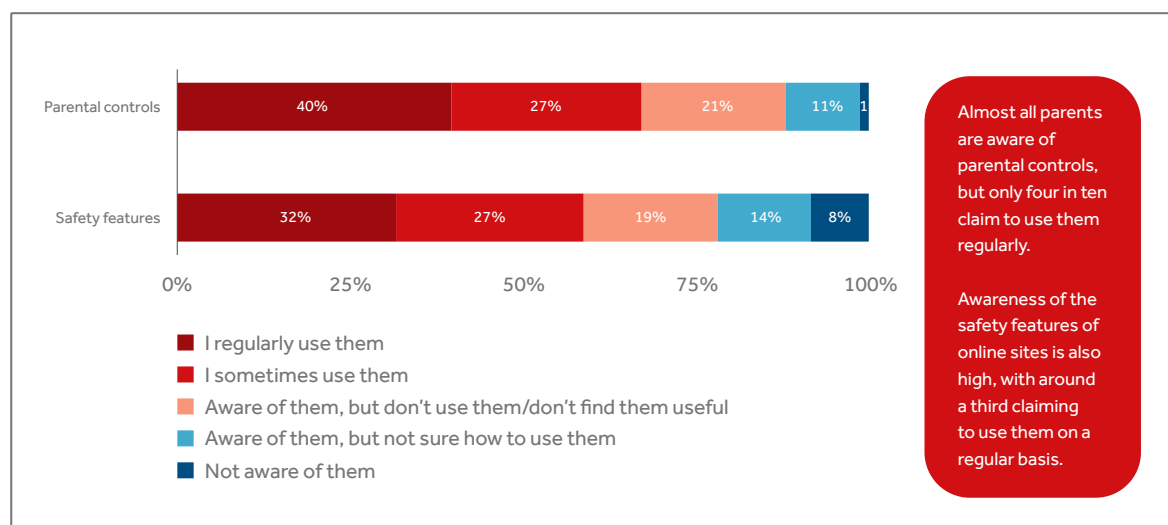
There is also evidence that parents who are confident are more likely to agree that there are benefits from technology in the development of their child (e.g. 71% of those very confident agree their child learns a lot from playing with tech vs 44% of those not confident at all). Parents who are confident are also more likely to be comfortable that their child uses certain devices (e.g. 75% of those very confident are comfortable with their child using a mobile or smartphone vs 45% of those not confident at all). Finally, the more confident the parent, the more likely they are aware of parental controls and safety features (e.g. 79% of the very confident use parental controls vs 50% who are not confident at all). It would seem, therefore, that parents who are confident about their own technology use hold more positive views about their children's use of technology than less confident parents.

The survey also explored parental levels of comfort with online safety. We began by finding out what children did online. When playing online, children played most often with their friends, then family members. Eight percent of 3–11-year-olds had bought a game online without parental knowledge (see Figure 47). Parents reported more play with unknown others in the physical rather than digital domain, but this may be explained by the fact that children often play with unknown others when they play in playgrounds in the park, which is often under adult supervision.

Figure 47: Children's online activities



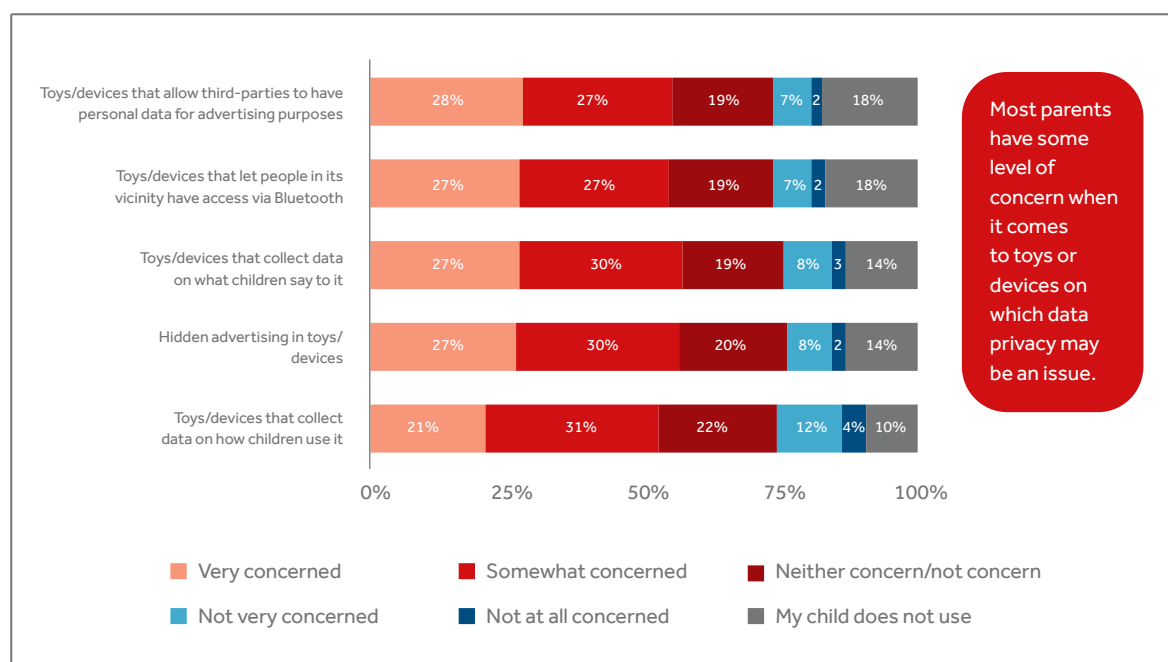
Source: Dubit/University of Sheffield - November 2019. CQ8. Has your child ever... (Base: n=2429)

Figure 48: Use of parental controls and safety features

Source: Dubit/University of Sheffield - November 2019. DQ3. What is your experience with the parental controls on the devices and technology that your child uses?/DQ4. Do you use any safety features of online sites (e.g. SSL, certificate, Secure/Certified) (Base: n=2429)

Perhaps because parents felt comfortable about children's practices online, only 4 in 10 used parental controls regularly (see Figure 48). Twenty-two percent of parents stated that they were not aware of, or did not know how to use, safety features of online sites.

Parents were asked about their levels of concern in relation to other aspects of children's digital use, such as toys or devices on which data privacy may be an issue. Approximately half of parents have some level of concern (see Figure 49).

Figure 49: Parental levels of concern about data privacy

Source: Dubit/University of Sheffield - November 2019. DQ5. How concerned are you with these aspects of data privacy? (Base: n=2429)

2.3 Summary

Apart from access to a standard TV, South African children have much less access to technology compared to their peers in the UK. Whereas in the UK 94% of children have access to tablets and 84% have access to smartphones, the figures are 38% (tablets) and 46% (smartphones) in South Africa. Moreover, in the UK, 48% have access to a smart speaker, such as Amazon Echo, Apple HomePod or Google Home, 28% have access to a wearable technology, 17% of children have access to virtual reality equipment and 15% have access to a smart toy, but less than 10% of South African children have access to the same technologies. In turn, this has significant implications for the extent to which children can play with these new and emerging technologies.

When comparing the level of access to these technologies within South Africa, household income is an important determining factor. However, there are observable differences according to the type of

technology. For example, more affluent households are much more likely to provide access to smart TVs, laptops, electronic toys and tablets in South Africa, while the differences for standard TVs and smartphones are small. Due to the country's apartheid legacy, the difference according to access is still tightly linked to race. In the UK, there are some differences

“Very few UK parents felt that their children did not spend enough time with technology, whereas many South African parents felt this way, thus indicating that South African parents have aspirations about children’s digital skills and practices that are not being met.”

in relation to social class and race, as outlined above, but these differences are not as stark as in SA.

Focusing on the types of games and brands that children play with, it is important to point out that a far lower proportion of South African children engage with any of the brands that are popular in the UK. For example, 27% of children in the UK played racing games, and more than a third played Minecraft. In comparison, while a similar proportion of children in South Africa played

racing games, other games (e.g. Minecraft, Roblox and Fortnite) are played by less than 10% of children. What is similar across both countries, however, is that boys are more likely to play racing games, while the gender gap across other games is much smaller. Lastly, and more generally, girls are far less likely to play more than one of these types of games in South Africa.

While more than half of the South African children can create digital content (58%), and almost half of UK children can (49%), and a substantial minority (40% in South Africa, 29% in UK) can share data without assistance, a smaller number of children can conduct searches and manage data/information, and only a quarter in South Africa (27%) and around a third in the UK (34%) understand issues related to data privacy. In comparison with UK children, a lower proportion of South African children seem able to accomplish more complex undertakings, such as coding games (14% vs 22%) and creating PowerPoint presentations (12% vs 23%), due to the more limited access to relevant technologies.

There were differences between parents' views on the extent to which children demonstrated agency in play, or displayed the characteristics of playful learning. Parents in the UK were more likely to say their child demonstrated agency, i.e. that they could own an experience (22% vs 13%), set their own goals (25% vs 13%), and take initiative (49% vs 30%). However, a higher proportion of parents in South Africa than in the UK very much agreed that their children displayed the characteristics of playful learning such as active engagement (61% vs 42%), joyful (60% vs 41%), meaningful (39% vs 23%), iterative (43% vs 30%), socially engaged (43% vs 30%). These findings may relate to the fact that South African parents were more likely to engage in play with children on many devices, so may not have felt that children's independence in play was as marked.

There were also similarities and differences in relation to parental attitudes. Reasons given for joining in with children's play were similar (primarily to support development and foster relationships). UK parents were much more likely to state that they felt their children spend about the right amount of time playing with technology, whereas South African parents said that they did not think their kids were spending enough time.

There were numerous similarities in parental attitudes towards technology across the two countries, with parents expressing both positive and negative thoughts about the actual and potential role of technology in children's lives, demonstrating an understanding of the nuanced role of digital devices in children's play. A higher proportion of UK parents than South African parents stated that they felt comfortable with children's use of all devices except television. It is not clear why UK parents feel less comfortable with television, which is the oldest and most established technology in relation to children (children's television programmes in the UK began in 1946). They may feel less able to manage children's television viewing, as the filtering systems on televisions are, arguably, less accessible than those on other devices. It is, perhaps, less surprising that UK parents feel more comfortable about children's use of devices than South African parents, given that UK children are more likely to use the devices, and therefore parents are more familiar with them. A higher proportion of South African parents stated that they had concerns about hidden advertising in toys/ devices (45% v 27%), and data privacy issues with smart toys (47% v 27%), and toys that connect to Bluetooth devices in the vicinity (44% v 27%).

Similar numbers of parents in both countries stated that they regularly or sometimes used the parental control and safety features of devices, but a higher proportion of South African parents stated that they were not aware of these (parental controls 18% v 1%, safety features 25% v 8%). As South African families were less likely to

access many of the devices, this is no surprise. Given these differences in use, it is of interest that a higher proportion of South African parents expressed slightly more confidence in playing with technologies (23% v 18%) and helping their child to play with technologies (25% v 21%) than UK parents.

Parents were asked about their feelings towards a range of uses and potential outcomes of using technology. There were many similarities, but some key differences. For example, South African parents were more likely to state that technology was important for success in education and life (65% v 56%) and impact on children's well-being (56% v 42%) and concentration (53% v 47%). However, UK parents were more likely to state that they knew who their children were playing with online most of the time (61% v 42%) and that they knew where to get help and advice if they needed it (58% v 44%), and so the increased use of technology did not appear to lead to increased fears. A higher proportion of South African parents stated that they worried about what technology their child played with (52% v 42%).

These findings suggest that there are both similarities and differences in South African and UK children's experiences and parental views of technology, and that these patterns can be largely traced to the extent to which digital technologies are present in families' lives. In the next section, pen portraits of each family are shared in order to provide an overview of the role of play with technology in their everyday lives.

Section 3: Pen portraits of case study families and children

In this section we include a pen portrait for each family, which outlines family members, provides demographic details, and describes the everyday digital play lives of the case study children. This section, therefore, offers a platform for the subsequent analysis of the data in the following sections of the report.

The families were very diverse in terms of social, cultural, ethnic, racial, economic and linguistic background. Table 7 provides a summary of the children who were the focus for the case studies.

Table 7: Children's online activities

South African case study children		UK case study children	
Family A	Zuko, boy, 6 (Black)	Family 1	Mallison, boy, 6 & Essa, boy, 4 (White British/ Black African)
Family B	Eshal, girl, 7 (Coloured)	Family 2	Alison, girl, 6 & Chloe, girl, 4 (White British)
Family C	Henry, boy, 8 (Black)	Family 3	Stephanie, girl, 9 & Saskia, girl, 6 (White British)
Family D	Sophia, girl, 11 (Coloured)	Family 4	Harvey, boy, 6 & Simon, boy, 8 (White British)
Family E	Linton, boy, 6 & Della, girl, 6 (Black)	Family 5	Zander, boy, 5 (White British)
Family F	Karabo, boy, 10 (Black)	Family 6	Leo, boy, 5 & Alfie, boy, 3 Cuban/ Turkish
Family G	Lulama, girl, 5 (Black)	Family 7	Anna, girl, 7 & John, boy, 4 (White British)
Family H	Kamden, boy, 4 (Coloured)	Family 8	Jeremy, boy, 11 & Cerys, girl, 9 (White British/ Mixed Heritage White British and Native American)
Family J	Gemma, girl, 8 (Indian)	Family 9	Hanif, boy, 8 (Yemeni)
Family K	Fahiemah, girl, 10 (Coloured)	Family 10	Noah, boy, 9 & Jacqueline, girl, 5 (White British)

3.1 South African case study family profiles

In the South African study, we started with 10 families (one family with twins), i.e. 11 case study children, who were selected by the teachers and observed in school. After the school visits, Family K decided not to participate in the family visits part of the fieldwork. The research team included a reflection on this account, as it exemplifies the complex socio-cultural context and the challenges of conducting a study in such environments.

SA Family A

Carla (40) and Alex (44) and their son Zuko (6) live in a modern, bright and spacious house in Pinelands, Cape Town. Carla and Alex are White South Africans. Zuko is Black South African and was adopted when he was a baby. Both of Zuko's parents are self-employed. Carla holds a Masters in Clinical Social Work and Alex has as a Bachelor of Arts degree but currently works as a software development manager. Carla is legally blind (she only has 20% of her vision) and has a hearing difficulty.

Carla and Alex each have their own home office and use their own laptops, as well as a bigger monitor. They both have iPhones and the family has an iPad. In Alex's office at home he has a camera and a GoPro. Zuko has his own camera and a radio in his bedroom which he uses every day. Zuko uses the family's iPad to play virtual games and to listen to audio and video stories. He also uses his parents' smartphones to listen to music and enter numbers on the calculator until the screen is completely filled. At times, Zuko listens to playlists on iTunes which Alex creates based on Zuko's song requests. Alex remarked on Zuko's song choices being mainly rock hits from the 1980s. Zuko watches Apple TV programmes like *National Geographic*, football and *PJ Masks*. Music is an important part of Zuko's life. He considers darkness and silence scary and cannot sleep unless there's some music or sound in the room at night. He loves comic books and the family consider read-along CDs as a nice form of technology that gives him more independence when parents cannot read to him.

Figure 50: Zuko playing outside



Zuko is very active and imaginative. At school on Fridays he takes part in Sports Hub, which is a paid after-school activity. When not at school, he spends a lot of time swimming, jumping on the trampoline, walking the dog with his mother, and playing with LEGO, plastic animals and cars. He thoroughly enjoys mostly looking at comic books and interpreting stories through imaginative narrations, and physical play both inside and outside the house.

Figure 51: Zuko's LEGO



When playing with LEGO, his parents have a rule that he has to follow building instructions first (which they know that he does not enjoy) before he can play with the bricks freely. He loves to play independently and invents his own characters, aeroplanes and vehicles to compose his stories. Zuko loves his books about superheroes and his favourite character is Black Panther.

Figure 52: Zuko in his Black Panther costume & Figure 53: Zuko's book



Central to Zuko's play life is his constant play companion, Judy Hopps. The origin of this imaginary friend comes from the female rabbit character in the *Zootopia* movie. She is a police officer who, despite her size, is a powerful character in the movie. Their play often involves complex rescue narratives. Zuko's accounts of their relationship are so convincing that his teacher thought that Judy was another person who lived with him.

Carla and Alex are concerned about how much, and what kind of, technology is used in their family, so they are in the process of reducing and monitoring it more closely. When they allow Zuko to have access to technology he is consistently seeking ways to incorporate imaginative games and stories. For Zuko, in this context, technology is not just about devices but also about electricity. In fact, the device itself can be manipulated in other ways, such as when Carla gave him her old cell phone so he could dismantle it and see what was inside and how it 'behaved' in the process of dismantling it. Zuko is very curious about the engineering and mechanical processes of technology itself.

Figure 54: Zuko exploring an old cell phone



SA Family B

Rihana (47) lives with her two daughters, Eshal (7) and Kabila (4), in a small beachfront apartment in Muizenberg, Cape Town. They are a religious, polygamous, Coloured family. Rihana was determined to complete her high school education despite the obstacles she faced along the way. In her early twenties, Rihana attended weekend tutor groups and lessons in order to complete her matric qualification. A few years later she enrolled at university and completed the first year in a Library Information Science degree. She was offered a bursary for her second year but was unable to accept the offer as she married Mahir (69) in the same year. Currently, Rihana volunteers at Eshal's school as she is committed to supporting her children and helping at the school. She helps with classroom tidying and the school feeding scheme. Eshal and Kabila have half-brothers and half-sisters. Mahir and Rihana are very committed to the education of their children. The family mainly makes use of the public transport system but walk to school as they live close by.

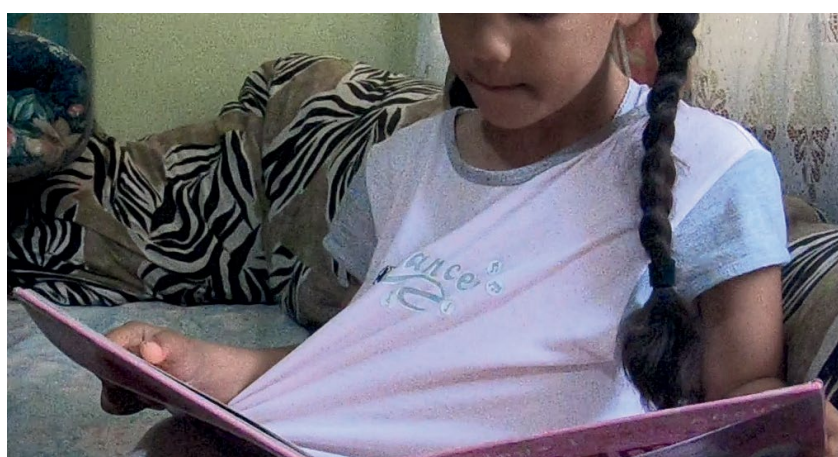
The family home is a small one-bedroom apartment which is a welcoming space and has the vitality of a classroom space. The walls and doors are decorated with posters and artwork, mainly with literacy and mathematical themes. Labels and examples of writing activities are displayed and invite learning and interactions for Eshal and her sister.

Figure 55: Wall and entrance door to Eshal's apartment



Eshal did not attend pre-primary school. Nevertheless, she started Grade 1 as a competent and independent reader full of enthusiasm for learning and play. Although Rihana does not acknowledge herself as a teacher, it is striking how much she played a very specific role in Eshal's learning. She pursued any opportunity for Eshal to explore and experience learning spaces when she was younger. They would attend free educational workshops at the library in the city centre and other options too, like activities at the science centre. Eshal's favourite thing to do is to build puzzles. She has lots of them around the house. Many of the toys and games are ones which are bought second-hand at the local Muizenberg market or flea markets elsewhere. According to Eshal, she plays with the toys almost every day. The family usually goes to the playground on the beach directly opposite their apartment. They also play on a small trampoline downstairs, which Rihana purchased second-hand for R50 (£2.65, €3.15), when Rihana hangs out the washing. Reading is a relevant part of family life, which is why they visit the library near their home and bring books home weekly to read. The family usually use their reading time to research and learn new things or for enjoyment. The family home has an old computer and a photocopy printer but, according to Rihana, the computer is not really working and has never been used by herself or her children. Because of this it is impossible to use the printer and so it is only used as a copier to copy drawings or parts of books that the children choose, or that Rihana selects based on what Eshal is learning at school. They have a standard TV and the children like to watch cartoons. They have time to watch after school every day. Rihana has a cell phone which has no games on it.

Figure 56: Eshal reading a book



Eshal is allowed to use the phone to research online (mostly for school topics) or to take pictures and watch videos related to her interests like science experiments. Her teacher confirmed that Eshal has limited access to technologies at home and, according to her, Eshal gets very excited when they use technology at school to research topics.

According to Rihana, the children sometimes have access to computers and laptops when they visit relatives' homes. Homework and learning at school forms part of family life, which is evident in the activities and projects Eshal does with her mother at home. Eshal is always involved in research. She generally relates the research she does at home to that from the school and vice versa. According to her mother, Eshal is always busy, and she always provides the cell phone as a device for Eshal to conduct her searches on Google. There is a timetable on the apartment door written by Eshal but created by her father, which allocates time for her daily activities.

According to their mother, the girls like to make videos and photos with the cell phone. During the research, Eshal and her mother used the WhatsApp app with ease, whether writing, recording voice notes or sending pictures. When using the GoPro camera, Eshal was happy to discover how to use some of its functions and communicate them to the researchers.

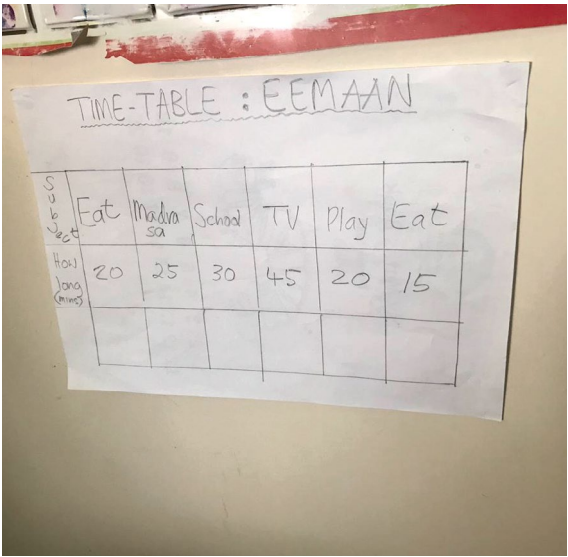
Rihana believes that technologies are useful in many areas, levels of work and people's daily lives, which is

why she considers their use by her daughters important, especially so that they are able to do many things that depend on understanding the use of technology. Rihana appreciates the work of Eshal's teacher with the technologies, stating that she does not make much use of the devices with children in Grade 1 but, according to her, it is enough for this phase at school. Although Eshal has very limited access to technological resources at home and at school she is very resourceful and excited to engage with technologies, even those that are new to her. It is noticeable how the roles of her mother and the teacher, as facilitators for access to (new) knowledge, are entangled with this way of relating to Eshal and the broader community.

SA Family C

Henry (46) and Lily (32) are a Black Malawian couple who, due to the social and economic conditions in Malawi, are economic migrants living in an informal settlement in Cape Town. Henry has been in South Africa for 12 years while his wife Lily has only been in the country for 4 years. Their son Henry (8) lives with them, while his 12-year-old brother remains in Malawi. Henry senior worked as a very successful fisherman in Malawi and currently works as a gardener in South Africa. Henry senior's work as a gardener is on a casual basis depending on when work opportunities arise or his employers require him. Lily mainly looks after Henry in the afternoons. The family makes use of the public transport system in Cape Town. Henry senior travels an average of 20km using at least two forms of public transport per day to get to and from work. Henry junior is the only member of his family who travels in a car as he is part of a school transport club.

Figure 57: Eshal's timetable created by her father



The community plays an active role in Henry's family life. Henry, like the other children from the local school, spends many afternoons playing ball games and constructing things in the street or in each other's backyards. Henry enjoys the freedom of exploring the neighbourhood and on a few occasions waited on the street corner at the fruit seller for the researchers to arrive. The neighbours and children knew about the project and welcomed us every time we visited. Family members and parents allow the unsupervised play in the afternoons between children whether in the streets, field nearby or at each other's homes. Despite it being a one-bedroom house with an adjacent lounge with limited space, as many as five children came in and out during the visits and were welcomed by Henry's parents to join in and play.

Even though the family has a standard television, Henry hardly watches any of the programmes available as there aren't many that interest him and he prefers being outdoors. Lily and Henry senior both have smartphones. Henry is allowed the use of his mother's phone, which he mostly uses for playing games, taking and editing photographs and recording audio clips of himself singing. The games he plays include shooting games, soccer games, car games and Talking Tom, which is a virtual pet app. Lily's phone has limited storage which means that Henry has to delete apps or games regularly. Henry senior owns a tablet which Henry is not allowed to play on as it is for his father's personal use only. Henry has access to game consoles at one of his friend's homes which his parents don't really know much about, but Henry says that he does not play there regularly.

Figure 58: Henry and his mother in the yard of his house making a ball



Figure 59: Henry arriving at his house with the tape he had just bought to finish the ball



Homework and learning at school forms part of family life which is evident in the activities and projects Henry does with his mother at home. During our visits we experienced the connection between school topics and Henry's play, especially when he started building homes using the LEGO blocks. Henry's parents believe that technology allows Henry to learn more but that it can also negatively impact his physical movement and play outdoors, which is why they monitor the amount of time he plays on his mother's phone. Henry plays independently on the phone and does not have any intervention or involvement from his parents when he is playing. His mother jokes about how Henry is better able to teach her things about how to operate the phone. Henry gets frustrated with apps and games as they require more data to move beyond the basic version. Data and connectivity limits the family's use of the internet. The family prioritises how data is used, for example staying up to date with the WhatsApp communication from Henry's teacher versus playing games that require data.

Henry is known by his peers and teacher as a competent and skilled builder and designer. He thoroughly enjoys exploring different ways to build using diverse materials like playdough, LEGO bricks, recycled and other materials which he can manipulate for his creative interests, like building a new soccer pitch. Henry has a wonderful relationship with LEGO bricks. His teacher has a small bucket of her own bricks from childhood and she has observed how Henry plays, creates, learns and constructs more than any of his classmates with these bricks. At home, Henry has a similar relationship with play according to his mother.

Figure 60: Henry and his mother making a ball



SA Family D

Sophia (11) lives with her mother Michelle (41) and her brother Sean (8) in a middle-class neighbourhood in Cape Town. They are Coloured South Africans. Sadly, Sophia's dad died a few years ago. Michelle has a degree in Law from the University of Cape Town and works as a project manager for a well-known South African insurance company. Michelle drives the children to school every day and then to work. They travel by car and it takes them about five minutes in the morning. Sophia spends all of her afternoons at school because she participates in after-school activities every day. Some of these activities include swimming, hip hop dance, hockey and participating in the Creative and Talented programme at school. When she gets home she plays with her brother or at the park close to her home. Sophia loves opportunities for learning and researching, which is visible when she interacts with her schoolwork at home.

The family owns a standard television. The computer is in the dining room, which allows Michelle to support Sophia while she prepares supper and other household activities. Sophia uses her mother's phone sometimes

but has recently received her own phone for her birthday. She is only allowed to use the phone at specific times and under her mother's supervision. Sophia has a PlayStation but hardly uses it.

Sophia loves cooking. She mostly watches cooking shows on TV such as *MasterChef* with her mother and brother. Sophia makes the most use of the home computer in the family. Her class teacher uses Google Classroom, which means that homework can be done online using Google Docs, Google Slides and other Google Apps. Michelle encourages the use of technology for her children as she can see that they are keen to use it for learning and exploring. She has seen how much the technology use related to schoolwork has supported Sophia's love of learning and creativity. Even though Michelle does not join in with their time on devices she observes the children and monitors the amount of time that they play. Michelle's mother, Sophia's grandmother, is very skilled and knowledgeable with devices and technology so when they visit her she often helps Michelle to understand better.

Figure 61: Sophia's family



Figure 62: Sophia cooking



Sophia is a creative and curious child. She believes that with research, reading and online access she can find answers to her questions and satisfy some of her interests. She is very strategic when addressing challenges and problems in her everyday life and makes lists and organises her plans. She is very interested in how technology could help the lives of people and how her relationship with technology can support and help others learn. This was affirmed by her mother, who notices her willingness to teach and assist in their home, as well as by her teacher who observes Sophia playing a key role in the lessons that require group work with technology.

Michelle shared the fact that one cupboard in the kitchen is a storage space for materials and resources which Sophia collects for constructing her own creations. Sophia is quite confident and capable at managing her time at home and keeps a good balance of play, online access and other activities at home. The facilitator of the Creative and Talented programme commented on Sophia's broad knowledge about technology and how easily she familiarises herself with devices and apps. This was confirmed when Sophia was introduced to the GoPro in the home visits. She produced a range of videos but mostly manipulated and made use of the device in an integrated way with her play and curiosity. She definitely recognised how technology can offer possibilities for learning but, more than that, it was not the only way to discover and learn.

Figure 63: Sophia shows her Future Machine



SA Family E

The family of the twins, Della and Linton (6), live in a two-bedroom flat on the second floor of a block in Yeoville, Johannesburg. Yeoville is a working-class suburb that was a designated 'white' area during apartheid. It is one of the few areas in South Africa where the historical race-based spatial planning has been undone. It is rather run down now and the high-density population is testing the limits of its infrastructure. Home to a large population of migrants (both rural South African and other Africans), it is vibrant and cosmopolitan. Sadly, it is also considered unsafe due to high crime levels.

The twins have an older sister, Bongi, who is 10 years old, and a mum and a dad. George, the children's father, is 42 years old and his mother tongue is seSotho. He was born in and grew up in Johannesburg. He works as an administrator in the Estate Agency Affairs Board (reporting to the Department of Human Settlements). He travels to Sandton in the north of Johannesburg by minibus taxi every day, often returns home late and sometimes has to travel out of the province. Their mum, Sithabile, is 36 years old and her mother tongue is isiZulu. She came to Johannesburg from KwaZulu Natal as a young adult. She is a sangoma (traditional healer) and takes on clients for healing. Her work is irregular and informal. Both parents had to leave school before completing the matric (final high school) exam and have plans to study. Sithabile is currently doing courses at the

N3 level (adult education). They have lived in this flat for about six years, since about the time the twins were born. It has one large bedroom and a small one. They all sleep in the main bedroom where they have a double bed and bunk beds for the children. There are large built-in cupboards, a smaller cupboard and a desk on which there is a laptop.

The second, smaller, bedroom is used by Sithabile for her herbal storage and other storage. There is a bathroom and separate toilet. The lounge and kitchen are open plan. The kitchen has built-in cupboards, stove, sink and fridge. There is a small balcony leading off the lounge with glass doors. In the lounge there are two couches, a plastic table and chairs, and the large flatscreen TV on a stand with cupboards for storage. They have a PlayStation and a large collection of PS3 games including the LEGO Harry Potter, LEGO Marvel Avengers, LEGO Batman, LEGO Superheroes, WWE, Gran Turismo, Sonic Unleashed, and FIFA soccer games 2010, 2012 and 2013. None of their games are played online. The children have toys like Barbie dolls, remote-controlled cars, and the remains of a LEGO set.

The apartment building has a small grassed area at the front of it where other children are often seen playing, but Sithabile and George don't like their children to play outside. George sometimes takes the children by minibus taxi to play in a public park in a neighbouring suburb, which is considered to be relatively safer than the local parks. The children play outdoor-type games indoors. On one visit, the children played hide-and-seek in the apartment.

The children are allowed to watch cartoons for an hour after school after they have finished homework and to play videogames for one hour (although Sithabile said that they are planning to stop the children playing videogames on weeknights). The PlayStation games are generally played in pairs so the three children have to take turns. They switch players every 10 minutes, sometimes using a rhyme ('Biti biti bota') to decide who takes the remote. The two girls, Della (twin) and Bongi, enjoy playing WWE SmackDown together, choosing young female wrestlers as their players. In Figure 65, Della is playing WWE SmackDown with her older sister, Bongi, while wearing the chest harness and camera.

Figure 64: The Yeoville park thoroughfare

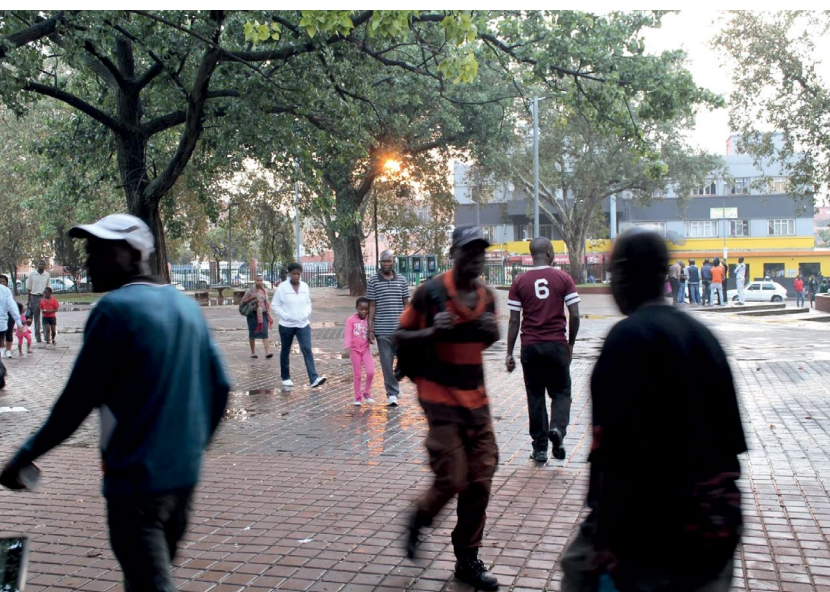


Figure 65: Eva Marie, a wrestler in WWE SmackDown

Their brother, Linton, much prefers the Marvel Superhero games. He has a lot to say about the drawings in his diary. His play world is a fascinating blend of ordinary everyday objects and events (garbage trucks, fruits and vegetables, burgers and bottles of tomato sauce) and less ordinary things like superpowers, light sabres and energy fields. The children sometimes play the PS3 soccer games with their dad, but their mom does not really play. She used to play an ice skating game until it got scratched and doesn't work anymore. She said her preference was Candy Crush. The parents both have smartphones and they use Facebook and WhatsApp. Linton mentions taking pictures of people and adding features (Snapchat) and the family also has a tablet that the children watch YouTube videos and play games on. It has a parent guide. The laptop is also used for play (for example, Plants vs Zombies described by Linton in a home visit interview).

SA Family F

Karabo (aged 10) is an eloquent and confident 10-year-old boy who lives with both his parents in a middle-class suburb in Cape Town. His parents are academics who work at universities in the city. They identify as Black African.

Their house is spacious, full of books, and reflects their interests. The family own a range of technological devices and the presence of devices reveals a family that uses technology extensively and for whom access to technology is important. Candace, Karabo's mother, searched YouTube to find out how to download the videos captured on the GoPro onto the researcher's phone when they could not get them to transfer. In terms of the technology they have in their home, there are some defunct items like an old VCR and computer that are no longer used. They also have televisions, a decoder (for satellite TV), a DVD player and a PlayStation 4. There are a number of games for these devices. Music is also important to the family and Karabo likes to listen to music and dance, which he often does when friends visit. They have an iPod and docking station as well as CD players. There are also designated work spaces with a desk computer and printer. Karabo's family owns cameras, iPads and laptops. His mother has a Kindle. The house is equipped with WiFi and thus has internet access.

Figure 66: Karabo with his toys in his bedroom

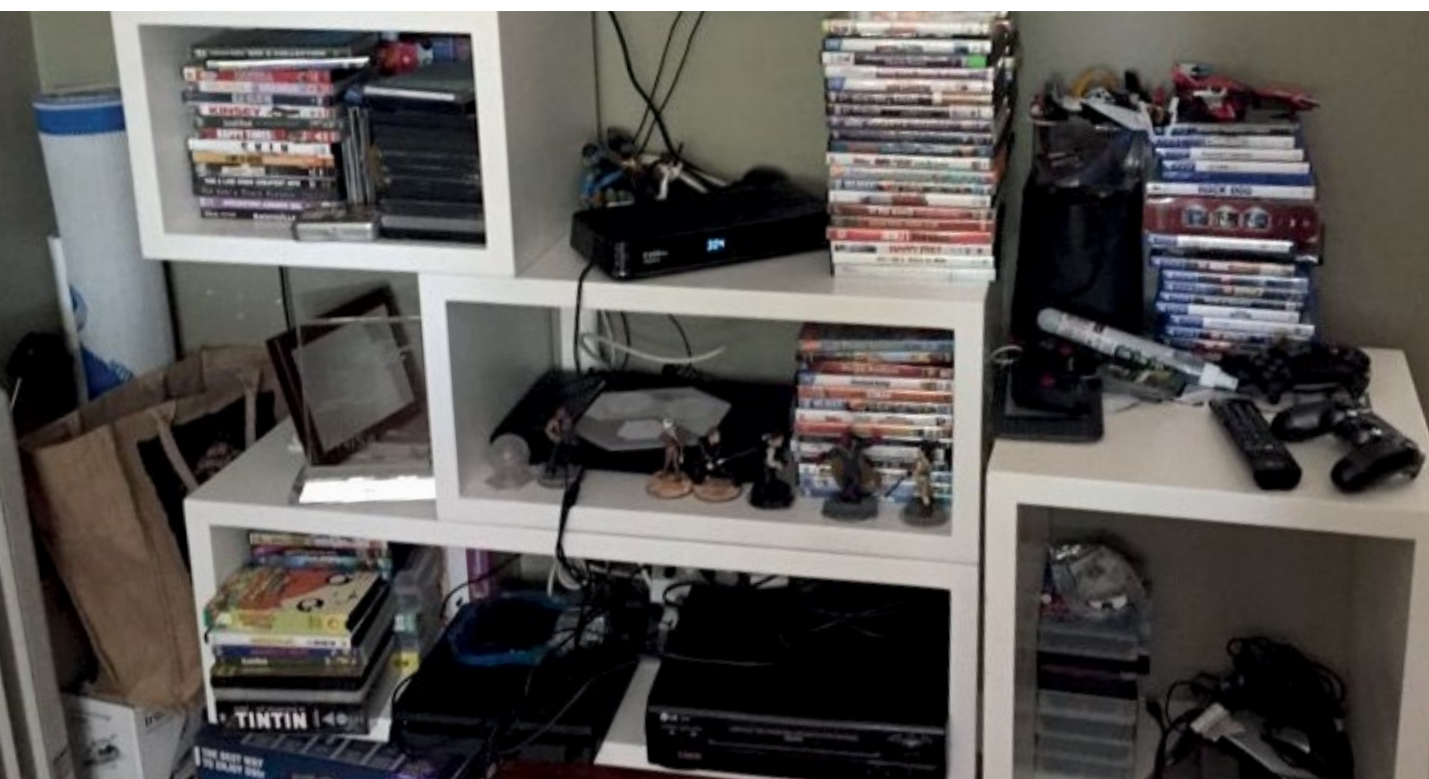
Karabo plays the recorder and guitar. He has played with LEGO since he was very young, starting with Duplo bricks, but as he has grown older he prefers to play LEGO with friends. He likes the creative possibilities it enables for him to 'make anything'. Karabo also has some smart toys which include a drone, a remote-controlled car with a charger, and Digitoys by Crayola that enable him to paint in a range of styles (e.g. 3D images) on an iPad. Karabo's self-declared favourite toy is the PlayStation 4. He likes to play FIFA and Uno but his favourite games are Minecraft and Fortnite. He plays the latter two online with a cousin and friends. Sometimes he plays with other children at his house or their houses. Alternatively, they use an online conferencing application to play the same game together in their own homes. Karabo's parents allow him to play online and watch a wide range of online content. He also plays games on his mobile phone. He loves to watch YouTube videos of others playing Minecraft and Fortnite. He explains that other players are better than he is and watching enables him to learn new things, develop his skills and be a better strategist. He likes the challenges presented in games like Fortnite but he does not like to change the rules in the games; rather, he looks for glitches in the games.

Although they do not play with him, Karabo's parents carefully monitor the time he spends gaming and his interactions with the games he is playing. They believe there is a relationship between gaming and well-being and a balance needs to be struck. They are concerned

about reports of children who, in Candace's words, 'become obsessed' and their experience of a child in their friendship circle whose parents banned him from playing Fortnite because he did not want to do anything else. They have noticed that Karabo can become engrossed in games like Fortnite. He is only allowed to play for an hour during the week and then has few restrictions on the weekend. However, when Karabo appears to be what Candace calls 'binge playing' she tells him to 'take a break and do something different'. His parents do not approve of the spending of money to buy items in games. After several conversations with his father after he spent all his birthday money in this way, Karabo has also come to realise that buying skins on Fortnite is a waste of money.

Candace values the element of social play when Karabo and his friends play the same games together, but believes that 'old-fashioned' play leads to better social interaction. She acknowledges the pleasure that Karabo derives from these games. She also acknowledged that the coding lessons that Karabo attends after school, and the small amount of programming experience that he has had, have been both enjoyable and have an educational aspect to them. Karabo's general knowledge is also extended by watching YouTube videos and playing games like Dumb Ways to Die as he deftly wove the fact that toasters are more dangerous than sharks into a focus group conversation.

Figure 67: PlayStation and games



SA Family G

Ndileka and Litha are the parents of Lulama (5) and a 3-month-old baby boy. Lulama lives with her parents and aunt in an apartment in a middle-class suburb in Cape Town. Both parents are employed. Litha is a liaison officer for a national student funding scheme and Ndileka is an administrator for an online gambling company. They had been renting a house in a suburb but felt unsafe there. At the time of the data collection, Lulama's granny had come to visit and was staying with the family. The family are Xhosa and, while they value aspects of their culture, they see themselves as less traditional Xhosas and have a Western orientation.

There is a range of technology in their home. Lulama's father has a laptop that he uses for work, her mother and aunt both have tablets and mobile phones. Her aunt also has a laptop and a WiFi router. Lulama had been given a mobile phone that had come from her mother's workplace. It is not a smartphone and had no SIM card but her parents were planning on getting a SIM card for her. There are two televisions in the home. One television is in the lounge and appeared to always be on, playing in the background; the second is in the aunt's bedroom. The family also owns a decoder for satellite television. Lulama's father was observed working on his laptop in front of the television. Lulama has an iPlay laptop that she describes as her favourite toy.

Figure 68: Lulama and her favourite toy, the iPlay



Fashion is important to Lulama and she wants to be a fashion designer. Much of her play centres on her dolls. She has paper dolls that she dresses up, and 'designs' clothes from paper and plastic. She also dresses up using her mother's clothes and then takes pictures of herself posing. Because until recently Lulama was the only child in the family, she has spent lots of time playing by herself. She appears to be quite self-contained and happy to do so. Litha commends this and values the fact that being able to play by herself is a sign of independence. He also believes that it is important for Lulama to be creative and that her play fosters this. For him, creativity, and the skills to get on and solve problems independently are important life skills. Ndileka did comment that her teacher was worried about Lulama's ability to play with other children because she had spent so much time playing on her own. But this has not been the case. Ndileka notes that Lulama's language ability is ahead of the children she plays with and attributes it to the television programmes she watches and the games Lulama plays.

It is only recently that Lulama has begun to play with her parents. Ndileka talks about how Lulama wants them to play 'school' with her where she asks the questions and they must answer. The adult in the family that Lulama spends lots of time with is her aunt, often watching television with her. Her favourite show is *The Lion King*. She loves to play on her iPad, either in her aunt's bedroom or in the lounge. She watches YouTube, plays games and listens to podcasts. Lulama also plays at making her own pretend podcasts. She integrates technology into her play. For example, when Litha is working on his laptop she brings her laptop out and sends pretend emails; she uses the intercom phone or her 'new' phone to have conversations. She is also fascinated with other acts of performance. In her play with two other children her interest in making films and performance is revealed as they take on the roles of 'sound' guy, and the guy who says 'cut and action'. She is also seen performing with a microphone.

Lulama appears to be unafraid of playing with technology and willing to figure out how things work. She pushed all the buttons on the Dictaphone during a family visit. Data off the GoPro indicates her experimenting with its options with little or no parental mediation. This willingness to try new things fits with Ndileka's explanation of Lulama as a child who prefers 'practice' over 'theory'. It is worth noting that the family view of

LEGO appears prescriptive. Lulama was given LEGO when she was much younger and her mother indicated that she did not use it like she was supposed to. She built her own things and there was LEGO all over the house so they donated it to the school. In receiving LEGO to play with, Lulama and her mother built figures suggested on the box.

Figure 69: Lulama showing the LEGO figures she built with her mother



SA Family H

Kamden (4) is the only child of Kameron (30) and Denise (27). He's a curious and energetic child. At the time of the research they were house-sitting in a middle-class suburb in Cape Town. By the final visit they had returned to their family house in a working-class suburb. They shared this house with other family members, which included Kamden's cousins. Both of Kamden's parents are employed. Kameron is a facilities manager and Denise is a receptionist. The family identify as Coloured.

In the family home Kamden has access to TV, a CD player, computer and keyboard, PlayStation and smartphones. He plays with an older mobile phone but prefers his mother's phone, which she describes as more modern and has better capabilities. Kamden uses the phones to access vlogs and YouTube and play games. Denise noted that he started watching movies and cartoons and playing with his toys and then at about two or two and a half, began watching YouTube. He is allowed to

Figure 70: Kamden dressed as a rock star



choose what he watches, and he finds his own vlogs and sites. He has taught himself how to download and save YouTube videos. His favourite game is Shazaam. Kamden knows how to use the PlayStation and likes the fighting and car games. The family cannot afford digital toys but he likes talking to Siri on his aunt's iPhone when they see her.

His play reflects some of the programmes he has been watching. For example, he likes cooking programmes and uses his playdough to 'cook'. He also likes to watch a programme where children receive new toys. He also loves playing with slime. He had seen it on a programme that he has watched and then learned to make it, which caused great delight. Kameron also commented that Kamden seemed to be affected by attitudes and emotions of the children when they engaged with robotic toys. This was both in terms of the shouting that the children did and the language they used to express this. His pronunciation has been affected by the American accents of the children he is watching as well as the vocabulary they use. 'Awesome' is a word

previously not used by the family that Kamden began using and then was picked up in the family's lexicon.

The family is very interested in cars and Kamden was clear that his two favourite toys were a Ferrari and a Lamborghini. The family play the car game Rio together, which requires moving and dodging obstacles. During one of the family visits Kamden was highly engaged in the process of making a Ferrari with recycled materials with his dad. This love of creating things is partly influenced by the Maker show he likes to watch. He also has Transformers that turn into cars that he likes to play with.

Kamden's parents value his playing. Kameron insists that it is something that should not be stopped because that is how children learn. At the same time, as parents they learn a lot by watching Kamden play. It provides insight into how children adapt with playmates and their surroundings, as well as his likes and dislikes. The appreciate his ability to take just about anything and turn it into a game. They do watch what he is watching so that they are aware of his viewing choices. Kameron talks about how the videos he is watching may in fact turn into a future career for him. Presently the family are restricting his play to watching YouTube videos. They are reluctant to let him play with PlayStation and are guided by the age restrictions on the games. Kamden has extensive knowledge of sea animals, which he is quite passionate about. He loves watching National Geographic. He uses the recommended suggestions on YouTube, based on his viewing patterns, to explore this interest.

Figure 71: Kamden playing in the garden



Denise downloads educational apps for Kamden to play with based on information she has received from Kamden's teacher about content he might be struggling with. He has a drawing app of patterns that helps with perceptual motor skills in preparation for handwriting. He also attends a computer class at school. Denise commented that she has seen him transfer the knowledge he gained from working with the paint application on her phone.

Although Kamden is described as a child who wants company and does not want to be alone, his LEGO play can engross him for long periods of time. He forgets that he is alone. Kameron says this kind of play makes him happy and confident.

Figure 72: Kamden engrossed in the LEGO set with his cousin



SA Family J

Jai (58) and Paula (42) are parents to Gemma (8), who is a Grade 2 learner at a former Model C school in a middle-class leafy suburb of the Western Cape, South Africa. Jai, who is Indian, and Paula, who is White, both have professional backgrounds and have tertiary qualifications. They have two children, Gemma (8) and Laya (4). Jai, a retired physical education teacher, takes care of his children during the day while Paula works. Jai was previously married and has older children from his previous marriage. They describe their family as blended and, as such, Gemma has other siblings who are Indian. Being of mixed race, Gemma identifies as Indian.

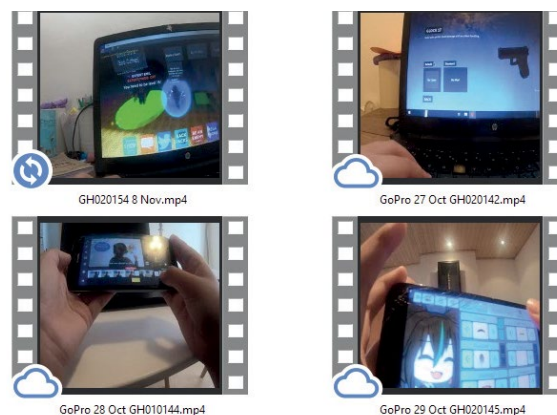
The family are digitally connected and have access to uncapped WiFi, Xbox games, a smart flatscreen TV, laptops, tablets and mobile phones. Gemma inherited her mother's old laptop which she has exclusive use of in her bedroom. Paula has connected all Gemma's devices to her (Paula's) Gmail account so that she is able to track her activity, as well as for security reasons. Gemma has access to a laptop and a mobile phone which she used to code and develop her own content. This is usually in the form of anime characters, games and music videos. Her phone does not have a sim card, and Gemma can only connect to the internet at home using WiFi.

Figure 73: Gemma playing with her LEGO set



Paula and Jai often play on the Xbox with their children. They particularly enjoy playing Maleficent, Minecraft, LEGO Indiana Jones and Avengers. When they are unable to progress in a game, Gemma is able to navigate the internet to find 'cheats' in order for them to move

Figure 74: Clips of Gemma engaging in digital play



forward. Paula made the comment that the LEGO Xbox games are the most child-friendly games in terms of 'children content'. In addition to digital play, their home has a fully equipped music studio as Jai is also a musician. Gemma is able to play the violin and piano. She is also an avid reader and does writing activities on the computer with the help of Grammarly.

In general, the family participates in various tech and non-tech activities. Over the weekends they spend time at the library or go for walks. As a family, they sometimes visit the playground to fly a kite, or stay at home and play Scrabble and quiz games. Gemma codes and develops her own music videos in Gacha Life, and codes and develops in Roblox. She watches lots of YouTube videos and has recently created her own channel. She often shares some of her interesting coding designs with her parents.

Gemma's parents are pro-technology, with a specific interest in the area of STEM. They are very open to the use of technology in the home and at school. They have purchased a number of books to support Gemma's love for coding and content development. Paula in particular is also aware of the pitfalls of the internet and constantly educates the children about cyberbullying and internet security. They actively participate and play with Gemma but are aware that she learns very fast and that she will surpass them in digital knowledge as she has already changed her mother's Gmail password.

Paula observed that much of Gemma's non-tech play activities, such as writing or drawing, are very often linked to the digital games she plays or YouTube videos

she watches. She hardly watches TV programmes as it is not stimulating for her; she codes, develops games and produces music videos. In addition, she creates avatars and imports them on to other platforms. She plays musical instruments and writes imaginatively and creatively well beyond the competency of children her age. She is also culturally and socially aware, largely due to her parents' open-mindedness and frank conversations about any topic. One of the ideas she expressed was for an app which will make people happier. Last Christmas, instead of toys she wanted robux (e-currency) to purchase upgrades for her avatar in Roblox.

SA Family K

As previously mentioned, this narrative has been included to reflect the complexities of engaging in fieldwork in settings across the diverse socio-cultural context in South Africa. The school which participated in the study is situated in a township on the Cape Flats in the Western Cape, South Africa. The area, like most of the Cape Flats, is plagued with high rates of unemployment, gangsterism, drugs and high murder rates. In 2019 this suburb was reported as being the second worst in terms of the number of reported crimes in the Western Cape.⁶ To this end, the South African government deploys the army to patrol the streets in some areas, including Mitchells Plain. This is the environment and context in which the school is located. Children from this school enjoyed various forms of play activities.

Figure 75: The school in Mitchells Plain (Cape Flats)



Upon embarking on the project at this school, the Grade 4 educator who welcomed us into her classroom identified a 10-year-old female learner whom she thought would be suited to participate in the project. The learner, as is common with many other children in South Africa, lives with her grandparents while her mother is employed in another province. While the mother was keen for her child to participate, the grandparents, who are Muslim, were not comfortable allowing a male research assistant into their home. In addition, there appeared to be further apprehension after explaining to the parent that interviews would take place and that the child would wear a GoPro. The mention of a camera was met with silence, which was an indication that this was not a comfortable option. The mother of the child indicated that the grandparents may not be comfortable with strangers coming into their home. After liaising with the grandparents, the mother indicated that they were not willing to allow any researcher to come into their home.

In light of this, the educator earmarked another student, a 10-year-old boy, for participation. However, his parents also refused access into their home. Through conversations with various stakeholders, including those from the governing body of the school, it became apparent that due to the increased occurrence of home invasions and violent robberies, people in this community do not easily trust strangers, especially those who enter their premises. Focus groups with learners from this school highlighted the stark reality of living on the Cape Flats.

For some of them, technology is a way of staying indoors, while for others it is used for the purpose of bonding with family members. It appears that playing digital games, often against one another, on the Xbox or PlayStation is a pastime enjoyed by many families. Some children enjoy watching various videos on YouTube, including how other children engage in play activities. Generally, the learners from this school enjoy playing digital games on devices such as cell phones and consoles, yet we also witnessed plenty of non-digital play. On the school grounds, we watched their activities in the playground during recess periods. In the week and over weekends, children participate in sport activities, such as netball, gymnastics and soccer.

3.2 UK case study family profiles

UK Family 1

Serena (34) and Kawsu (47) live with their two sons, Mallison (6) and Essa (4), in a modern semi-detached house in North Sheffield. Serena is a midwife and Kawsu a car salesman. She is White British and he is Black African. Serena is dyslexic and her family have a genetic hearing impairment, which means Serena and Essa need to wear hearing aids.

Mallison and Essa are both very active. When not at school, they spend a lot of time playing with their cousins and doing sport, such as swimming, horse riding and football. They train regularly at a local junior football club and attend Sheffield United matches. At home, the boys love junk modelling and building things out of LEGO. They have numerous LEGO sets which they build from the instructions, aided by Serena, or use independently to invent their own buildings, vehicles, figures and gadgets. Serena is proud of the imagination they display and often keeps, or photographs, their creations.

Figure 76: Essa's drawing in his play diary of the family in bed



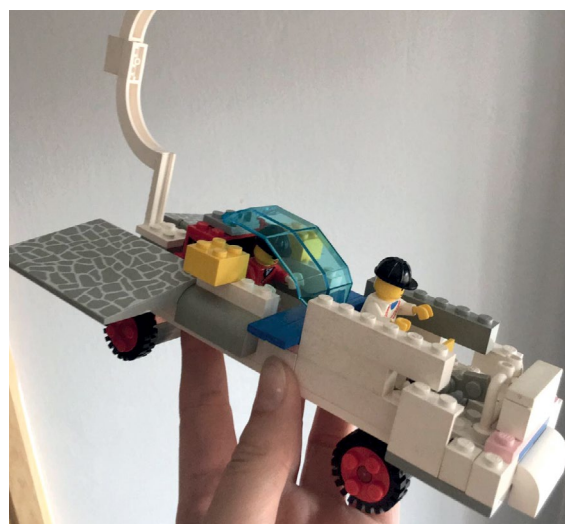
Essa is passionate about animals and enjoys music and dancing. Both boys have vivid memories of a trip to Senegal in 2017 when they went on a safari, and they have a set of African drums which Essa plays. Two of their favourite films are *The Lion King* and *The Greatest Showman* but overall they do not watch films much on

DVD or at the cinema. Essa's toys and play reflect his love of animals, especially horses. He has plastic farms and paddocks, numerous farm and wild animals, riders, trucks and jeeps, including a well-used LEGO Friends horse trailer set.

The family home has a standard television and DVD player, iPad and, a more recent acquisition, a Nintendo Switch. The iPad has a number of apps downloaded by Serena, including YouTube Kids, and the family have Minecraft, LEGO The Incredibles, Super Mario Party and Just Dance for the Switch. Essa and Mallison sometimes access their grandmother's mobile phone and are occasionally allowed to play on their parents' mobile phones when their iPad is not available.

Serena and Kawsu have consciously limited the boys' play with technology. Instead, Serena encourages them to play with their toys and LEGO or to be outside playing football. Mallison and Essa are, however, allowed to go on the iPad and the Switch when they have been well behaved and have done a variety of other things as well. Serena is also keen for Mallison to use the iPad to go on the educational apps Times Table Rock Stars and Spelling Shed, to which he has access through school and in which he excels. With her help, he also carries out research for school topics on the iPad and he enjoys finding out information in this way.

Figure 77: Mallison's flying car



Mallison's favourite game, however, is Minecraft, which he plays on the Switch and which he became aware of through his school friends. Serena and Kawsu have limited videogames experience and are not familiar with the Switch so, once Serena set it up for him, Mallison has more or less taught himself. He learns through trial and error, and from other children. He was put off at first by survival mode and now always plays on creative mode, where he is progressing quickly.

Mallison also uses YouTube Kids on the iPad to find videos relating to his interests, including Minecraft and football, and helps his younger brother to do the same. Mallison has played a zombie apocalypse role play game with his younger cousin, which was inspired by watching a popular YouTube personality, Papa Jake.

Essa also likes to play with technology, but not as much as Mallison. Essa mostly plays on the iPad and enjoys the Star Stable Horses app that his mum downloaded for him, which involves looking after and training foals. He also enjoys word and colouring apps, such as Alphablocks, Pixelart and Peppa's Paintbox, and a Thomas the Tank Engine racing app. With Mallison's help, he has started to play The Incredibles on the Switch and will sometimes observe his brother playing Minecraft.

At school, Essa prefers to play football with his friends and Small World construction play rather than playing with technology, such as the interactive whiteboard. However, his love of dance finds expression when the teacher puts on routines from the movement app GoNoodle, which the whole class copy.

UK Family 2

Alison (6) and Chloe (4) live with their parents, Susan (33) and Craig (34), in a semi-detached house in North Sheffield. Their mum works for a photo booth company and has just launched her own business while their dad works on the finance team of a telecommunications company. They are White British.

All the family enjoy art and craft. Alison delights in drawing, colouring, writing and making, incorporating these into her pretend play as well. She does gymnastics and takes part in choir at school. Chloe likewise loves drawing, modelling and colouring, and playing with dolls and soft toys, such as her unicorn and Disney film characters. The girls enjoy hiding and surprising people and share a passion for L.O.L. Surprise! Dolls.

They often play games of pretend together, Alison taking the lead. Outdoors they go on the trampoline and explore the natural environment.

Alison and Chloe have a Kindle Fire on which Alison uses YouTube Kids to find films, such as doll play videos, the '3 Marker Challenge', and unwrapping Kinder Surprise Eggs. They also have several digital toys, such as Chloe's VTech Kidizoom camera. The home has a standard television, which they upgraded to a smart television during the study period, and a Google Home Hub. The girls' viewing includes films and CBeebies programmes, *Dora the Explorer* (Netflix), *Unikitty*, and the animated Nick Jr. series *Shimmer and Shine*. Because they could not operate the standard TV themselves, they were increasingly watching YouTube films on the Home Hub. They use their parents' mobile phones to take pictures or access books or apps when the Kindle Fire is not available. The family has a laptop, mainly used by Susan for work, and Craig has a PlayStation. Susan takes numerous photographs of the family, and the girls' artwork, to preserve family memories. She posts some on Facebook and Instagram, and creates displays of them in the home, refreshing them according to the seasons and family anniversaries.

Figure 78: Alison and Chloe watching YouTube videos on the Google Home Hub



Susan and Craig encourage the girls' play interests and value imagination and creativity. A talented artist himself, Craig coaches their drawing and regularly takes them out on nature walks. He enjoys playing with LEGO alongside them. The family have visited LEGOLAND and other theme parks, and they watch television programmes together, such as *Britain's Got Talent* and *The Chase*, and LEGO and Disney films. Susan and the girls sing along to Disney songs on the Home Hub, and she has introduced them to Just Dance 2016.

Alison and Chloe regularly imitate YouTube films in their play, one pretending to film the other. In another game inspired by their family life, Alison pretends to be driving a car (the bunk bed) while Chloe is the 'sat nav' giving directions. They also follow YouTube drawing tutorials, such as those produced by the ArtforKids Hub, prompting Craig to consider starting their own family channel of art tutorials with split-screen demonstrations.

Susan helps Alison use the Holodraw Fashion app, in which a lens placed over the camera of Susan's phone allows the designs she colours to be projected onto the screen in virtual 3D. Susan has taught Alison and Chloe how to verbalise instructions clearly to the Google Home Hub and helped them make bread by finding and following a YouTube film on the Hub.

Figure 79: Chloe using her Kidizoom camera



Both parents are generally enthusiastic about digital technology, viewing it as important for their children's future. They have supported the girls' uses of technology from the outset and shared some of their own media practices and interests. They do insist that the girls change to other activities if they are using a particular device or app for a long period and, on one occasion, they deleted the Peppa Pig app for several months because they felt that the Peppa character was encouraging bossy behaviour. They also have reservations about the quality of some YouTube content that the girls view and imitate.

At school Alison often mentions her home experiences of technology in class, such as games she has played and things she has seen on television or found out on the internet. The school introduced her class to Times Table Rock Stars the previous year (Year 1) and, as her parents' familiarity with it has grown, it has become more embedded in Alison's home life alongside her other digital activities. She is proud that it has helped her improve her times tables. Her parents likewise plan to encourage her use of Spelling Shed at home to ensure she is well equipped to participate in class challenges.

UK Family 3

Katie (39) and Matt (40) and their two children, Stephanie (9) and Saskia (6), are a White British family living in a modern semi-detached house in North Sheffield. Katie trained as a legal secretary but now works in a primary school office while Matt is a supervisor at a surgical instruments manufacturer.

Stephanie and Saskia are avid readers and have many books in their shared bedroom. They enjoy reading stories to their many soft toys and plastic figures. The girls play together and also independently. They have a playroom with a tepee, dolls house and pretend cooker but Stephanie prefers to be on her tablet elsewhere now she is older. The girls also play on the trampoline and swings in their garden and take the dog out for walks in the park.

Stephanie and Saskia are both keen on making and have an extensive range of art and craft materials. Saskia's LEGO collection includes Disney princess figures and Cinderella and *Frozen* castles. She enjoys mixing up the pieces, making up stories, and doing different voices for the figures. Stephanie likes building with LEGO and craft activities.

Out of school, Saskia goes to Rainbows, swimming and dancing, and Stephanie does gymnastics and Brownies. Stephanie also learns cornet at school. The family sometimes play board games together and have 'movie nights' at home or go to the cinema. They have a standard television which includes access to Netflix and a DVD player, and Matt can also cast films to the television from their mobile devices through Amazon Fire Stick, Chromecast, and the ShowBox app.

Stephanie got her first tablet when she was 5 and now has a Lenovo one with a detachable keyboard. Saskia was given an Amazon Fire for Kids when she was 4, pre-loaded with children's apps. They used to have electronic toys such as LeapPad and a VTech teddy bear.

Stephanie bought an Amazon Echo Dot smart speaker with her own money. The family mainly use it to listen to pop music. Saskia also likes asking it for jokes. They listen to commercial radio in the car and the girls occasionally play children's party music on a CD player in the conservatory. They put on shows for their parents, using tablets or phones to access music.

The girls borrow their parents' phones to take photos. Katie is also a keen photographer and the whole family enjoys looking back at photos and reminiscing. Matt has a Sega videogames console but rarely uses it now, although the family have occasionally played Sonic the Hedgehog on it together. Katie has two laptops as well.

Stephanie and Saskia play on their tablets after school or first thing in the morning at weekends and in the school holidays. Their favourite app is YouTube Kids, which they watch more than television. Stephanie watches cartoons and gaming videos by YouTubers such as DanTDM, as well as craft videos and pop music. Saskia loves YouTube challenges, a few of which she and Stephanie have tried themselves. She often watches *Horrid Henry* and *Alvin and the Chipmunks*.

Stephanie uses her tablet to make videos. With her sister she has made videos with their teddies and L.O.L. Surprise! Dolls, imitating the films they watch on YouTube. This practice extended to school when Stephanie's teacher got the class to film each other doing a gymnastics sequence for peer review.

Stephanie has identified many other apps for herself, such as Roblox, Duolingo, Paint 3D, Piano Tiles and Helix

Jump. She particularly likes Roblox for the variety of different games and customisable characters it offers. She would like a Cozmo Robot AI toy, which she has seen on YouTube, and a mobile phone which her parents say she can have when she goes to secondary school.

Figure 80: Stephanie and Saskia using an Amazon Fire



Katie and Matt adopt a light-touch approach to their children's technology use. They keep the girls' bedroom and the dinner table 'technology free'. Time spent playing with technology is limited by other activities the family has planned, otherwise Matt and Katie get the girls to change to another activity when they feel they have played on their tablets long enough. They trust the filters on YouTube Kids to prevent inappropriate content. Their biggest concern is apps in which it is possible to be in contact with strangers. Stephanie's cornet lessons at school are taught using Charanga and Stephanie enjoys accessing the music on this at home to do her practice.

UK Family 4

A White British, middle-class family, mum Diane and dad Julian (both aged 42), Harvey (6) and Simon (8) share their suburban detached home with their lively pet dog. Diane is a nurse and Julian a barrister, and in their free time the family play outdoor games with friends, play card and board games, and enjoy reality TV shows such as *The X Factor*, *The Great British Bake Off* and *Strictly Come Dancing*.

Simon and Harvey are encouraged towards sporty outdoor activities; Simon has football training and belongs to the Cub Scouts. He is interested in technology – coding with Scratch, building robots, producing stop-motion videos (something he learned at Forest School) – and making funny PowerPoint presentations. He enjoys reading and watches *Horrible Histories* on CBBC, considering it educational. Harvey is more interested in the BBC natural history shows *Planet Earth* and *Serengeti*, which are family viewing. He sets up his toy animals in what Julian calls ‘panoramas’, playing games of ‘predators and prey’, and weaves his appreciation of natural history into his imaginative play with Simon, pretending to be a polar bear stalking a seal. Harvey likes *Beast Quest* books and collects Pokémon cards, interests he shares with his classmates. He has toys from the CBeebies show *Octonauts* and liked pretending to be the characters when he was younger.

Both boys have LEGO, both individual bricks – some inherited from older relatives – and kits from the Star Wars and Harry Potter series. They enjoy watching the Channel 4 television programme *LEGO Masters*, marvelling at the competitors’ creations. Harvey plays with LEGO at home and at school where his interests in animals and Star Wars inform his play in his classroom’s LEGO area. In class, his knowledge about animals shows itself in the games he chooses on the class laptop, and what he draws and writes about during creative exercises. At after-school and breakfast club he creates spaceships with construction materials, sharing imaginative ideas with his friends.

While the family has TVs and a DVD player, an Alexa Echo Dot, a PlayStation 3, a Nintendo 64, smartphones, a tablet, and Kindles for mum and dad, and Nintendo DS consoles for the boys, technology use and internet access is restricted. Diane admits she has little interest in technology and games. Her phone is for reading the news and chatting, although Julian joins in computer

games occasionally. One videogame the whole family enjoys is *Start the Party*, a series of augmented reality mini-games designed to be social and interactive.

The boys have limited access to their DSs, and the Nintendo 64 is considered a treat, while the Alexa (Amazon Echo speaker assistant) – connected to Spotify – is monitored after Simon ran up a bill listening to an audio book. Diane even hid the device, due to the boys’ incessant playing of songs including ‘Crazy Frog’ and ‘It’s Raining Tacos’. When they do use their DSs – and Diane finds them useful entertainment when she is in the gym or they are at the hairdressers – the boys play *Trackmania*, *LEGO Indiana Jones*, *Mario Kart*, *Super Mario* and *LEGO Star Wars*. Simon has played *Minecraft* and the boys like watching ‘let’s play’ *Super Mario Odyssey* videos by YouTuber Stampy.

Figure 81: Harvey and Simon using a tablet



Diane sometimes jokingly suggests that she could be perceived as ‘mean’ because of the restrictions she places on technology in the home. She says, though, that without restrictions, Simon and Harvey would be on the computer or watching television constantly. She feels that digital play affects them emotionally, noticing that their mood alters when they are asked to switch off their games. She is further concerned about games involving weapons such as the James Bond-inspired *GoldenEye*, which Simon and Harvey like to play on the

N64, using it as inspiration for Nerf gun battles. Julian is more ambivalent. He enjoyed computer games growing up and has his own PS3 games such as Call of Duty: Black Ops. While he enjoys them as a stress reliever, he would not like Simon or Harvey to play them as they are inappropriate for their age. Online safety is a worry for both parents, with Diane feeling that internet companies also need to become more responsible.

They are aware that things are changing as the boys get older. While Julian jokes that Simon's first mobile phone will be a Nokia 'brick' and Diane acknowledges they have become stricter with technology as the children have grown up, Diane is also conscious of Simon's apparent flair for, and interest in, technology, and that both boys are growing up in a digital world.

UK Family 5

Zander (5) and Greta (2) live in a 3-storey middle-class home with their parents Ria and Miles (both aged 40). The family is White British. Ria describes herself at present as a stay-at-home mum and is a journalist who has also worked for a life-coaching company. Ria is artistic, creating beautiful seasonal displays in her house, and encourages her children to get creative and crafty. Chartered engineer Miles is competitive and sporty, championing Zander in his activities which include tennis, swimming and football, and is the family authority on technology and computer games. Family activities include park visits and board games, including Pop-Up Pirate, Game of Life Junior, Monopoly, and family favourite, the Disney game Eye Found It!

Zander and Greta have tablets, and Zander's is the toy he loves the most because of the games he can play on it. The family has a smart TV and Netflix and Amazon Prime subscriptions. Zander knows how to browse, selecting the film for the family's Friday pizza and movie night, although the settings prevent him searching above a PG rating. The family has Alexa (Amazon Echo smart speaker), but Ria has concerns about privacy. Zander likes Alexa, requesting songs including the Ghostbusters theme, and 'Yellow Submarine', and asking it questions. The family also has a PlayStation, used primarily for DVDs, and a Nintendo Wii which is usually played when Miles is at home. Zander likes playing Mario Kart with his dad and Ria joins in family games of Wii Sports. The family estimate this type of play takes place around once a month. Ria and Miles share an office on the top floor of the house, with their own laptops.

Figure 82: Zander playing on his tablet



Ria is not anti-technology and is positive about educational games but believes that it should not be the only thing in her children's lives. She describes the tablets as 'a last resort'; a distraction for long car journeys. Once, she says, she found Zander playing on his tablet under his bed, and since then she has made the tablets less accessible. She worries about the levels of violence in children's cartoons and movies, the age appropriateness of films and games, and the potential for peer pressure, as Zander is among the youngest in his school year. Greta and Zander's playroom features physical toys such as vehicles, a pretend shop, and dressing up clothes, including superhero outfits. Ria creates scenarios on the playroom table, for example, setting up a Playmobil pirate scene for the children to explore with. She is supportive, though, when Zander brings his movie and game interests into creative play, building Star Wars-inspired vehicles with LEGO and making a light sabre from a cardboard tube.

Miles spent part of his youth in Hong Kong, with access to the latest games and technology, such as the Sega Mega Drive, before they reached the UK. He is a keen gamer who is excited about introducing Zander to the films and games he enjoyed, the superhero- and comic-book filled world he grew up in. His company uses virtual reality for clients and he is enthusiastic for when this technology will be part of everyday life. He selects apps and games for Zander to play on his tablet and the laptop, such as LEGO Batman and Minions games,

which he thinks helps to develop problem-solving skills, and plays CBeebies games with Zander such as Dangermouse, and educational games accessed through Zander's infant school's website.

Zander likes dinosaurs, dragons and vehicles such as trains and cars. He likes construction, with his wooden train track and with LEGO, and his superhero toys, including Captain America and Batman, who battle the bad guys. His interest in sports, and sports brands like Nike, comes across in his tennis coaching sessions and features in his schoolwork.

Zander likes the LEGO movies series, including LEGO Ninjago and LEGO Batman, and also live action films that inform his play in the school playground. With his friends he plays Star Wars, taking the role of Luke Skywalker, and also Home Alone. He plays Star Wars games and also football and driving games on his tablet and is becoming interested in the possibilities mobile phones offer for filming. At school, Zander likes the LEGO area of his classroom where he creates spaceships inspired by Star Wars. He is knowledgeable about Pokémon and reads the Beast Quest book series.

Greta has recently started to pay more attention to the television. She loves *Peppa Pig*, which she watches on her tablet, and has toys such as jigsaws, soft toys and figures relating to the show. She also has some educational interactive Leapfrog toys.

Figure 83: Greta, dressed in a lion costume, using an electronic keyboard



UK Family 6

Rosie (44) and Thomas (42) share a first-floor apartment with their children, Alfie (3) and Leo (5), in a city suburb. The family is trilingual: Thomas is from Cuba and speaks Spanish while Rosie is from Turkey. At home Alfie and Leo speak Turkish to mum and Spanish to dad, speaking English at school and nursery and with friends. Rosie notices that the boys tend to speak English while playing, calling English their 'play language'. While Leo's English is fluent, Alfie still prefers to speak to and through his parents, although at nursery he demonstrates greater English proficiency. Mum and dad are keen for the children to retain their languages, with Thomas a believer that different languages open gateways to different ways of thinking. They attend a Saturday morning Spanish-language club as a family, where they socialise and Leo has Spanish lessons while Alfie plays with toys designed for preschoolers with the younger children. Facebook page, informative website and email aside, technology does not feature in the club's activities.

Thomas holds a PhD and is a university teacher. Rosie is at home with Alfie but holds an MBA and worked in business administration. Interested in app design, she tries out and approves the boys' games and apps, ensuring they are appropriate. The boys don't have a games console or a PC, and have relatively little experience of computer games, but the family has a laptop, a smart TV, and an iPad which the brothers can play on, observed by their parents. Both boys like playing strategy videogame Clash Royale, while Leo likes Roblox and watching YouTube videos about LEGO products. He has recently discovered Horrid Henry through friends. He uses the household iPad to photograph his LEGO creations to preserve them as, says Rosie, LEGO is intended to be broken up and re-used. Alfie, meanwhile, is learning how to take photos of his Playmobil toys on mum's smartphone. If Leo is proud of one of his creations, he can share it with his friends over Rosie's WhatsApp account.

Both Rosie and Thomas want to ensure that Alfie and Leo are not exposed to too much technology. While Leo can play educational games based around the PBS Peg and Cat cartoon on the laptop, and use the paint tool, screen time is limited, at first to two hours and now one hour per day, with Rosie noting that the boys can become excitable with lots of screen play. She worries about games designed to be addictive and their potential to

eat into family life, and subscribes to the blog 'Screen-Free Parenting'. Thomas's family was among the first in his home town in Cuba to get a computer. He recalls being taught that it was for work, not play – an attitude he maintains. He is concerned that watching videos is passive, limiting creativity, and feels that outdoor play is valuable, although it is not as possible where the family lives currently. In their spare time the family likes to be outdoors in the park – Leo has shown an interest in football – and playing board games or dominoes.

Leo and now Alfie love creating scenarios with LEGO on their living room windowsill, a favourite play space. Sometimes they add characters from other media, like Disney Pixar's *Cars* series. They have soft toys, dressing up clothes, and shelves of books in the family's languages. Leo and Alfie watch cartoons in all their three languages. They also enjoy playing around their home; they play hide-and-seek and pretend that the floor is lava, leaping around the furniture. While Leo also enjoys reading, and construction in school, Alfie is described by his parents as being more physical in his play. Alfie shows a keen interest in technology and at nursery enjoys the chance to use the iPad. His nursery key worker suspects he has greater access than he does to technology at home, as he appears comfortable and confident using it at nursery.

Figure 84: Alfie and Leo using a tablet



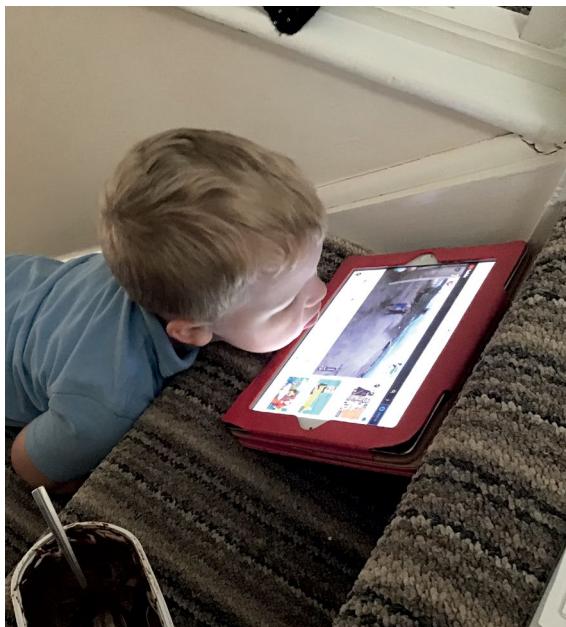
Both parents have mobile phones and, with family around the world, Thomas and Rosie use social media to keep in touch and use Skype to communicate with family and friends. Leo and Alfie are accustomed to talking with family on Skype, and Alfie with playing with his cousin online, showing each other their toys and laughing together. The brothers also have an Instagram account, curated by their parents, to allow family to see what Leo and Alfie are getting up to. Leo recently took a 'selfie'. The boys also like to ask Google Siri funny questions.

UK Family 7

Anna (7) and John (4), and their mum Marina (39), are a White British family living on a council estate near Sheffield city centre. Marina and the children's dad have split up but they see him regularly and also spend lots of time at their grandparents' house. Marina has given up her sales assistant job to look after the children and volunteers at their school. She is dyslexic, as is Anna, and John has a slight speech impediment which is improving through therapy.

Anna has many interests, including arts and crafts, playing with LEGO-style bricks, dressing up, and playing with her dolls, soft toys and with their pet hamster. Singing and dancing are a passion that Anna shares with her mum, and they sing to the radio and dance to music videos together. Anna also loves hide-and-seek and playing tricks, and goes to Brownies, drama club, book club and choir each week after school. John enjoys colouring, drawing and constructing things, and is fascinated by how things work. He plays with his Transformers figures, remote control robot, Nerf gun, and bow and arrows. He is also a fan of Power Rangers, watching the films and dressing up as a Power Ranger. John is a proficient driver of an electric quad bike and fire engine which are kept at his grandparents' house. He is also fond of dancing.

Figure 85: John watching YouTube and eating an ice cream on the staircase



Outside, John and Anna play on their scooter and bike and in the playhouse. They both play football and go to Sheffield United football matches. As a family they enjoy board games and watching films together on the smart television in the living room. Among John's favourite programmes are Paw Patrol, which he also plays as a pretend game at school, *Fireman Sam*, *Numberjacks* and *Mr Tumble*. Anna tends to watch programmes on CITV, CBBC and Nickelodeon. Both children have a television and DVD player in their bedrooms, and a collection of DVDs. They are allowed to watch television an hour before bed which Marina finds sends them to sleep.

Anna and John each have an iPad, given by their grandparents, on which they love to access YouTube Kids. John likes films by YouTuber Stephen Yeager, videos relating to Power Rangers, and the father and son unboxing films on the Turbo Toy Time channel. Anna accesses films relating to her interests in drawing, animals and music, as well as YouTubers such as Ryan and Tiana Wilson, and story videos at bedtime. Both children use the iPad to watch television programmes and films on Netflix. John also has the CBeebies Playtime app and Anna enjoys beauty, clothes and hair-styling games, jigsaw puzzles and maths games, and likes doing homework on the Maths and Spelling Shed apps encouraged by her school.

The family have an Amazon Echo Dot which they have found useful for homework and for playing music. Anna and John have also had fun making up mischievous questions to ask it. Marina has a laptop which the children are not allowed to play on and a phone which she lets them use to take photographs on and to FaceTime their dad. They also have a SEGA Mega Drive games console on which the children play Golden Axe III and Sonic the Hedgehog, largely encouraged by their dad. John in particular becomes very involved with the actions of the characters on videogames and jumps around imitating them.

Marina takes an active interest in the children's play with technology. They are allowed to watch television after school and have a film night together at the weekend. She prefers educational apps and apps that help John with his speech therapy. Marina also supports their learning by searching for information on the internet and showing them different places on Google Earth.

Anna makes films of herself and others on the iPad, and has a big collection of family films and photographs. She views these regularly and revisits the memories they hold. She has also asked her mum to upload films she has made to YouTube but Marina does not know how to do this and is concerned who will see them. Marina steers the children away from YouTube content that she thinks is unsuitable, and feels that many films on YouTube involve watching rather than learning. Nevertheless, Marina and the children have fun dancing to GoNoodle films together and watching a roller coaster simulator while sitting on the floor and pretending to be on it.

Figure 86: Anna watches the rollercoaster simulation



UK Family 8

Travis (63) and Denise (44) met as environmental protestors and have created a comfortable, creative home in a semi-detached house on a city housing estate, filled with books, pictures and artworks, and with a wood-burning stove in the living room. Denise works as a self-employed photographer and in hospitality at entertainment venues in the city. She is also involved in filmmaking. Travis spent 20 years as a computer programmer. He still works on web programs, which he combines with work as an event steward. In summer the family decamps to festivals which mum and dad help organise, while their children Cerys (9) and Jeremy (11) experience a relatively technology-free existence, bar mobile phones which can be used to play 'camera tag' but soon go flat.

Denise is White British. Travis is of mixed heritage, White and Native American, and has one English parent. Thanksgiving is part of the family's customary calendar. Jeremy is in Year 7 at a large modern secondary academy. He has autism spectrum disorder (ASD) and was slow to speak as a toddler, having speech therapy and becoming more verbal once his younger sister arrived. He is now a chatty, friendly pre-teen – in the family home – who is keen to share his thoughts, drawing on an impressively broad general knowledge and incredible memory.

Mum, Jeremy and Cerys have smartphones and PCs; Denise has one in her workspace and Travis's computer is in the basement, while Jeremy and Cerys have a computer each in their bedrooms. The family has laptops and Denise has digital cameras to support her work and uses Cortana. Both children have a Nintendo DS and like Xbox games; there is an Xbox in the living room and Cerys has one in her bedroom.

Figure 87: Cerys playing photo tag



Denise uses her computer most days, jokes that she is probably addicted to the internet, and says that as an environmentalist she is interested in making technology more sustainable. Both children have been playing on her phone since they were babies, and Denise estimates that Jeremy can spend around six hours a day on screens. While he shows little interest in traditional 'creative' activities offline (he dislikes writing, drawing and construction toys like LEGO, and has never engaged much with toys, according to mum), online he has enjoyed playing Minecraft, and now Roblox Soulshatters, as well as phone games like Clash of Clans and HayDay, a farming game. He likes games that involve battling opponents, preferring Minecraft in survival rather than creative mode. Jeremy also watches YouTube 'let's play' videos – a favourite being Stampy, and he visits the gamer channel CaptainSauce and has ambitions to be a YouTuber himself.

Figure 88: Jeremy on his computer



At school, Jeremy is more reserved and while his academy runs a Minecraft club, he hasn't joined, although he sometimes plays chess in the library. At weekends he attends a club for children with ASD, where he engages the volunteers in games of chess or plays on the computer there. Sometimes Cerys comes along, preferring the art activities on offer.

Cerys is a keen artist and watches YouTube drawing tutorials to create images of the animals she loves, especially wolves. She is gamer like her brother; games that allow her to play and interact with other players in animal form appeal to her. Wolves' Life, a Roblox game, which lets her create her own wolf avatar, is a favourite at the moment. Cerys and Jeremy can play with each other online and sometimes friends join in too. Playing online is a means of socialisation for them both. Cerys has also created a WhatsApp group for friends and family.

Sometimes Cerys and Jeremy act out computer games in their offline play. Until recently they would pretend to play Minecraft, incorporating gamer lore into their narrative.

Denise and Travis have a reasonably relaxed attitude to screen time in contrast to some of the other families in the study, although they do spend family time together away from technology. On birthdays, Travis sets treasure hunts in the wood behind the family home, and they enjoy visits to the seaside.

Denise has imposed restrictions at times, when technology use was interfering with Jeremy's sleep, for example, and has some concerns, aware that Jeremy is vulnerable, over online safety and socialisation. She also dislikes the representation of women in some games. She feels that the time her children spend at festivals not only offers some balance, and a space where Jeremy feels comfortable and accepted, but allows them to see men and women in different roles not dictated by gender.

UK Family 9

Halima (35) is mum to 4 children, Samir (12) and Ahmad (14), who are at secondary school, study focus child Hanif (8), and toddler Kamal (2). The family has a Yemeni background. Although she has family close, including her mum for whom she has some caring responsibilities, Halima's husband works abroad as a site manager. While the boys FaceTime dad regularly, Halima is responsible for running the home day to day, including monitoring what her technology-focused family is playing and looking at online.

Halima has a Postgraduate Certificate in Teacher Education (PGCE), is a teacher of Arabic, and a school parent governor with a keen interest in education – her own as well as that of her children. Concerned about the amount of TV she feels she watched when younger, she now listens to TED and 'inspirational' talks on her phone around the home and encourages her children to use technology for learning, installing educational apps on their devices and monitoring their performance. She has also found YouTube useful in helping her children learn to recite the Koran.

The children have smartphones and at one point had a tablet each, although two are now disabled. There is an iMac laptop for homework. They have a PlayStation 4 and a smart TV, and the family has an online home assistant, a Google Pro, which the boys encourage to tell jokes. Halima tries, though, to restrict the PlayStation to weekends, and finds that it can be a source of arguments with the siblings comparing how much time they have had. Fortnite was a favourite game but has been superseded by the FIFA series.

Figure 89: Playing FIFA



The family watches Netflix and YouTube through the TV. Kamal enjoys cartoons and unboxing videos featuring toy cars on the YouTube channel Ryan's World, while Samir and Ahmad like to watch football, Fortnite gaming videos and funny videos featuring pranks and life hacks. They are fans of the YouTuber Morgz and also like videos made by a collective called Sidemen. At home, the older boys like to mimic pranking videos, and for a while Ahmad – who is dyslexic – had his own YouTube channel. Recently the boys have discovered TikTok. The boys are very aware of what technology friends and other family members have, and lose interest in their own devices and consoles if their cousins upgrade to newer models. Halima has noticed that with the introduction of technology into the home, her older children have lost interest in physical toys.

Halima is concerned about the influence of digital and online media on her children, describing children exposed to lots of screen time as 'zombies'. She has read articles on the risks of technology and would rather her family was outside exploring the world than looking at screens. She is concerned about potential dangers of YouTube challenges and the influence of YouTubers, and watches YouTube with her boys, expressing her own views on the content.

The family enjoys playing together in their free time. They have a pass for unlimited ice skating and swimming during the school holidays, and also enjoy playing football and basketball together, and going to the park. Halima has joined in, playing two-a-side football with her boys, but says she is losing her 'cool mum' status as her children get older, so is happy to be able to sit and watch like the other parents. There is a trampoline in the back garden and the family plays ball games and card games. Sometimes the boys are allowed to move the furniture around and have Nerf gun battles, and the family plays cards and Uno.

Hanif is described by mum as more of an observer than a player. This might be because his older brothers sometimes tease him about his game playing and call him a 'noob' (i.e. 'newbie'). He does, though, enjoy playing FIFA at home, which he claims he never gets bored with, and also Clash Royale on a tablet. He likes Times Table Rock Stars, which his school participates in, although sometimes his older brothers help him. He likes to experiment based on what he watches on YouTube, and once asked his mother for a whole roll of

tin foil to make a ball with. He likes football, basketball and climbing, and prefers to play with others rather than on his own. He likes to dress up and has some superhero outfits including Captain America and Spiderman. At school he enjoys lessons featuring technology, using the class iPads, and playing on the Xbox at after-school club.

UK Family 10

Lindsay (34) and her 2 children, Noah (9) and Jacqueline (5), live on a council estate near Sheffield city centre. The children's dad no longer lives with them but they visit him regularly. Lindsay has a new job as a care worker in a residential home for seniors. The family are White British.

Figure 90: Jacqueline drawing on a tablet



The children's bedrooms are filled with toys. Jacqueline has an imposing Playmobil princess castle and Noah a mansion, composed of numerous sets put together and built by Lindsay. The children play with these most days after school and at weekends, playing out imaginary scenarios with their extensive collection of Playmobil pieces which includes over 400 figures. They enjoy making new creations with Playmobil and LEGO bricks too, with Noah sometimes drawing pictures of his models.

LEGO Transformer figures are also among Noah's preferred playthings, prompted by his watching Transformers on television and film. He is keen on the Marvel superheroes and the associated films, and he likes to play LEGO Batman on their Nintendo Wii.

Figure 91: Noah playing on the Nintendo Switch



Jacqueline has lots of teddies, princess figures and doll babies with which she plays 'mums and dads'. She loves dressing up and pretend play, sometimes enacting scenes and dialogue with her mum. She shares her mum's passion for art and craft as well.

The family go to the cinema on a regular basis, as well as swimming and the park, but the children do not attend any out-of-school clubs. Lindsay has always encouraged them to play indoors or in the garden. She disapproves of children playing on the street as she is concerned about traffic and 'stranger danger'. The family have a standard television and DVD player. Jacqueline likes cartoons, which she watches on Tiny Pop, and she and Noah like the Pop channel. Noah enjoys watching police programmes, such as *Traffic Cops*, and has a number of police cars and police-themed playthings.

Noah and Jacqueline share a Kindle Fire 8. Their home does not have broadband so access to the internet is via a hotspot which Lindsay creates using her mobile phone. Their favourite apps are Skyscraper Builder and YouTube Kids, and Jacqueline also liking Subway Surfers and Crossy Road. Noah plays on Times Table Rock Stars but finds it boring, although it is improving his maths. He finds Spelling Shed more fun. Not surprisingly, Noah and Jacqueline like Playmobil animations on YouTube. Jacqueline also loves unboxing videos. These have helped to make her very knowledgeable about L.O.L. Surprise! Dolls, although she does not have any of her own.

A significant part of Noah's YouTube viewing is Minecraft films. His dad introduced him to these five years ago and Noah has wanted to play Minecraft ever since. He occasionally played Minecraft on his dad's PlayStation but recently his dad has given him a Nintendo Switch. The console came with Mario Kart 8 and Noah bought Minecraft and LEGO Jurassic Park for it with money he had saved himself. He plays Mario Kart with Jacqueline but mostly plays on his own, building things in Minecraft and learning his way round it. He draws on YouTube films he has seen, including those by YouTuber Jelly, to help him build things, introducing his own refinements. He prefers creative mode and enjoys experimenting to see how the various elements work.

Lindsay makes little use of technology herself. She does not have a laptop, using her phone instead to search the internet, do shopping and get the news, as well as to take photographs. She lets the children use it to do schoolwork. There are no games as such on her phone but they all enjoy adding filters and effects to photographs on FaceApp, and she shares videos about animals and pranks with them from her Facebook feed.

Lindsay has few rules on the use of technology by her children. Up to now, they have opted to play with their toys or watch television, only asking to use the Kindle every few weeks. Noah's preferences are changing, however, and he is becoming more engrossed in using the Switch. Jacqueline plays on it infrequently but likes to observe her brother on Minecraft. As a result she has begun to do a bit of building within the game and Lindsay is impressed by how much she has picked up already. Noah shows Lindsay what he has built too, and offers to show her how to play on Minecraft but while she admires his creations, she is not interested in playing herself.

Figure 92: Noah playing on Skyscraper Builders on the Kindle before he had the Switch



3.2 Summary

These richly illustrative pen portraits provide an insight into how socio-cultural and economic contexts shape children's play with technology. As was the case with the quantitative data outlined in Section 2, the portraits raise issues that are pertinent to the so-called 'digital divide'. To many, the term 'digital divide' merely refers to those who have access to technology versus those who do not (Van Dijk & Hacker, 2003), particularly because the term has most often been used in relation to research focused in the global north. However, the concept is more complex and dynamic than is often assumed.

Van Dijk and Hacker (2003) identify three levels of the digital divide which can be seen to interact in complex ways in South Africa. The first level focuses on access to infrastructure, which remains a critical factor in the context of a developing country with continued racial and economic inequality. It is also important to note that although South Africa is more developed than other African countries, a lack of basic infrastructure

(e.g. electricity) and network infrastructure still plagues the country. Additionally, while mobile phones have transformed life for many Africans, mobile subscriber penetration is more than 20% lower than the global average

(GMSA, 2018). This is further compounded by the high costs of broadband (Hilbert, 2016) and incomplete geographical coverage (Pashapa & Rivett, 2017).

The second level of digital divide deals with differentiated levels of skills and patterns of usage, as is evident from the findings of the quantitative data across the UK and SA. In addition, access and educational quality based on race and class differences are significant. The third level of the digital divide deals with population groups who have near-universal access to the internet and related infrastructure, but because of forms of structural inequality a divide still exists. Local and international research findings show that race, ethnicity, income, age and gender affect access to and utilisation of technology (Bornman, 2016) as do levels of education and class (van Deursen & Helsper, 2015). In addition, people

from lower income groups, which in South Africa is also racially aggregated, are more likely to use technology for games and entertainment (van Dijk & Hacker 2003; Mirra et al., 2018). The data show that in resource-poor communities, children have less access to digital technologies, and are more likely to create their own games with materials that are available, such as sticks and stones, or paper as in Henry's (8) case (see SA Family C), and imaginary friends (as in the case of Zuko (6) from SA Family A). Indeed, in the informal settlements and township settings where some of the schools in the SA study are located, we found that children have little or no access to toys invented by adults, or digital devices, in comparison to children from resource-rich communities.

It was critically important to take heed of the point made by Scheerder et al. (2017) that in our methodologies not enough attention is paid to working with theoretically grounded categories in digital divide research which affect levels of comparability across bodies of work. We cannot assume that all children have equal access to material resources, develop the same kinds of digital skills from a young age, and that their usage is not affected by infrastructure or shaped by class or cultural preferences. The result of centuries of colonisation, marginalisation, deep inequalities, government-controlled media and a two-tier educational system compromise mental, material, skills and usage access to technology fundamentally affecting who people are and what they know (Mignolo, 2009). Hence, we took as much account as possible in our research design of the challenges that South African educators, parents, children and also the researchers face in marginalised communities in the Western Cape and Gauteng. From them we have much to learn about the implications of the digital divide in the SA research context where access at all three levels is unequal (Scheerder et al., 2017; van Deursen & Helsper, 2016).

There is also inequality in UK children's uses of technology, although these are less pronounced than in South Africa. The case studies, as well as the survey data in Section 2, illustrate that families with lower socio-economic capital own a similar quantity of devices than richer families (sometimes more), but the case study data indicated that they are more likely to own cheaper devices that often do not have the same

“The ways in which the digital divide plays out in different contexts needs careful consideration (Dixon, 2020).”

capacity/ memory or length of battery life than more expensive models. This affects the quality of the digital play episodes that some children engage in (Marsh et al., 2015). The uses of the technology also differ across families, in that middle-class families are more likely to purchase apps and games that relate to the school curriculum. In this study, it was notable that schools were an important source of educational apps for children in lower socio-economic families. In addition, many of the practices and interests, as outlined in the pen portraits above, were similar across UK families, regardless of ethnicity. The differences in this respect related largely to user experience, as children from BAME communities are less likely than White children to come across apps, games and websites that offer them opportunities to explore their own identities and heritages. Nonetheless, across all UK families, it was clear that technology permeated children's play lives, bringing online and digital practices into new configurations with those that were non-digital and offline.

The pen portraits also convey the extent to which children's play with technologies is shaped by other aspects of the 'family habitus'. Drawing on Bourdieu (1990), family habitus can describe the established practices of families that are shaped by cultural, social and emotional capital, in addition to economic capital (Tomanović, 2004). Time, space, the nature of relationships, family histories and family interests can all impact on digital play. While there are some common dilemmas that face parents, such as how much technology they should let children use, or what apps and games should be accessed, it can be seen that each family addresses these in different ways, based on the family habitus, the beliefs and values of parents, and sometimes the values and practices of the extended family, including grandparents, uncles, aunts, cousins and so on. These issues are explored further in Section 4, which considers the role of play with technologies in children's everyday lifeworlds.



Section 4: Children's digital play ecologies

This section outlines the role of digital play in the daily lives of children. It draws out some of the themes identified in the survey data, exploring them in depth. The insights are also informed by the detailed pen portraits that were developed of the case study families, outlined in the previous section. The aim of this section is to provide an analysis of the way in which digital play is woven into the cultural, aesthetic, emotional and political fabric of children's lives and to examine the role of adults in supporting – or limiting – this play. Research

that only focuses on digital technologies 'runs the risk of not recognising the importance of the interplay between different technologies and how children traverse the landscape of technological possibilities to suit their purposes and current levels of technological competence' (Dixon & Janks, 2019: 88). Therefore, attention is paid to the historical, material, linguistic and socio-economic contexts as an intricate part of children's digital ecologies.

4.1 Digital play ecologies

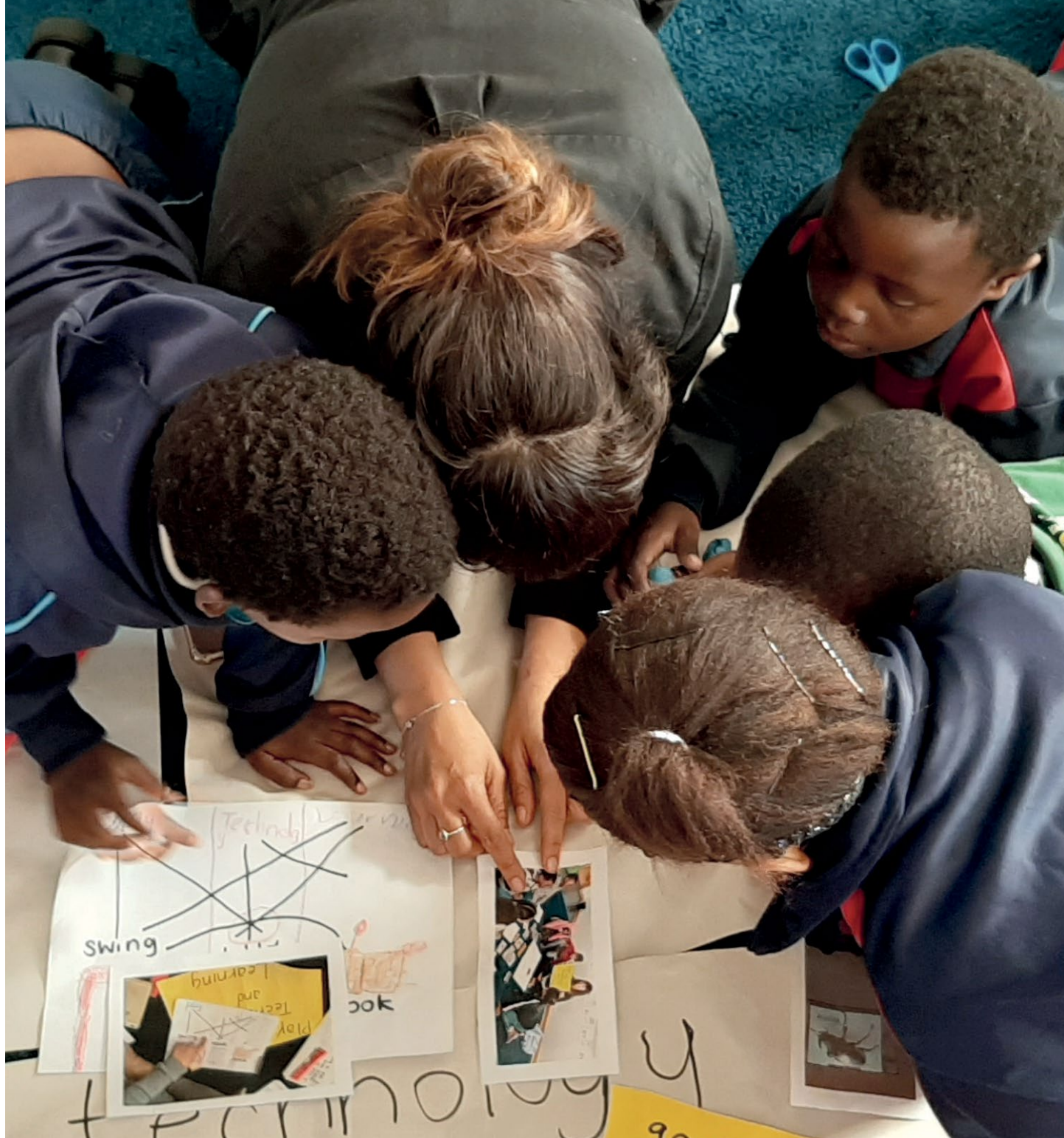
In the UK, children spend time daily playing with digital devices, as outlined in Section 2, but they also play with a wide range of non-digital toys, some of which have been around since toys were first invented (e.g. dolls, vehicles and so on). In resource-challenged communities and/or in rural areas in South Africa, children are more likely

"This study demonstrated that children's play lives in the UK and South Africa are as vibrant and complex as ever in this digital age. Technology is embedded in children's lives, playing an important part in their 'multimodal lifeworlds' (Arnott & Yelland, 2020)."

to create their own games with materials that are available, such as sticks and stones, or paper as in Henry's (8) case (see SA Family C), and imaginary friends (as in the case of Zuko (6) from SA Family A). In the informal settlements and township settings where some of the schools in our study are located, children have little or no access to toys invented by

adults, or purchased digital devices, in comparison to children from resource-rich communities.

The differences between the UK and the SA findings from the quantitative survey and the qualitative data confirm the digital divide (Dixon, 2020) between the two very different cultural, socio-economic, linguistic, ethnic and racial contexts. After the television, the mobile phone is clearly the most used and accessible technological device for children in the Coloured and Black communities of the Western Cape (see Section 2). On the whole, children in these communities have less access to a wide range of technological devices (Ng'ambi & Bozalek, 2016), as opposed to (mainly) White middle-class South African (or other) children who tend to have more access to devices such as tablets. For example, of the SA case study children, all had access to mobile phones, but not all families had internet access. Also, in the telephone interviews, many parents expressed concerns about safety when children are online with strangers. Some of the case study children had more access than average in the quantitative study, which can be explained by the fact that these children were selected by teachers and principals of the schools – schools that in turn were carefully selected by the researchers as a convenience sample. They had not been randomly chosen. But rather than regarding such lack of material resources as necessarily negative, we were



struck by many examples of children's creativity and resourcefulness in finding opportunities to seamlessly move between applications on one device (e.g. from game to WhatsApp to video on the same phone).

In contrast to the children in SA, children in more affluent countries such as the UK have greater socio-economic opportunities to move between devices. But despite the lack of financial wealth, our qualitative data show a wide range of examples of how digital play (Titus & Ng'ambi, 2019) is a significant and vital form of intergenerational communication between people of all

ages in both countries, involving complex human and non-human networks (Latour, 2011). These examples question developmental conceptions of who and what can be playful (Haynes & Murris, 2019; Murris, 2019), as, for example, the case of Zuko (6) (SA Family A) and Hanif (9) (UK Family 9) illustrate.

Thus, we can say that technology is embedded in most children's lives, albeit in different ways, and they spend time playing with both digital and non-digital devices and toys. Playthings can encompass a wide variety of artefacts, as outlined in Table 8.

Table 8: Children's online activities

Artefacts/Objects used by children for play	Examples from the datasets
Non-digital playthings	LEGO blocks and other construction toys Dolls and furry toys Puzzles Trampolines Books Balls Action/fantasy figures and worlds Transport models Plastic animals Replications of real-life artefacts e.g. cooker
Non-digital artefacts not designed for play, which are adopted for play	Newspaper Sellotape Domestic items e.g. bread containers House furniture Street furniture
Digital toys	Virtual reality goggles Smart watches Drones
Electronic toys	RoboPet Toy tablets Remote-controlled cars
Technologies with software designed for play	Games consoles e.g. PlayStation, Xbox, Nintendo Switch Smartphones Tablets Laptops
Technologies/software not designed for play which are adopted for play	Smart Assistants e.g. Alexa, Siri Chatbot Chalk CCTV
Equipment designed to support outdoor play	Trampoline Kite Skipping rope Soccer ball Bicycles Climbing frames Slides, swings, etc.
Nature material used outdoor play e.g. Mud, sticks and stones	Egg shell Sticks Mud Trees

Artefacts/Objects used by children for play	Examples from the datasets
Recycled materials	Paper Bottle tops Plastic bottles Straws Pipe cleaners String Wool Wire
Books	Library books Picture books Magazines Comic books Colouring in books School readers

In addition to these material objects, children also played with imaginary friends, which can be considered 'playthings' in the sense that imaginary friends can be controlled independently by children.

Children themselves recognised the varied nature of their play lives. Some children in the focus group interviews, for example, were asked to produce concept maps that outlined their play, and these demonstrated the range of play interests they had (see Figures 93 and 94).

Figure 93: SA children's (Grade 2, aged 8) concept map of play

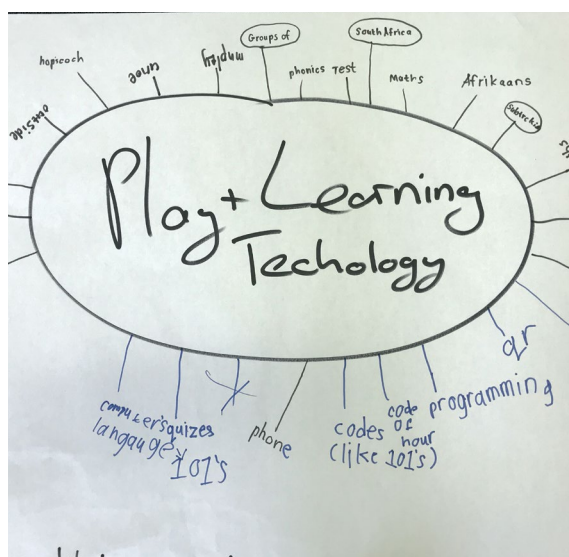


Figure 94: UK child's (Year 4, ages 8–9) concept map of play



As outlined in the summary to Section 3, this ecology operates differently within families, and the extent to which children use any of the resources above is dependent upon a range of factors including the family's economic situation, the family's geographic contexts (e.g. if they live near woods or the beach), the history of play in families (e.g. gamer parents are more likely to foster videogame play than other parents), and the interests of children (e.g. their favourite media characters, sports interest, and so on). As the work of Scott (2018a and b) outlines, play episodes of children are multi-layered as they draw in popular cultural interests, family practices and experiences from everyday lives. Play permeates the nooks and crannies of children's lives and the play tours of homes conducted in the UK demonstrated that every single room in homes reflected something about children's play, even if this was limited to a few non-digital toys, such as in bathrooms. As explained in Section 1, in South Africa, it was agreed upon by the researchers from the outset that home tours were not always appropriate. In some cases, the home was one room (a shack).

Play 'on the go' is frequently digital in nature in the UK, with families reporting play in cars, trains and other forms of transport using tablets and smartphones, for example. In South Africa, the public display of technological devices can encourage theft and related violence, hence play 'on the go' is much less likely. Moreover, public transport is less developed and more risky. For example, SA Family G's teacher said that she seldom brought her laptop to school because she does not have a car and taking public transport is not safe. In addition, access to WiFi and data is limited across some socio-economic contexts. In the case of SA Family C, the limited phone storage and cost of data directly affects the range of games, storage of photos and updates of software and games.

Children's engagement with digital technologies also impacted on their outdoor play in both countries, as one parent of a 5-year-old boy in the UK noted:

Interviewer:

Do you ever think there is an influence of technology in those outdoor play spaces? Do they ever pretend to be playing Fortnite or anything like that?

Parent:

Yes, they'll do the dance and they'll do the racing cars, they'll pretend their bikes are cars or the scooters and going quite fast in the garden and I try to slow them down. And they do pretend that the walkie talkies which they have are telephones in the garden, they do that a lot. Yes, I do think it does have an influence when they're outdoors, yes.

One of the SA families restricted their children's outdoor play due to concerns for safety. Children did not exclude 'outdoor' play from their repertoire, however, engaging in hide-and-seek and even 'tag', although their mother objected to their running in the house. In SA Family B and SA Family C, protests and violence affected the children's access to school and meant that the children stay indoors for safety reasons. This occurred during one of the home visits.

Children's play lives are therefore varied and they integrate traditional and new toys in a seamless manner. The majority of children initiate moves themselves from one type of play to another, as they become bored with one activity or wish to have a change. This appears to be consistent across cultural contexts as well as across digital and non-digital play, as this interview with a SA parent of a 10-year-old child conveyed. She outlined how her child moved from one play activity to another, not out of boredom but as a constructive activity to master a skill:

Interviewer:

Can I ask you what sort of play she typically engages in?

Parent:

She's instinctively using YouTube and Google to find out how to do stuff. She'll put on the piano thing on YouTube then she'll play piano.

Some parents and children did talk about what they did when children became bored with digital play. As this UK parent of a 3-year-old boy suggests, children are often more likely to move from digital to non-digital play, rather than from one type of digital device to another:

Interviewer:

Do you ever think that your child gets bored with playing with technology?

Parent:

After a while he definitely will get bored, because he can't sit down [unclear] for too long, and then he'll need to actually play with some physical things. So, yes.

Interviewer:

Okay. Do you think that this is similar to the way that they might get bored with non-technological play, or is it different?

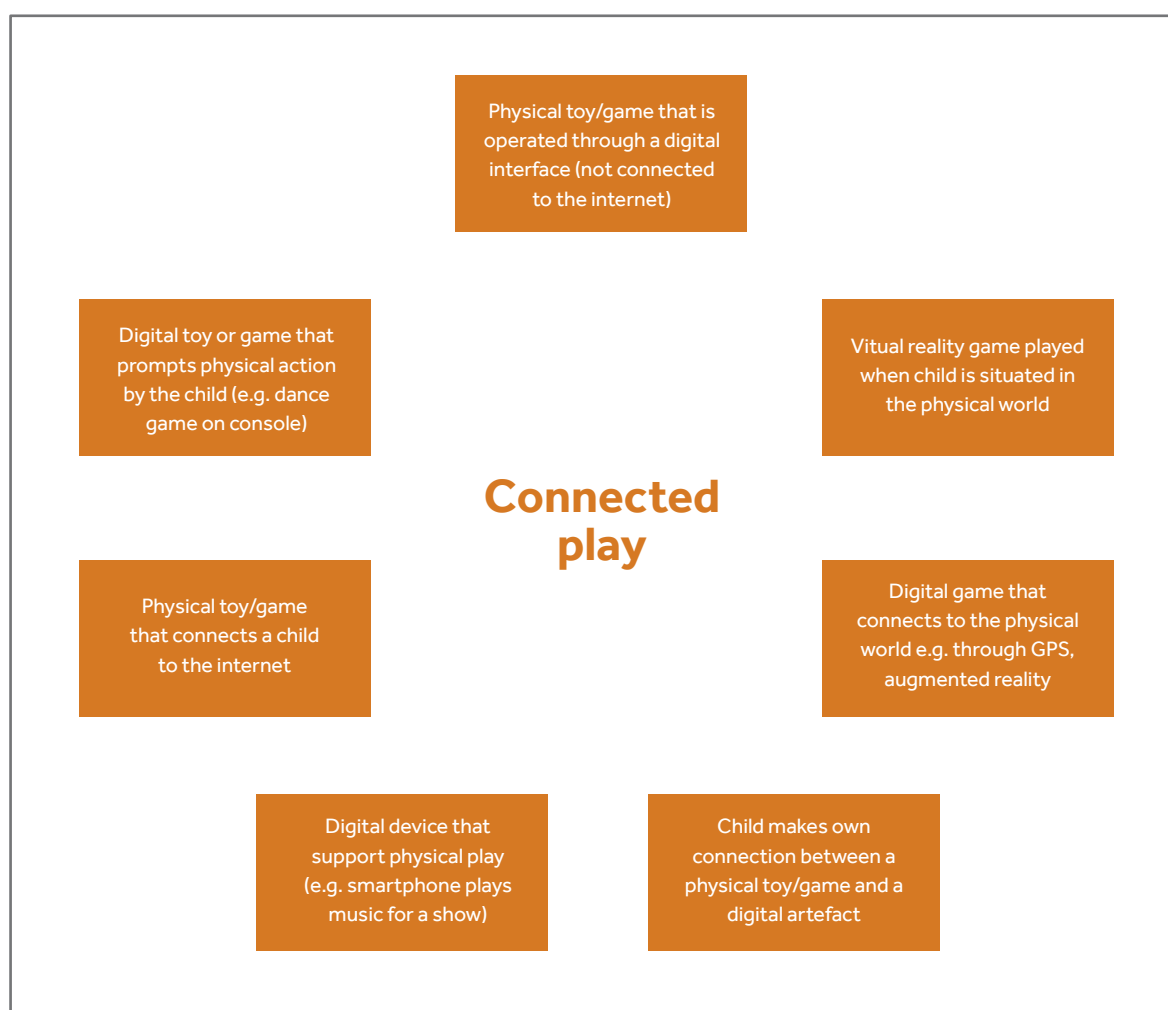
Parent:

Yes. I think with non-technological, like something else, I think he would leave one toy and play with another toy, while this, he would have to leave altogether, not go to another technology thing. So, yes, I think it's a bit different.

So, as the survey data, the family narratives and these data suggest, children in both countries move comfortably across digital and non-digital artefacts in their play (when they have access to digital devices), and their play sometimes integrates the digital and non-digital. This integration of the digital and non-digital operates in different ways according to the resources involved.

There are a number of ways in which the digital and non-digital relate to each other in play, as outlined in Figure 95, which captures the various dimensions of this 'connected play' (Fields & Kafai, 2013; Marsh, 2017). These dimensions all involve the child, devices, and space in different ways.

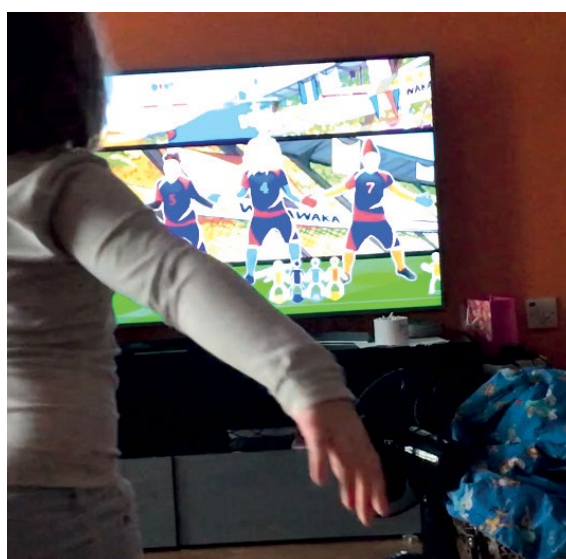
Figure 95: Connected play



These connections can be described as follows. First, there are physical toys that are specifically designed to connect the digital with non-digital in children's play, through the use of the internet. Such toys include brands such as Hasbro's Furbies, which are toy monsters that respond to instructions from an app and enable the user to access a designated website. These are categorised as the 'Internet of Toys' (IoT), and such toys bring with them a range of issues related to data privacy and safety (see Mascheroni & Holloway, 2019). However, many UK parents did not appear to be concerned about these matters, focusing instead on the social nature of the play, as Furbies can be connected to other Furbies. As one UK parent of an 8-year-old girl noted, that did foster family play: 'She did play with her cousins, because they can connect, can't they? So, they would just sit them together when they'd have sleepovers and stuff. So sometimes she'd play with others.' There are also toys that connect to a device/app but do not enable a child to have a direct connection to the internet, such as a toy robot.

Second, there are digital games and toys that prompt some kind of physical response by a user. A number of the UK case study families, for example, mentioned using the games console Just Dance. This contains avatars on a screen that demonstrate dance moves, which can then be replicated by the users. Figure 96 illustrates Anna (7), (UK Family 7), copying dance moves in this way.

Figure 96: Anna copying on-screen dance moves



Using a handset or a mobile, the games portray users' movements on screen, as the parent of a 3-year-old girl commented:

Interviewer:

Has she ever had a chance to play with any kind of augmented reality or virtual reality?

Parent:

Actually, my wife had an app for dancing. It just came to the market now, so yes, so she used to dance with her mom. So basically you hold the mobile phone and you do the steps, and it shows what you're doing on the TV. So my wife would connect the mobile phone to the laptop, and of course, the laptop would then go to the TV. So she can actually see her movements.

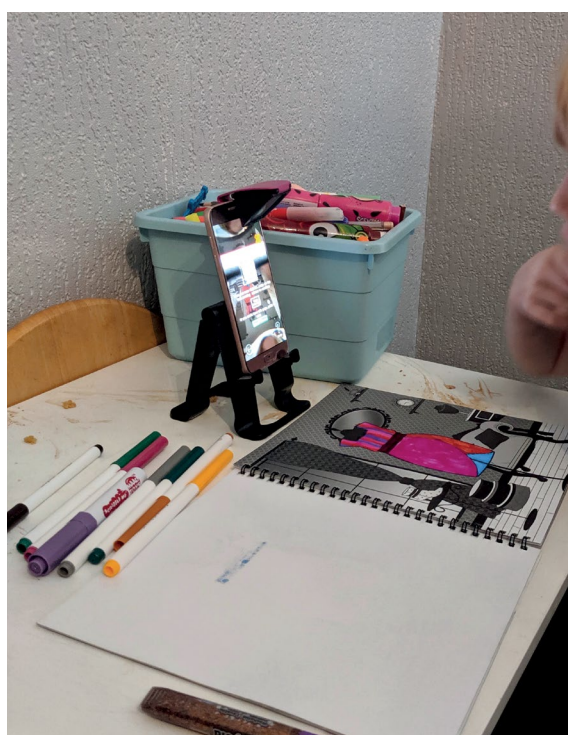
Third, digital artefacts can also be used to support play in the physical world. For example, smartphones and smart assistants were used in the study by children to provide musical background for imaginative play. Children also played with musical apps and devices, as the example of Zuko (6) demonstrates. The music he played on his parents' smartphones and on the radio in his bedroom was itself fun. Zuko often stopped playing with other things to listen to a song and suggested that the music protected him during the silence of the night that sometimes bothered him (see Figure 97).

Figure 97: Zuko with a smartphone, listening to his playlist



Fourth, digital devices can, through the use of technology such as GPS or augmented reality, deliberately connect the digital and physical world. Many children in the UK had played with augmented reality (AR) apps, such as Pokémon Go, and some AR apps were also enjoyed. Alison, in UK Family 2, enjoyed playing with an AR app Holodraw, which presented clothes she had coloured in as a 3D pop-up model using an app (see Figure 98).

Figure 98: Alison using the Holodraw app



Fifth, children can bridge the physical and virtual world as they wear headsets for virtual reality games. This has the effect of taking them into a visually separate world – sometimes with sound – while their bodies are still located in the physical world. Fewer children had virtual reality (VR) hardware and software, as the survey findings, outlined in Section 2, indicated. In SA, play with VR was present in some children's lives, albeit in a limited capacity. A parent as well as 10-year-old children from an under-resourced school in a low-income community relayed their experiences and exposure to VR:

Parent:

So we actually have a VR headset but one that you put in your cell phone that you download the rollercoaster.

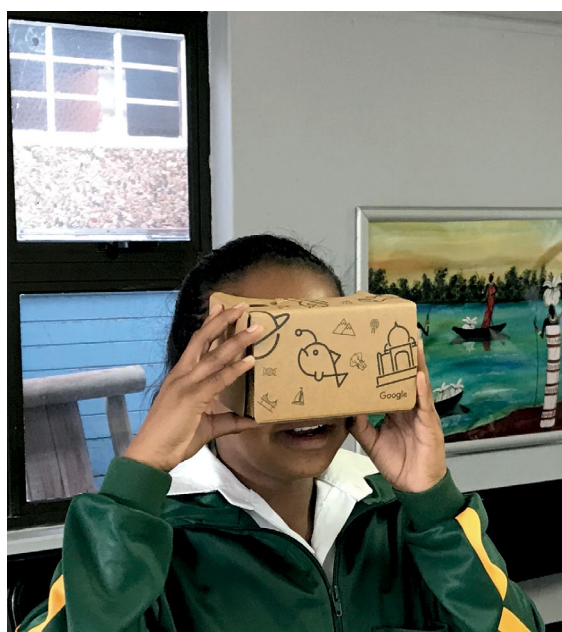
Child 1:

My daddy has it because he got a new phone so then he said 'try this', then while I was walking I almost fell off the bed because I was on a roller-coaster

Child 2:

They give you goggles and then you're seeing the thing but it's not real. It looks real but when you take goggles off it's not real.

Figure 99: Focus group child (10) from school in SA Family K engaging with cardboard VR set



In the following image (Figure 100), Sophia's (11) (SA Family D) teacher demonstrated during an interview how she uses different digital devices in the classroom with the Grade 5 children. There are 33 children in the class and during the observations, researchers noted how the children took turns and engaged with one another, their written work, and technology such as the VR headset.

Figure 100: Sophia's teacher in a teacher interview



A number of families in the UK expressed a wish to engage in this sort of play, having encountered it in friends' homes, schools, museums and so on. In SA, people are much less likely to have such encounters. Some parents in the UK felt that such technology was valuable in offering their children new opportunities, as the father of a 7-year-old boy noted:

Because the [unclear] and digital were quite close to the eyes, I was a bit uncomfortable with the 7-year-old using it. But we did have that, they very much enjoyed it and they do miss it. I think it was good to do a bit of sporting activities on there as well and just give them that little bit of an insight into what it's like.

Finally, children can, in their play, connect digital texts/toys with physical artefacts. This is a different order of connected play in that the device or toy itself does not make this connection; in this case, it is the child's imagination which makes the link possible. An example of this was seen in UK Family 7 when Anna (7) demonstrated how she could colour in a drawing of a whale in an art app on a tablet.⁷ She then asked the adults in the room to pretend they had not seen the whale and rubbed out the drawing. Insisting the adult closed their eyes, she brought out a stuffed whale toy that made a noise. The whale looked very similar to the drawing she had just coloured in. Anna's mum, used to this procedure, exclaimed, 'It's come alive!' Anna retorted: 'You know how I did that magic trick? ... I rubbed it out and I already had this whale, I bought it.'

Further to this, children can also invoke the digital world in their play, without actually using technology. For example, 6-year-old Linton's (SA Family E) drawings in his diary were developing narratives and images that draw on his experience of using PS3 games, Marvel Avengers and superheroes in particular. Children have always re-purposed artefacts and resources that are not designed for play for their playful purposes or have imagined props in their fantasy play. This is no different in a technologised world. For example, families described children's play with devices such as CCTV and Sat Nav technology, as was the case with UK Family 2:

Parent 1:

Well that's what Chloe was doing upstairs, she was saying, 'Turn left on to....'

Parent 2:

Yeah, A62 or something like that. I was doing the garden, I was outside and they had the windows open, it was quite a warm day, I was just mowing the lawn. And when I stopped I just heard Chloe being the sat nav, I think Alison was driving and Chloe was sat in front of her.

Parent 2:

And they were using the bunk beds as the car.

Parent 1:

Yeah. So Chloe was the phone on the holder. Wasn't she, in the position. She was sat in front of Alison, while Alison was in the position. She was sat in front of Alison, while Alison was driving she was sat facing her being the sat nav,

Parent 2:

Which is so funny, because when I was a kid I remember playing cars at the top step with my sister, playing cars but no sat nav. And now it's progressed to one child driving, one child being the sat nav!

Smart home assistants, such as Alexa, Google Home and Siri, were also popular playthings in the UK. Indeed, play with smart assistants was widespread in the UK, with many examples of children asking such assistants to answer absurd questions, tell jokes and even count to 10 while they played hide-and-seek. Children expressed a wide range of opinions about play with technology, which were largely positive. There did appear to be some devices which proved to offer minimal opportunities for play over time, as batteries ran out, or needed charging regularly, as this child in a UK Year 5 (ages 9–10) focus group noted was the case with a drone:

Child:

I've got an Xbox, I've got Fortnite now, I used to have like a drone but it just didn't work at all, it took like half-an-hour to charge and it run for one minute.

Interviewer:

What did you used to do with the drone?

Child:

Just fly it round the house and harass my parents!

This phenomenon was also observed, but to a much lesser extent, in the South African context as the survey illustrates (see Section 2). However, when children in the study were asking Siri questions, they had varying degrees of success. While some children are familiar with a range of smart assistants and the interactions are pleasurable, the two examples below indicate that the purposeful accessing of information is constrained by accents and children's ability to ask questions Siri can reply to. The SA parents of a girl (10) commented as follows:

Parent (Mom):

She likes asking Siri questions. Some of the things that she has asked, 'Say hello in Japanese'.

Parent (Dad):

And Siri will say the most ridiculous things because she hears differently, so it's more fun at trying to pick up.

Parent (Mom):

She's over that so she doesn't just do it with Siri to see. She will quite happily Google a destination on Google maps or something, so she's very aware of the accessibility of the information and how you can request it ... and there was a program she used a while back like it was a Virtual Assistant almost, what was that?

Parent (Dad):

The chalk room program

Parent (Mom):

No, this was someone. It was like a robot but you can have a conversation with it. What was it...Also her accent ... Google gets confused and Siri gets confused because she's got a weird funny ... South African (accent)

Kamden's (4) mother Denise (SA Family H) described his interactions with Siri:

Denise:

My sister with the iPhone. He doesn't see her often, but when he does he wants to speak to Siri and ask her questions. Or when she is driving he would have the GPS on so that he can speak to Siri.

Interviewer:

What kind of questions does he ask Siri?

Denise:

Um, for example we went for a Sunday drive – I cannot remember the exact question, it was something to do with baboons, but she (Siri) did not understand the question. So, it wasn't answered, but he asks random questions.

Children's online play remains consistent with previous studies (Marsh et al., 2015), in that the most prevalent online play appears to be the use of YouTube/YouTube Kids and online games. YouTube is the brand that is most firmly embedded in the online playscapes of children, and it also crosses over to their offline lives in various ways. The videos that they watch are varied, as outlined in the Social Media, Technology and Children (STAC) study (Marsh, Law, Lahma et al., 2018), such as unboxing, unwrapping Kinder eggs, children and adults using playdough, videos related to their passions (e.g. LEGO, transport, dance, etc.), videos related to videogames, famous vloggers, and so on. Children incorporate elements of their viewing in their offline play, and a number of them capture their own play and upload it to YouTube to share with others. In many ways, children's engagement with YouTube reflects long-standing folkloric practices, such as the circulation of challenges/pranks, and the sharing of myths and legends, which used to be passed on orally in face-to-face situations, but now occurs online as well (see Blank, 2009).

Indeed, children's play with digital media more broadly reflects these folkloric practices. An example of this is found in the accounts of the children in UK Family 8, who played Minecraft together and told the research team that they would pretend in their offline fantasy games, sometimes played out in nearby woods, that Herobrine⁸ was their friend. As a character, Herobrine does not actually exist in the Minecraft game—he is known through gamer folklore (Ohlendorf, 2016). Players believe (or some may not strictly believe, but perhaps play along with the idea of believing because it is fun) that Herobrine is somehow in the game and look for evidence and

'glitches' that indicate his presence. Herobrine features as a character in a series of fan fiction novels based on Minecraft called the Elementia Chronicles.⁹

There are some differences with previous generations, in that young children's online play with unknown others is more limited than it used to be when virtual worlds such as Disney's Club Penguin were popular, over 10 years ago. Young children do play with others online, but this is likely to be with family members and family friends, who they play with over FaceTime, Skype, SnapChat and Instagram, for example. In the UK, play using video-conferencing tools often involves traditional games such as hide-and-seek, guessing games, sharing jokes and so on. For most families, this takes place in time-limited calls but, in UK Family 8, the children played with a child who lived around the corner from them, leaving the video-conferencing tool on for hours as they played virtually alongside each other. This was mirrored in SA Family F, where Karabo (10) played in the same way with a friend who lives nearby, but he was an outlier in the sample because of the costs associated with having internet access for many families in South Africa. Play using photo-sharing tools involves the use of filters that are often used to tease and taunt each other. Older children are more likely to play with unknown others via videogames such as Fortnite, Minecraft and Roblox. In SA, a couple of parents expressed their concern about this app, sometimes influenced by the media. For example, one parent of 8-year-old Gemma (SA Family J) indicated that her daughter has requested Fortnite:

And Fortnite, I'm not keen on her doing Fortnite, she's mentioned it I've said not yet just because that doesn't seem to be age appropriate. I think, I'd like to keep her it sounds funny but just until she's 10 or something just to limit, I don't subscribe to the idea that violent games lead to violent offending I don't subscribe to that idea I think it's far too simplistic to argue that, but I think it minimises the value of life and that might be something.

TikTok was another app mentioned frequently by older children as a site for online sharing/play with others. However, digital play also offers children a way to keep on playing with friends who have moved away, as this boy in a UK Year 5 (ages 9–10) focus group noted:

I like to play basketball a bit. And I like to play football, but at school I don't really play it a lot. And then on technology-wise I just like it because like people who I've met before, like who used to play for my football team, I've like got them as a friend on my Xbox and then they like have to leave the football team and I can still like talk to them.

Digital play played a significant role in the emotional lives of children. Children explored and expressed their emotions through digital play, strengthened family ties through it and forged friendships in it. For example, playful uses of practices such as reviewing family photographs and videos were observed, with such processes being important for forging and renewing family memories, as the mother in UK Family 2 noted:

Interviewer:

So when they find the object that they're seeking in this sort of exploration [going out with their dad on a nature walk] is there sort of other things that they'll do?

Mother:

Yes, they like to take pictures to record it, mainly to show me because I'm not usually there, to show me what they've found ... There we go. She cut dad's head off a little bit but that's Chloe taking that photo for us.

Interviewer:

Oh that's lovely.

Mother:

I asked her.

Interviewer:

Yes.

Mother:

I asked her if she could take a picture of me and dad because we'd taken some fun family pictures on the beach and we drew in the sand.

Interviewer:

Oh that's lovely. Oh that's a great selfie, there.

Mother:

Alison did hers and she asked me to take a picture. So she made that knowing to take a picture to take a memento away from it.

In Family 5, Zander and his father bonded through the co-playing of computer games. For his father, this was important because he had grown up as a gamer:

When I was a kid I absolutely loved it. I grew up on all the old consoles. We used to live in Hong Kong actually so we used to get the consoles before people did here. And then when we moved back when I was a kid obviously I had a Mega Drive before they'd actually made it to the UK and stuff. And then like a lot of people, we were more the Sega, so we had the Mega Drive, then we had the 32 bit and then the 64 bit system. And then we got into the PlayStation. But we also had the Nintendo 64 at uni where everyone played

Golden Eye, that was like a massive game, that. Mario Kart has been a game I've played since I was young ... which is why when I realised it was available on the Wii and you could get the steering wheels, then I thought I could share something that I used to be as a kid, with Zander.

The data outlined in this section highlight the varied ways in which technology contributes positively to children's play lives. However, digital play also affects children negatively at times, as will be explored in Section 6.



4.2 Relationality and children's digital ecologies

One of the areas the project considered was the way in which children's play with technologies crossed boundaries of homes, communities and schools.

In SA, school and home spaces allowed Eshal (7) to cross the boundaries of situated learning environments. In the home visit section of the fieldwork in South Africa, the researchers were struck by her ability to facilitate learning and discover across spaces and places. When her teacher introduced new topics or responded to an interest shown by the children in her class, Eshal would follow up on these later at home, at the local library and then at school again. We see this in the example below, Figure 101, where the class is doing investigations about water at school. After that, at home, Eshal performed a Google search, looking for experiments. She then watched a video on YouTube and followed up with her own version of the experiment she had just watched. It is in this way that digital ecologies form part of playful learning. Eshal then sent a voice note on WhatsApp, which brought the researchers into this vibrant encounter of digital ecology production.

Eshal:

Hallo teacher, it's me, Eshal, speaking. This is an experiment I did. I Google it on my mommy's phone because we were learning about water in my class.

During a home interview with Rihana, she mentioned the role of Eshal's teacher in facilitating the expansion of digital ecologies. The teacher encouraged Eshal's love for projects to which she responded with further enthusiasm, as is seen in her mother's humorous account of Eshal's project for school. The project was so big that it needed extra hands and transport.

Rihana:

Once had to make the building like the school.

Interviewer:

I saw that. I saw that at the school in the hall. It was magnificent.

Rihana:

Eshal wanted it that, Eshal wanted a big a bigger one, I had to cut it down to size, I had to explain to her why we can't have it big, we had to turn it sideways.

Interviewer:

Because you can't get it out the door?

Rihana:

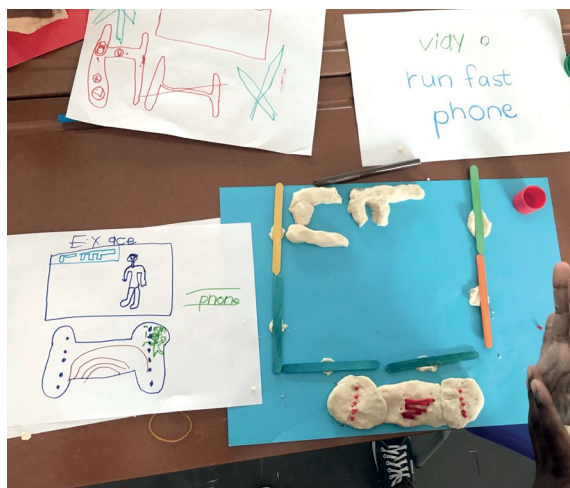
And lucky we asked Ms Lizen who had to take it to school in her van, she drives a van. So Eshal's creativity isn't limited by the size of the room. Ms Lizen said when does Eshal ever do anything small?

Figure 101: Eshal's experiment



Relational entanglements were also evident with one of Henry's peers in the focus group. Henry (8) (SA Family C) brought his interest and daily play experience at home into his learning and creative invention during the final focus group session. The school does not have a playground big enough to enable children to play soccer. A number of the children in this focus group played soccer every afternoon after school in the street. So the school invented a digital device with the purpose of making more soccer play possible. This process of inventing went further into ecologies of literacy and reading as the researcher asked this group of 6-year-olds to spell the words so she could label each part of the invention design.

Figure 102: A group of 6-year-old children invent a digital device



Henry was part of this focus group, so he designed a device for soccer playing. A few days later, during one of the home visits, Henry planned a ball-making activity. Beforehand, he requested a few materials for the researchers to bring along. This became another relational space as materials, adults and children participated in the activity. Seeing the adults playing an active role in the activity with Henry illustrated the comfortable, playful and learning relationship between them. Afterwards, Henry took the ball to school and used it during break times with his classmates, further extending the ecological relations.

Figure 103: Henry (8) at school with the ball he made at home



In the UK study, there were examples also of the crossover between home and school digital domains. Most of the time, this was a case of children using at home some of the games and apps they had been introduced to at school in order to practise skills. However, in UK Family 4,¹⁰ Simon showed the researchers a series of games he had made using the app Scratch, which aims to develop coding skills. In one visit, it took considerable time to show the researcher all the games Simon had made and the making of games seemed to have become quite an embedded practice. Simon commented, 'I have done all these games. I made them at home and school, at study club.' In UK Family 1, Mallison showed a researcher the homework he had completed on the iPad related to a school topic, the sinking of the ship the Titanic. This engagement in online research at home then impacted positively on the classroom experience, as Mallison's teacher commented:

with The Titanic, it excited them because, randomly enough, one of them found out that, like, 'it sank on my birthday' – and things like that. So they cling to little things like that. So then when we started going through the lessons in class on later dates, they were able to be like, oh yes, we saw that, we saw pictures of that, Miss, when we were researching it. Or how did you know that date? Oh, when we were researching it, we found that date, and things like that. So it was quite nice and it kept them engaged throughout it.

Mallison's mum subsequently commented on a boat Mallison made from LEGO at home (see Figure 104), wondering if it had been stimulated by his engagement in the school topic and homework:

Mum:

I reckon that has come from your project.

Mallison:

Project of what?

Mum:

Titanic.

Figure 104: Mallison's LEGO boat



This kind of flow between online, offline, school, home, formal learning and play is part of the everyday fabric of children's lives. Sometimes, schools deliberately introduce digital practices to the home, beyond specific educational software. For example, in UK Family 7, Anna had suffered anxiety due to observing difficulties between her parents before their separation. The teachers at Anna's school suggested that Anna may wish to record her feelings and thoughts on her iPad, which she then used as a digital diary. She regularly took this into school to share with teachers. While this use was not playful, it is of interest that a tool that had normally been used for play in the home had been appropriated by teachers in this imaginative way, for the benefit of the child. This co-presence of playful and non-playful uses of devices was the case in other UK families.

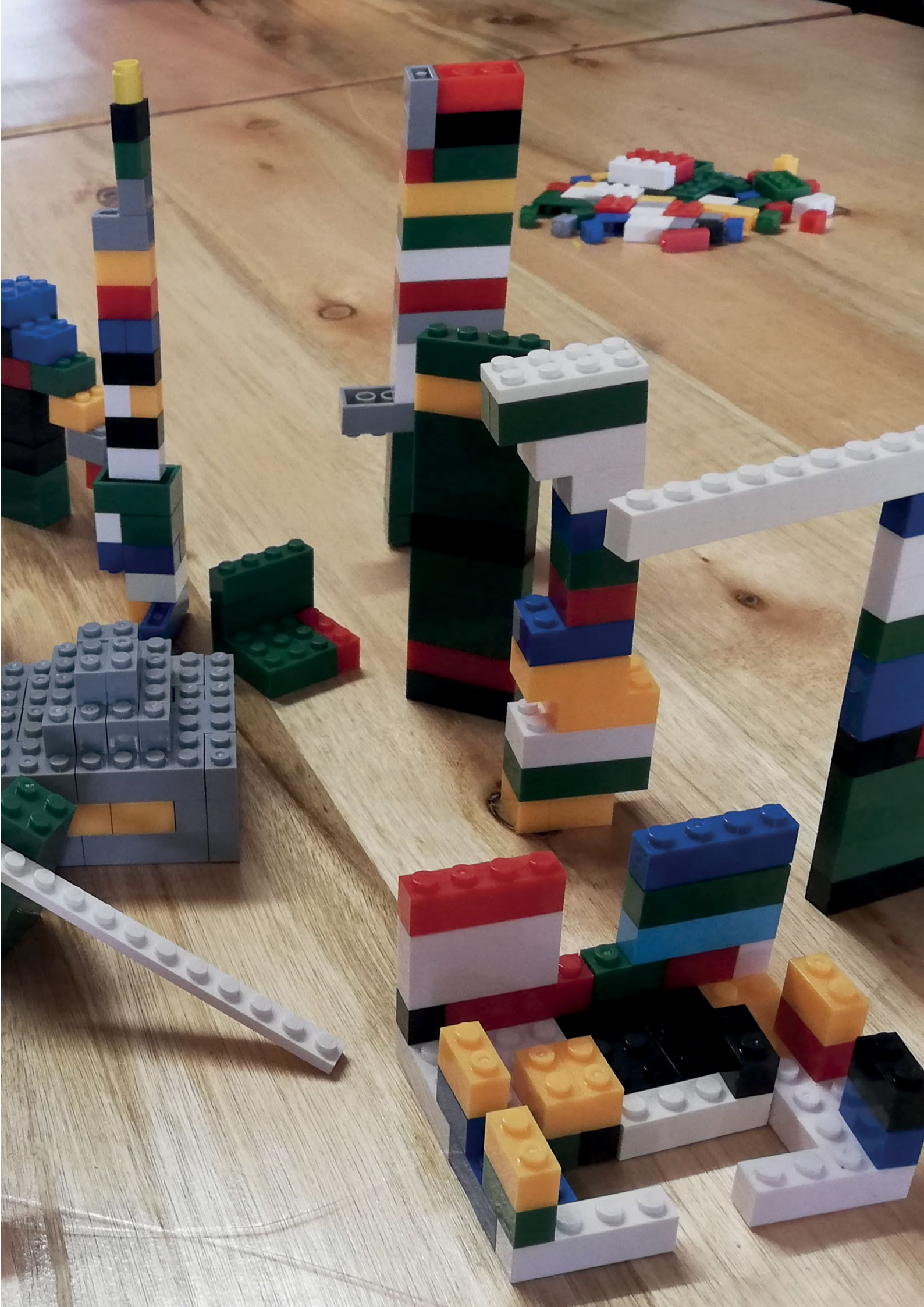
It was clear that while school uses of digital technology informed play in the home, there were few examples of home digital play informing school and community spaces in the UK, although one after-school club did allow children to play games on a console that they encountered at home. Largely, this was due to the lack of resources in after-school and community classes. However, children themselves transferred interests across domains, even when there were few explicit links. Some children even made these connections when the

links did not exist, as they had not experienced some domains. For example, Cerys (9) (UK Family 8) said that she had learned a lot of survival techniques off YouTube – including how to identify poisonous snakes – and while she had not put them into practice, she felt that she could probably look after herself if she was ever stranded in the woods. This kind of transfer – both imagined and actual – across domains serves to reinforce children's sense of coherence as they engage in their everyday lives.

Most of the time, the key question about technology in schools is:

“How do we introduce new digital devices into the classroom?”

But as the rich datasets show, the relationality between the environment, both human (peers, teachers, parents) and non-human (technology, atmosphere, weather) is all part of a relational network that makes certain uses of technology possible and renders children capable (Murris, 2016). The research project created an environment where teachers, students, parents, chairs, computers, tablets, humans and non-humans were agentic in producing new theories, arguments, ideas, knowledge, concepts and ideas.


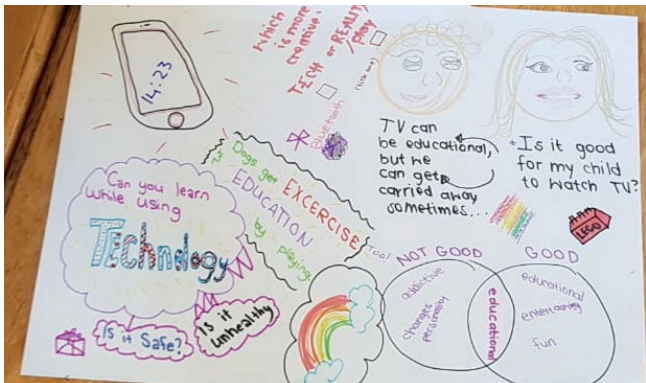

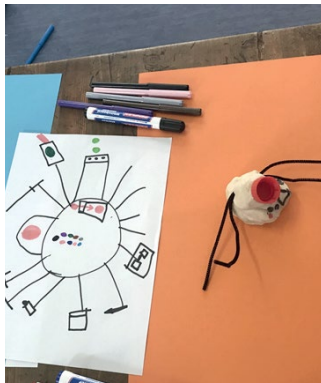


4.3 Children’s reflections on digital play

As outlined in Section 1, the research teams used a range of participatory tools to ensure children’s voices were captured in the project. For example, children completed concept maps and, as we have seen above, they classified devices into categories such as ‘I Have Played/Not Played With This’, ‘Good/Not Good for Play’

and ‘Good/Not Good for Learning’, they completed research diaries, captured their play using GoPro cameras and created LEGO models of toys they would like to be invented. Table 9 provides an overview of these participatory approaches to studying children’s engagement in digital play.

Table 9: Methods used to collect examples of children’s digital play

<p>Concept maps</p> 	<p>Categorisation (e.g. Good/Not Good for Play)</p> 	
<p>Play diaries</p> 	<p>GoPro cameras</p> 	<p>Invented toys using craft materials and LEGO bricks</p> 

These methods enabled the research teams to gain a range of insights into the children's views about play and technology.

Some of the children who participated in the focus groups were asked to determine which devices would be particularly good for play, and which would be bad for play. It was clear that the children were aware of the ubiquitous nature of technological devices in their lives, many of which they felt were not appropriate for play (e.g. scales, electric razors) and others, like phones that could be used for play. In addition, children were also aware of some of the common concerns about the use of technology (see, for example, Figures 104 and 105), which are discussed in Section 4.3.3.

Figure 105: SA children's thoughts about play and technology

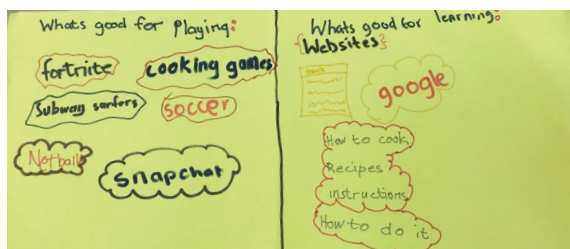
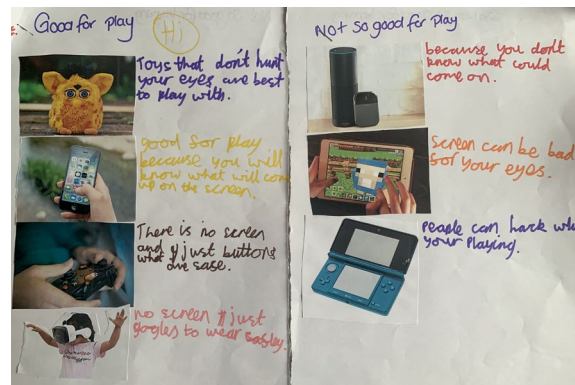


Figure 106: UK children's thoughts about play and technology



Here, it is important to note that this activity demonstrated that children understood some of the nuances of technology use, with devices being able to be used in both productive and unproductive ways. Children recognised that technology cannot easily be placed into one category or another, as a UK child in a focus group noted:

Interviewer:

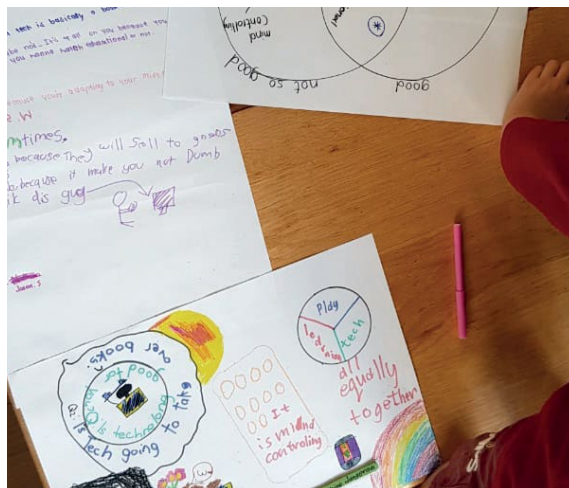
Tell me why you've put the Xbox and the DS in the middle.

Child:

They're good for you and bad for you.

Children like Sophia (10) from SA Family D, and Karabo's focus group also challenged the idea of technology being categorised as good or not so good for play. Some children in Karabo's group drew arrows inside and outside a blue circle to disrupt the binary between good and bad uses of technology (Figure 107). The children made visible in their maps how play, technology and learning should not be separated, but are in fact related to one another in many ways, as the case study data illustrates (Figure 108).

Figure 107: How play, technology and learning should not be separated (Sophia's focus group)



SA children in the Grade R focus groups also demonstrated what they perceived to be good technologies for play, and what would be good for learning. As with the UK child above, they also resisted the choice to choose one over the other. Figure 108 depicts children using LEGO bricks for the voting process. Some children placed their brick on the hoop, as their choice was actually in-between rather than good or not so good. The images also show them working with older children at the school, using technology in and outside the classroom.

Figure 108: Casting a vote for play, technology and learning



The activities, therefore, were helpful in enabling children to engage in critical reflections on the role of technology in their play lives, and they demonstrated that many children understood the complexities involved in its use. Across the various datasets, children's attitudes towards technology surfaced and, inevitably, these were both positive and negative, as outlined below.

4.3.1 Children's favourite digital play practices

For children who had access to the technology, videogaming was very popular across age groups. However, as the previous section indicated, in general, this did not seem to be at the expense of other types of play, as this Year 5 (aged 8–9) child in the UK suggested:

Well, I like doing trampolining because I do lots of competitions. I did one on Sunday because like I'm really good at that. And I do like to go on my Xbox and that. But I feel different when I do my sport than to the other stuff because I'm active and I'm not just sat about. But when I do like the technology stuff I feel more relaxed and just ... and I enjoy myself. But I also enjoy myself in trampolining.

Minecraft and Roblox in particular were very popular in the UK. A child in a UK Foundation Stage 2 class (ages 4–5) reported that she enjoyed playing Roblox. The interviewer feigned ignorance in order to elicit a description:

Interviewer:

What's Roblox? I don't know.

Child:

Roblox is like LEGO.

Interviewer:

Like LEGO?

Child:

Yes.

Interviewer:

What do you do with it?

Child:

You can jump and walk on it, and guess what?

Interviewer:

What?

Child:

And when you die, all your LEGO falls off of you.

Children frequently mentioned the interactive nature of play with their physical LEGO bricks and digital games. For example, Gemma (SA Family J) an 8-year-old child who enjoyed coding and content development using Roblox and other coding media, demonstrated a videogame which she developed herself within one week:

Parent (Mom):

I frequently die in this game. I'm just here to die. She designed this world, so like yeah from scratch it's like a toy box you go in now she's pressed it and now all the baddies were going to come out.

Interviewer:

Did you choose Maleficent for yourself?

Parent (mom):

She specifically chose Maleficent, she wants to, she asked for Maleficent for a bit.

Interviewer:

So why did you choose Maleficent?

Child:

Because I think she's a really cool person. Because I think Maleficent is so cool so I wanted her so bad and now look at me, a pleasure as always.

Parent (Mom):

She likes this one and who's the other one that you, like, Violet from the Incredibles, hey.

Child:

Yeah, and you could switch your character

Interviewer:

So Gemma, how long did it take you to build this?

Child:

Pretty long

Parent (mom):

It's quite a complex world.

Parent (Dad):

So how long, how long is long?

Child:

I think it took me about a week.

Figure 109: Digital game built by Gemma (8) within one week



Children also enjoyed digital play that enabled them to explore characters in addition to narratives. Della (6) from SA Family E enjoyed playing WWE SmackDown on the PlayStation with her older sister, Bongi. They chose young female wrestlers whose clothing and style seemed to be an important part of the experience. The children's research diaries were filled within a few days with detailed drawings of the wrestlers, their clothing and hairstyles, as well as narrative scenes in which opponents are defeated and/or knocked out, and the audience cheers and holds up fan posters.

Figure 110: A drawing inspired by playing WWE SmackDown



As the survey and case study data indicated, there were differences across families and children. Sometimes this was due to age, as younger children tend to favour digital play on tablets and smartphones, while older children gravitated towards consoles, but sometimes it related to what might be seen as family's 'digital habitus'; that is, established ways of playing with the digital in families. Children were observed playing a range of apps and games, and it was notable that when there was sufficient challenge, they demonstrated high engagement and pleasure in the activity. If the play was insufficient, or too demanding or challenging, then they disengaged, reinforcing the relationship between active engagement and pleasure.

4.3.2 Children's positive thoughts about technology

Some children felt that engagement in digital play could be educational, as was the case with this Year 1/2 (aged 5–7) child in the UK:

Interviewer:

What do you do with it? Can you tell the class about what you did? What did you do with your virtual reality?

Child:

I think I played by looking in some binoculars, and then it could be some goggles that, because they're in your face and then you could see around [unclear], you can see around the desert, you can see around anywhere.

Interviewer:

...What was the best thing about it, Rolf? Anything?

Child:

Best bit is that we could change places, and we can learn more.

Another child in a UK Year 5 (aged 8–9) group felt that the automated spellings that appeared when texting friends in games was helpful: 'I think that it is good for learning because you can text your friends and it can teach you how to spell because words pop up at the top.'

In the example below, the children in Sophia's (11) (SA Family D) focus group generated many ideas and thoughts about play, learning and technology. In Figures 111 and 112, it can be seen that papers were too small for all of their discussions and documenting of ideas. Additional pieces of paper were added to extend the exploration for the children. The expansion of the

activity emerged as the children debated the different positive aspects of the use of technology, such as its educational and entertainment benefits, as follows:

Child 2:

To me it is a robot that basically can do lots of things.

Interviewer:

Okay, anybody else see on the sheet of paper any answers to that question, 'What is technology?' What does it say here? [Interviewer points to sheet]

Sophia:

'What is one advantage of using technology?'

Interviewer:

So, did you put that question there?

Sophia:

Yes.

Interviewer:

What are some of the answers that you have?

Sophia:

Um, at one person said that it is easier to communicate, one person said learning things and meeting people and another person said to entertain yourself and another person said it is fun.

Child 3:

I have a question no one answered.

Interviewer:

What is it?

Child 3:

Do you think reading is a form of technology?

Child 4:

Oh, I didn't see that!

Interviewer:

Read the question again, so we can hear it again.

Child 3:

Do you think reading is a form of technology?

Interviewer:

Okay, we have someone here that wants to reply.

Child:

They change their voice though like after a while. And there's one, I've got this like cowboy and it goes just really weird.

Interviewer:

Right. Have you got a Furby at home?

Child:

Yeah it's like a blue and white one.

Interviewer:

Do you play with that, or do you just leave it alone?

Child:

I just leave it alone otherwise it just starts screaming in the night if you don't leave it.

Children's playful reflections on technology were sometimes surprising, funny and at the same time informative. In the following truncated extract of a SA focus group transcript, with children aged 6, a child invites engagement with a picture about robots that might be seen as negative (TV makes you 'brain dead', and 'lazy'), but also positive ('you don't do what your mommy says you must do'). Children's evaluations might be different from the adults caring for them:

Child 1:

Look at this picture, that picture looks so cool, about robots.

Interviewer:

It's about robots and technology. What do you think is going on there?

Child 1:

Maybe they're doing technology and fun facts.

Child 2:

TV can actually make your brain dead.

Interviewer:

So it's TV, what about other screens then, other devices like phones and...?

Child 2:

Can still do it.

Child 3:

What happens if your brain is dead?

Interviewer:

Ooh, I'm not sure, what happens if your brain is dead?

Child 2:

You just get lazy.

Child 3:

And you don't do what your mommy says you must do.

Other concerns expressed seem to mimic adults' health concerns about digital media, as some made comments about getting 'square eyes' when viewing screens. However, even adults' concerns about 'square eyes' go in a fascinating direction when transformed by children's own perspectives. In a SA Grade R class (5–6-year-olds), the following exchange took place in a focus group when discussing whether adults could or should restrict their access to the television:

Child 1:

It's enough TV and you can get square eyes.

Interviewer:

Oh, you'll get square eyes. What does that mean?

Child 2:

You actually get square eyes.

Interviewer:

What, how?

Child 2:

And then after your square eyes, you get square, your whole face goes.

Interviewer:

Oh my goodness. Have you seen anyone that that's happened to?

Child 2:

No, my dad, my mom showed me pictures.

Interviewer:

Oh, my goodness.

Child 2:

And it really happens.

In both countries, concerns about data privacy were expressed more frequently by adults than children. In SA, this might have something to do with the fact that parent telephone interviews clearly showed that very few children were given online access in SA without adult supervision. One parent of a child aged 8 commented: 'Yes and then they interact with random people. You know I always put my mobile data/WiFi off when they have my phone, so they can only watch previously downloaded things, so they can't watch other things on YouTube.' This view about child protection in terms of online access is confirmed by the quantitative data in Section 2. While concerns about data privacy issues were largely an adult affair, there were instances when UK children also demonstrated awareness of these issues. For example, a child in a Year 5 (age 8/9) focus group had become familiar with concerns about data privacy when using smart assistants, 'because ... they're not to mess about with because ... there's people listening on what you're saying to them'.

4.3.4 Children's future digital toy inventions using LEGO/craft materials

Children were asked to invent a toy that they would like to play with in the future. The aim of this exercise was to find out the extent to which technologies featured in these digital imaginaries. Children's inventions for future toys were varied in nature, with some replicating toys that were already available and they enjoyed using. However, some children added new and innovative elements to these toys. For example, Felicity, in a UK Y1/Y2 (ages 5–7) focus group, built a doll's house (see Figure 113), and imagined that she could shrink down to enter it:

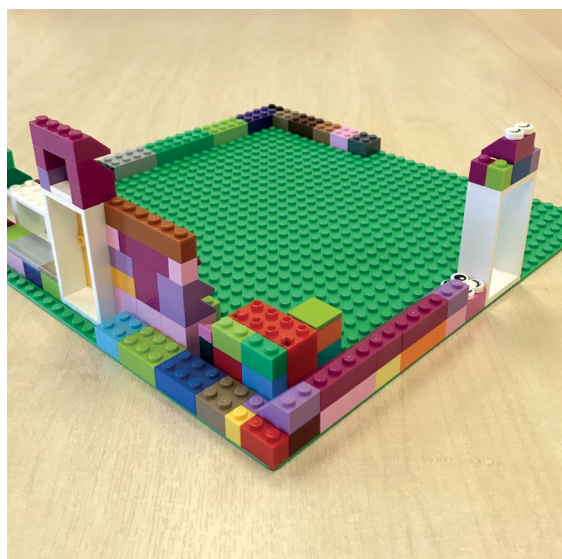
Interviewer:

Okay, and Felicity, tell me about what you're building for me here. It looks very interesting.

Felicity:

I'm building my house that I would like to play in. I'm building a dolls house, which I would just like to shrink myself down.

Figure 113: Felicity's doll's house



In the same group, another boy created an idea for a book, but this one sent information about moons to another child, who had created a space rocket:

Interviewer:

A moon book?

Child 1:

And it's connected to solar panels and it sends information to jets about it.

Interviewer:

So yours links with Rhodes' then?

Child 1:

Yes.

Interviewer:

So yours is a moon book and it's up there in space already.

Child 1:

Yes, and it sends facts about the moon into jets, and as you can see...And I could make that better, making it more stable, because I wouldn't be able to make another one of these, because it was [unclear].

Interviewer:

But would you want noises and lights? Would you want to connect to iPads or [unclear]?

Child:

No, only connected to Rhode's head.

Interviewer:

So it's got a generator...

Child:

That top bit took me ages to build.

Interviewer:

Yes, it's amazing. So you've got a generator and we've got the information collector there.

Child:

And then it extracts all the information and then sends it to Rhode's head.

A number of children liked the idea of creating toys that would give them a sense of agency and control:

Interviewer:

Right, OK. Next question is, can you think of any kinds of toys you would like to be invented that have not been invented already?

Child:

Yes.

Interviewer:

Go on then, Frederick.

Child:

Like a robot what you can get what looks exactly the same as you what you think of the ideas and it will do all things what you want it to do.

In an example from Sophia's group (Figure 114), two children invented devices which were for technology and play. As with the children in the UK, they added innovative features to technologies that already exist. The children began by designing their inventions on paper first and then used materials to create it. This invention, while searching for information and connecting to the internet, is also enabled to access thoughts and brain waves.

Figure 114: Google Air invention in Sophia's focus group



A child in a 6-year-old SA focus group made two robots which she explained have animal features (Figure 115). The desire to have agency and control take the shape of the butterfly and a tiger, which are both robots that take the role of protectors who are not afraid of humans.

Figure 115: Protective robot



Children's inventions were not all whimsical, fantastical creations with no relation to the ways in which toys are part of a consumer culture. Karabo and his friend revealed an awareness of the marketing around toys in a consumer culture. When asked what their toy was called his friend replied, 'Battle fort' (Figure 116). Karabo challenged this:

Karabo:

No... that's unoriginal. It needs something (pause) cool.

Researcher:

It is important what the new toy is called?

Karabo:

Yes. So it gets people's attention and then they can be like, so if it is too long then they'll be like dadadadadaaa... And then the name will be hard to say.

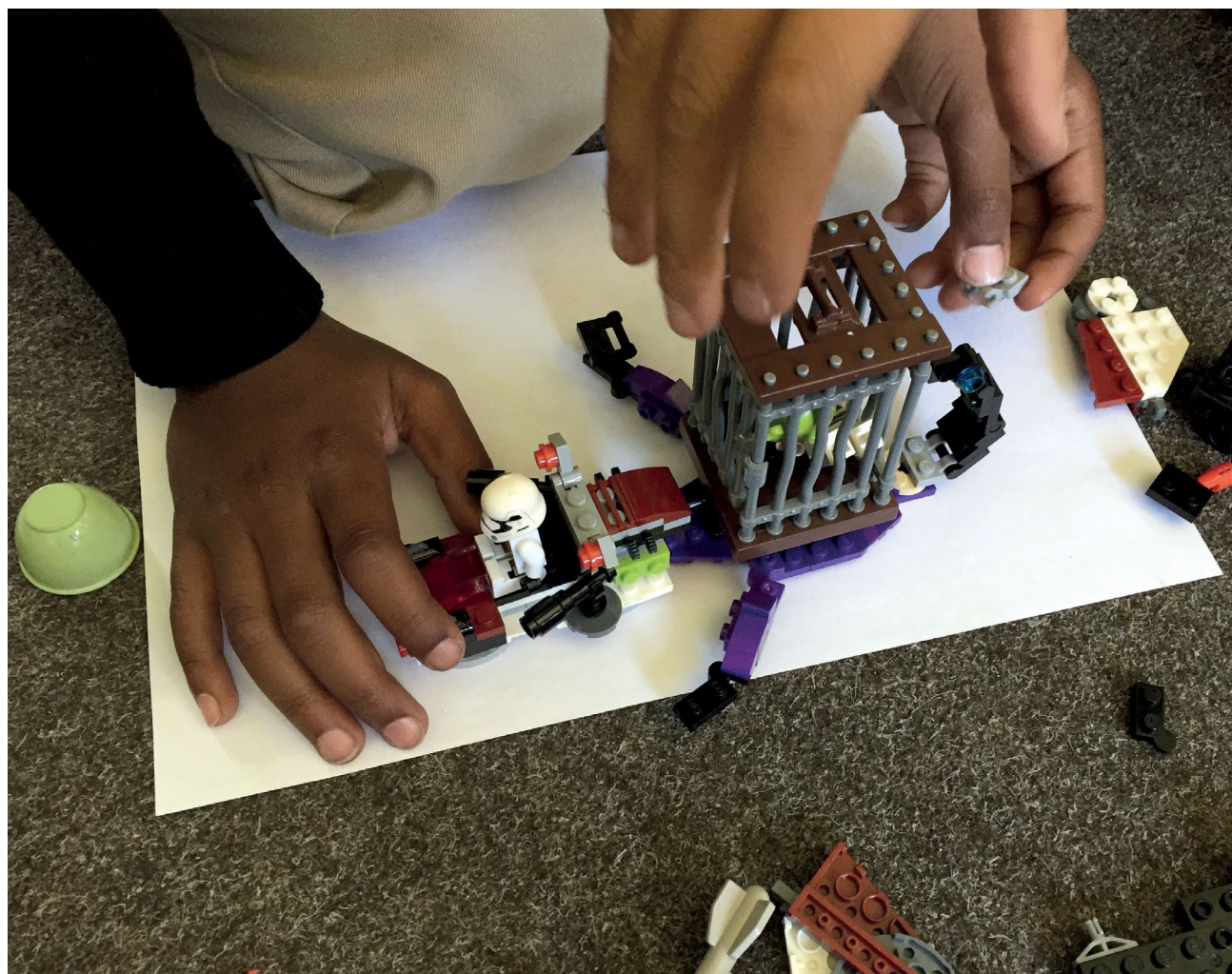
Friend:

And no one will want to buy it because everyone will say, 'What is this?'

In this focus group, other children were careful to draw attention to the fact that their toys had logos on them.

The key messages that emerged from this activity were that children would like more toys developed that link together online/offline domains, they would like those toys to foster a sense of independence and self-efficacy, and they would like toys that enable them to link up with friends. Indeed, these features are already present in many toys available at present, which suggests that children's media producers should continue to develop these kinds of products in the future. The children also had an awareness of the ways in which toys are branded and marketed, which some incorporated into their designs.

Figure 116: Invented Toy: the battle fort





4.4 Summary

In this section, children's rich digital ecologies that span a wide range of places and spaces have been outlined. Even though there was great diversity in the homes of the case study families, there were many similar beliefs and practices across them. There was a great deal of play across digital and non-digital domains, and play that attended to the specific features of the technologies. Digital play occurred around the home, but much of it took place in shared family spaces. Children played digitally both on their own and with friends and family members, both in the physical world and virtually. Despite parental concerns to the contrary, this study confirmed the outcomes of earlier studies (e.g. Marsh & Bishop, 2014; Willett, Richards, Marsh et al., 2013), that the majority of children have varied play lives and technology plays an important part in them, but not to the exclusion of other forms of play.

Collaboration was also strongly present in school and community contexts. Researchers in South Africa witnessed classrooms where children were sometimes working on the floor, then in small groups, or in pairs, and then again followed by working on their own (alone-with-device). They co-produced with their tablets, exploring new possibilities through socially interactive discussion and open-ended explorative argumentation and enquiry with peers and a variety of adults. Case study children in South Africa were observed taking their emergent ideas from home to school, then to the library, after-school club and/or beach, and then back to school again. UK researchers similarly were struck by the influence that schools had on children's home digital play practices, enabling these to be enriched and extended. There were some disjunctures between experiences across place and space, particularly

when both formal and non-formal learning providers did not consider in sufficient detail the digital capital that children bring with them to these contexts.

The differences across the two countries focused largely, as we have outlined, on the differences in access to technologies, and the costs associated with digital play, given the disparities in economic and social contexts across SA and the UK. This digital divide has significant implications for the children in our study, as they grow up in a rapidly changing world that will require complex technological solutions to 'wicked' problems (e.g. the environment, food and water supply, migration and so on). Issues of social equity are key and, while we can celebrate the similarities in the experiences of children in both contexts as they create, invent and innovate in their digital play, we must be mindful of the differences that are structurally and economically defined.

In the next section, we consider the relationship between digital play and learning.

“Children and parents in both countries embraced the positive elements of digital play, the children in particular, while being mindful of many of the risks involved in its use.”

Section 5: Digital play and learning

As the findings from the survey indicated, parents felt that their children learned a great deal through digital play. The range of skills and knowledge gained from digital play varies from child to child and is dependent upon a range of factors such as devices, games and apps

used, family approaches to learning with technologies, children's abilities and interests, and so on. However, across all of the datasets, learning was identified across the following areas:

Figure 117: Knowledge and skills developed in digital play



Each of these areas is discussed below.

5.1 Subject knowledge and understanding

Subject knowledge can be defined as content knowledge about subjects that learners encounter in both formal and non-formal learning spaces. Curricula vary across countries, but the key subjects in most early years settings and primary schools are mathematics, language and literacy, science, geography, history, art, music and technology. Content knowledge differs from the skills that children need for learning, in that it consists of facts, concepts, theories, and so on, rather than the skills required to apply this knowledge. In both South Africa and the UK, there are national curricula that outline the key content to be acquired. Subject knowledge can be differentiated from understanding, in that understanding requires a deeper level of reflection,

leading to the comprehension of facts and other material learned in the curriculum, and the ability to integrate various bodies of knowledge.

In both countries, parents made a clear distinction between play and work. Parents suggested that engaging in digital play can enable children to develop subject knowledge and understanding across a range of areas, which correlates with the survey, in which parents felt that play with technology was important for children's learning and development. However, some parents expressed the view that play was only allowed once school work had been finished.

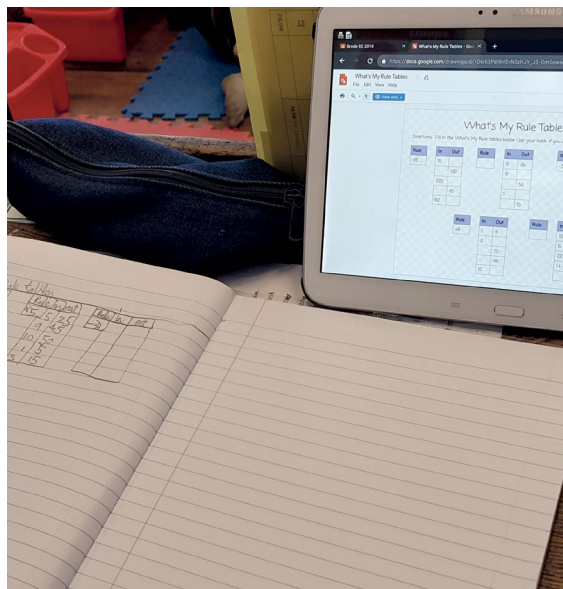
At times, and especially in the UK context, the development of subject knowledge is through the use of apps and games designed specifically for this purpose. The increasing gamification of learning by schools was notable in comparison with previous UK studies (e.g. *Technology and Play* (TAP), Marsh et al., 2015), with families mentioning a range of games that schools recommended children play at home to enhance their learning. For example, Mallison (6) in Family 1 was observed using Times Tables Rock Stars, an app that had been recommended by his school.¹¹ He demonstrated an ability, as outlined in the English National Curriculum for Mathematics, to 'solve one-step problems involving multiplication and division, by calculating the answer using ... pictorial representations', as well as using mental arithmetic. His brother Essa (4), in a GoPro video¹² that he recorded himself using the Spelling Shed app, was able to spell a range of words, including 'about', 'always' and so on. The game provided Essa with feedback on his progress, outlining his correct spellings along with a 'Well Done!' message. Essa said proudly, 'Yes, got all of them right!' There were numerous instances such as this across the families, due to schools recommending apps to help develop skills in specific subjects.

At other times, families sourced apps themselves to help with learning. In UK Family 3, Stephanie (9) explained to a researcher how she had independently found and downloaded the app Duolingo, which she found helpful for learning languages:¹³

It just helps you learn different languages in an easier way ... if you've got a new word or something, then it'll tell you, it will do, like, a wiggly line under it, so you can tap on it and see what it means in English. It just helps you learn it and to memorise it.

Digital tools were sometimes used alongside non-digital to enhance learning. For example, Sophia (11) (SA Family D) used a tablet and book at the same time in her mathematics lesson. Sophia's teacher created multiple mathematics activities on Google Classroom and the children made choices about which activities they wanted to work on and in which order. The children engaged with one another and tried to solve problems and find solutions with their friends, using different devices (digital and non-digital).

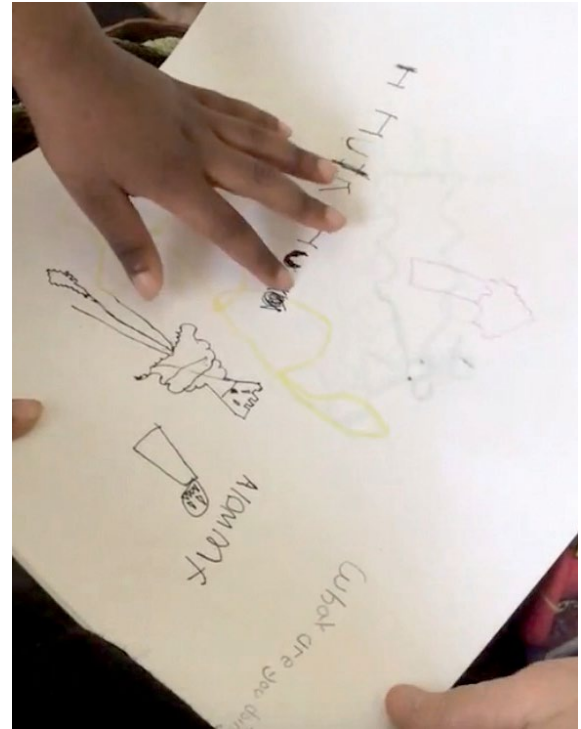
Figure 118: Sophia with her tablet and book in the maths classroom



In SA Family E, Linton (6) showed how children's rich imaginary life can impact directly on their desire and need to communicate through a range of 'languages': visual, verbal and written (Giorza & Haynes, 2018; Rinaldi, 2006). Digital media sources can play an important part in this process. Linton recruited his experience on the PlayStation Superheroes and Marvel Fantastic Four and Avenger games for extended literacy practices using his research diary. He played in the space between the oral and visual, creating narratives about superheroes and characters with powers, pointing out significant elements in his drawings.

Linton's commentary on his drawing was as follows: '*In the first drawing, Mystique is acting like Venom (she can change into anyone) and she is controlling the machine (the orange net-like image). The different colours on the tube-like shape correspond to the powers that different characters have. Beast, the small blue figure on the right of his page, is "stuck in there".' In the second image there is a drawing of Hulk, with his name written beside his image, and another character that Linton had named Alommf. His older sister's writing can be seen at the top of the page. Linton's emerging practice as a literate subject is evident in his frequent attempts at writing key words, like GAMES, Hulk, LEGO STAR WARS, and asking his older sister to write 'what are you doing?' and 'burger'.*

Figure 119: Linton's drawings



He also worked hard to get his mouth around difficult words like 'telekinesis'. In this example, we see the ways in which digital media provide a valuable stimulus for children's language learning.

At times, specific subject skills and knowledge were developed through the use of YouTube. Children acquired a range of knowledge across subjects such as geography, history, science and art through their engagement with YouTube. For example, in Family 2, Chloe (4) and her father learned drawing skills by watching a father and child draw together on YouTube. Indeed, the family talked of wanting to set up their own YouTube channel in which they would do likewise, using a split-screen effect for others to learn from.

Parents of younger children, such as this UK father of a 3-year-old, noted that watching YouTube developed their child's basic knowledge, such as names of objects:

What I like about her is she quite likes to watch informative stuff, even for her age. This could be like a big video of a person throwing toys in a bathtub, but they will say the name, so she would say the name of the fish they are throwing in the toy. She's picked up so many names and a

couple of times me and my wife were a bit surprised, she knows that animal as well. But yes, I think technology is helping on that kind of thing, she knows so many animals and things like that, colours and things like that without us even telling her.

At other times, learning occurred through watching television, such as parents who noted children learned Spanish through viewing the programme *Dora the Explorer*, or that their child loved nature programmes and thus enhanced their geographical knowledge. Gaming consoles were not mentioned in relation to subject knowledge acquisition but British parents did feel that virtual reality games could develop children's familiarity with unknown spaces and places (according to the survey, this is something still almost unknown in South Africa).

5.2 Digital skills

Digital skills are those skills required to be digitally literate in the 21st century. Children need to be able to operate devices, but they also need a wide range of skills that facilitate creativity and critical thinking using technologies. The EU Digital Competence Framework 2.0¹⁴ outlines five areas that are important to becoming a digitally literate citizen: (i) Information and data literacy; (ii) Communication and collaboration; (iii) Digital content creation; (iv) Safety; (v) Problem solving. Key skills outlined in this framework were asked about in the survey questions discussed in Section 2. Digital skills are becoming increasingly important as life is shaped by the 'fourth industrial revolution', which is characterised by rapid technological transformations that are leading to breakthroughs in areas such as artificial intelligence, biotechnology and robotics. These changes will transform our social, cultural and economic lives over the next decades in ways that are unimaginable at the present time, although some trends are anticipated, such as the increased use of robots in workplaces. In this context, children currently in early years settings and primary schools will be entering an employment market very different to the one experienced by previous generations, and in this market digital skills will be important.

As the survey data indicated, children acquire a wide range of digital skills through their digital play. They quickly learn how to operate the key devices they use, and develop the ability to use a variety of apps and software, as this father in the UK study of an 8-year-old boy noted:

It's quite a significant factor, especially because it helps him to improve his learning skills, life skills. Basically, how to use a computer, how to use technology. For example, even at the age of 8, he's able to handle PowerPoint. He puts the music on the display, and then if he wants to play games, he does it on the computer. He knows exactly how to handle all these things, the software in a computer. Sometimes, if I don't

understand something, he's able to find out the answer. Problem solving, he's quite good at that. So, the technology has really helped him a lot in this age of smartphones.

The superior knowledge and ability of children in this area was a theme embedded throughout the telephone interviews with parents, although some parents were obviously very skilled themselves, having worked in jobs that required IT skills or being keen gamers themselves. It is significant that in the SA study also, various parents who were interviewed were either professionally or otherwise interested in IT, which may have impacted on the digital skills development of their children.

Sometimes, children had acquired digital skills because they were interested in a particular game or site. A UK parent of an 11-year-old girl commented that this was the case with the social media app, TikTok:

TikTok makes her ... she's developed playing TikTok with technology in the way that she uses software and she edits videos. It's given her another form of language as well because she uses all these technical words that you would use in info editing that she now uses as well.

Because of the competence that many children demonstrate with some of the technical aspects of using devices, adults may overestimate their abilities with technology. In addition, some adults may assume that all children develop digital skills from a young age, when a number of children only have access to a limited range of devices, apps or games, especially in South Africa. In other words, the development of digital skills is always situated and contextual – an important feature of this project that we discuss further in Section 8.

5.3 Holistic skills

The LEGO Foundation takes a holistic view of child development and learning, and stresses the importance of children's social, physical, cognitive, emotional and creative skills (LEGO Foundation, 2017). These skills are discussed in the following sections.

5.3.1 Social skills

Digital play can be very social as children play with both present and distant others. They learn to communicate and collaborate with others, to understand their perspectives and to build empathy. There were numerous examples of social skills being developed as children played together. Zander (5) (UK Family 5) and Harvey (6) (UK Family 4), were observed in school playing games on a laptop together:

Zander and Harvey sat next to each other on chairs in front of the laptop which was on a low counter allowing them to reach it. Harvey took charge of the laptop and came out of the game, back to a page which offered choices of games (all BBC Bitesize). Zander was excited, pointing at the screen, especially when he saw a game called Galaxy Pugs, and said 'wooah!' The laptop was slow to warm up, and Harvey groaned and said 'Oh, come on computer...' Zander said 'sometimes it works if you do it again', suggesting that they come out of, and then back into a game. The boys were sharing knowledge of how to make the laptop work. At first the boys appeared to slip naturally into taking turns on the laptop. Harvey was confident and wanted to take control of the laptop more than Zander during the session, although at this point Zander didn't seem to mind (he became more bothered as the session went on). Zander would at times attempt to turn the laptop towards him; then Harvey would angle it back in his own direction. It was Zander's turn again and he was trying to build a food chain. Harvey told Zander to press 'check it' which was written on the screen, revealing that his answer was wrong. The game reassuringly told him never mind, and to try again. Zander pushed his face into his fists (his elbows were resting on the counter) and pretended to wail (jokingly) that he had got the answer wrong. He tried again – although in fact Harvey was pressing the keys and having input – and when it was correct he punched the air with his fist and said 'yeah!' 'That's because I did your turn', said Harvey, claiming the win for himself. Harvey was taking the next turn but Zander was pointing at the screen while they

decided which animal or plant they should pick. Zander tried to take the laptop by steering it towards him, but Harvey said 'No, let me', adding that there was something he wanted to show Zander and pulling up a different screen. Zander took the laptop while Harvey pointed out what he should do. Throughout the session they were playing together and making suggestions to one another.

(Field notes, 27.11.19)

In this example, while the control of the computer was obviously a tussle for the boys now and again, there was some understanding of the need to take turns, and instances in which one supported the other to achieve tasks. This was also the case with UK Family 1, in which Mallison (6) originally taught Essa (4) to play *The Incredibles* on Nintendo Switch. In one play episode, Essa was unsure what to do at one point and said, 'Mallison I've found a robber, please, can you come and help me?' Mallison moved over and took the device off Essa, saying, 'I'll take it out of it'. Mallison tried to find the robber on the screen and Essa told him, 'It was over there, and it come that way', pointing to the bottom of the screen. Mallison eventually detected the robber, at which point Essa grabbed the device off him to try and resolve the situation. This was one episode of a number in which the older brother supported the younger brother, demonstrating the ability to help others, and Essa also learned to ask for help when he needed it.

Social skills were also developed in play over a distance. For example, Noah (9) in UK Family 10 communicated with his father, who lived separately to him, through co-play on a games console and this enabled them to develop a stronger relationship. In the UK data, there were numerous examples of children using video-conferencing software to play with others. This was not always for short-term play related to specific games, but sometimes the technology lent itself to longer periods of more open play, as noted by a parent of an 8-year-old girl:

She will play with her dolls and sometimes like over FaceTime. FaceTime is really, really good because her and her cousin, who's like a year younger ... will play for like hours and hours, and that's something we never had as kids. You had to go round to somebody's house you know and it was

the most harrowing thing in the world to have to ring the house and have to speak to their mum and dad and whereas obviously now she's got that immediate contact, FaceTime and it's there and then and they can play over FaceTime and it tends to be that you will walk in the room and FaceTime will be on and my daughter will be somewhere else and her cousin's chatting away to nobody there. So there is sort of that ... they don't need to go round to each other's houses to play, but they can have that playtime over yeah, yeah, so it's contact using technology.

Play at a distance through the use of digital devices can also be of value to children who otherwise might be socially isolated. The parent of one 7-year-old boy in the UK felt that technology was important in enabling his only child to interact with his friends:

Interviewer:

So, what sorts of emotions do you think that your son is involved in while he's playing with digital toys?

Parent:

Well, I think he's excited if he can do something that he hasn't been able to do before. Proud when he's achieved something. Then there's a social aspect when he's playing with his friends. So, he's an only child, so I'm good with that because that's a chance for him to interact with his friends when his friends aren't around. And that makes him happy. He's a very sociable child.

Of course, conversely, digital play can also lead to social exclusion through cyberbullying. However, it is this aspect of digital play that is frequently referred to in media reports, with a concomitant lack of attention to the more positive social skills that digital play can develop.

The interviews with teachers and parents in SA offered many examples of how digital play develops social skills. Despite the limitations of having only one remote, a mother of 5 (with children aged between 1 and 15) commented:

With the Xbox, we only have one remote, but when his cousins come they bring their remotes, so there is socialising there. Even in Minecraft you can play two players. However when we are home alone, we only have the one remote, so there is some turn taking and showing what he has done. He is also happy for you to sit there and he will talk you through what he is doing. He also tries to encourage me to play with him, so that he can show me

how to create my own. My husband also plays with them on the Xbox. On the phone it is the same kind of thing, but just smaller. I definitely think between the phone and the Xbox, the Xbox is more social.

Another mother (with sons aged 4, 10, 12) pointed out how a split screen mediated social play:

They never had tablets, but we have a fibre connection with the smart TVs. They also play Xbox, and they play Fortnite together. Before they could only play alone but now they have some sort of a split screen, so they can play together. Then, they do have phones, but they are not smartphones. It is just for calls.

The sheer materiality of having a timer on a game was also seen to facilitate social development. A Xhosa mother of an 11-year-old boy, observed that this is the case with games such as:

Child:

NgooTom and Jerry, uyofike pha bedlala i-game ufunuba baphekisana. Yonke laa nto, kuthiwa omnye makaye ekhitshini, ayopheka, intwezinjalo, anxibise unodoli apha efowunini. Ubone ukuba yinto emnandi leyo.

Tom and Jerry, cooking, dressing dolls, they take turns on the phone. Games that count.

Interviewer:

Batshintshiselane?

They take turns?

Mother:

Ewe, batshintshiselane. Ngoba ziya-count ixesha xa bedlala.

Yes, they take turns. Because there is a timer on the game when they play.

One of the teachers in the SA study (Zuko's teacher), herself a mother, observed how the games themselves facilitate or inhibit social play. She commented in an interview:

'My own kids play all sorts of strategy games, on the computer and there are some fantastic games out there, that are developing those skills, but a lot of it is quite limited to a one person or a two person player.'

And indeed, as reported previously, some games are particularly conducive to social play. As a South African mother (with two sons 7 and 10) points out:

I love Minecraft, but I don't like any of the fighting games. I would say Minecraft is my favourite ... because they fight a lot, but [they actually play together] definitely with Minecraft.

She continues:

They have this game on the PlayStation Little Big Planet, and they will always call each to come and play. They never just sit there alone and play; they always call the other one.

Digital play also enabled social interactions to take place with those who were not actually physically engaged in the game play. Della in the South African study (SA Family E) played the PlayStation game WWE Smackdown with her siblings. On one of the home visits she was playing against her bigger sister, Bongi. Their brother, Linton, was not excluded from enjoying the game even though he was not directly involved, offering commentary and encouragement from the side.

Linton:

Della! Reverse! Reverse!
I remember the one time it (the game) was making me talk.

Della is playing.

Della:

Alicia Fox is going to get (the chair from under the ring)

Linton:

Ah! Yoh! (Dances in front of the TV screen)

Della:

This is how they run.
(Della shows the controls that make characters run)
(Linton continues dancing and jumping in front of screen)

Researcher:

Are you (Linton) pumped up on the adrenaline?
What is that thing there? That blue – it is like a line...
That thing here. This thing?
(Researcher points to something on the screen)

Linton:

This thing right here ... If it is enough, you will beat him (opponent). It has got to be bigger. (Seemingly the score is tracked by the length of the player's bar or line)

Bongi:

Come on!

Researcher:

You see there – she has more –

Linton:

She has that thing.
(Referee moves the staircase out of the ring)

Bongi:

No, don't throw it (staircase) outside.

Della:

Yes, he has too. (Della's character kicks the referee)
Oops!

Linton:

Della!

Della:

Just did it by mistake.

Researcher:

Wow, she kicked him.

Bongi:

Are you allowed to do that?

Della:

Yes.

Linton:

And you know they will do like this chu-chu-chu
(Linton imitating wrestling moves)

Researcher:

You see that blue line is long?

Linton:

Mm.

Della:

Yes, Alicia!

Bongi:

Come on Referee!

Many parents held mixed views about the social nature of digital play. As one parent of a case study child (SA Family D) put it:

If I can be honest with you, I think she would have a similar view as mine. She understands the importance of technology and the perks of it and how it can benefit one's life, but she also seems like the type of individual who likes to enjoy life in the moment. And she enjoys the simple things in life of human interaction and learning from other people, and not just learning from a Google source. So, for me, I think she is going to end up being someone who is pretty balanced in the two. She won't allow it to take her life over completely.

Parents also felt that media representations of marginalised cultures were limited, which could impact on the extent to which children wish to socially interact using technology. Interestingly, the lack of representation of South African lifeworlds in media was seen by one parent of a child in a telephone interview as an inspiration to do further research, to satisfy 'an itch of enquiry':

But we then started talking a little bit about that, and really interested in that. And then he said, that actually, there's another thing that happens in Canada is they have these things called rodeo races, where you climb on a bull, and then you until you fall off, then like, whoever stays on the bull, the longest is the winner. And then we started talking about wow so different countries have different games and activities that are like known and quite symbolic to that country. So then we were like if there's anything is South Africa that's quite kind of known to us, South Africa. So we kind of started talking about what, the one or two games that teacher Vera has taught us that in Xhosa, so clearly it must be South African. And then I sent them all home to go and do some research now. Okay, on what different games are there from. What is a traditional game from a different country? So I know that I don't go to, my go to isn't Google, I know that going home that is the go to and that's fine, because they're getting exposed to it. But that, that there's not just one way of kind of scratching that itch of inquiry.

This re-emphasises the importance of ensuring that children have access to high-quality digital games and apps that reflect their cultures, in order to enhance further social interaction in communities.

5.3.2 Physical skills

Digital play can develop a range of motor skills. As children develop the ability to use menus on apps, for example, or operate a console handset, they are also developing their motor co-ordination. This was prevalent throughout the case study data. Sometimes, the challenge in homes of operating devices or navigating screens involved many actions such as pushing, pointing, swiping, clicking and scrolling. There were also examples of activities in classrooms in which children engaged in playful use of devices that developed fine motor skills. For example, Zander (5) (UK Family 5) was observed at school. The class was learning about the fairy-tale of the Elves and the Shoemaker, and were undertaking work around the story. The teacher talked about a shoe that all the children had each brought in and said that they would be decorating them. She said that they were going to take turns using the Chromebooks to design their shoe decoration and selected three children to go into the hall with the trainee teacher (TT) to work on their designs:

TT helped the children find black and white outline templates of shoes. They could pick any design such as a boot or walking shoe. Zander chose a trainer, and when TT pulled up the images [on screen] he honed in on a Nike trainer and said to the girl sat next to him [Child A]: 'I've got a trainer with a Nike tick' (the 'swoosh' design). Zander recognised the brand. He began to colour in the 'swoosh' with his finger using turquoise colour. When he had finished colouring the swoosh he put his head to one side, evaluating it. Then, again, using his finger he coloured it in black. He said that the tick 'makes it go faster' adding to Child A 'look at my shoe'. He began to experiment by drawing random lines in black on the shoe, then tried to remove them by erasing them but couldn't get rid of the final one. He began making black splodges on the shoe. TT reminded him he was on a paint tool and said he needed to rub out what he didn't want. She helped him, but then he said that he wanted a new shoe, and was looking through the designs scrolling up and down. As TT helped him by moving the page he said, 'Wait, I just found one I really like!' He wanted a design that TT said would be difficult. He carried on looking and scrolling using his finger and seemed to enjoy looking at the different styles.

Eventually he settled on another, chunkier design. This was also Nike. He tried to colour in the 'swoosh' again but kept going over the lines. Zander appeared to want to stay in the lines and was working carefully to try and get his picture exactly right. 'This is so difficult', he muttered. He decided he wanted a shoe like Child A – they kept looking at each other's pictures although she was working more quickly, if less precisely, and had nearly coloured hers in completely ... Zander then wanted to change his shoe again. He seemed to want to get it perfectly right. TT selected a more basic 'half cab' shoe and he said 'oh yeah...' as if pleased that it might be easier to colour. He sounded satisfied with the choice. He started to make the dots again and TT came round to him again, and suggested he use the mouse (which was a touchpad) because otherwise the dots would be too big. He could control the size with the mouse. 'I don't want it on dots', he told her, and was told that the touchscreen was playing up a bit. He began painting the shoe again, choosing the turquoise blue he had from the beginning but using the mouse this time. Zander stayed with the mouse this time, which seemed to give him more control for staying within the lines, which he was concerned about doing. Zander began trying to turn the shoe into a Nike shoe but couldn't do the tick to his satisfaction and kept rubbing it out. TT tried to draw one but Zander was dissatisfied with it and said: 'Actually, I don't want one'. Then he tried three lines. I wondered whether he was trying to do the Adidas stripes on the shoe. He tried several times but each time felt that the last line was wrong. When TT tried to help he corrected her and was not satisfied with what she was doing.

(Field notes, 19.11.19)

In this example, Zander could be observed attempting to colour in his shoe with his finger, but then finding he could be more accurate with the use of the mouse. In these instances, in addition to all of the other actions he engaged in, Zander was developing fine motor skills: important skills to be able to transfer to non-digital contexts.

Technology can also promote gross motor development and honing skills through physical play in some contexts. Dancing frequently appeared in both datasets. Some of the case study families in the UK discussed using the console game Just Dance, as discussed previously, which requires users to copy dance moves portrayed on screen. Virtual reality also presents opportunities to engage children in whole-body movements. The UK parent of a 7-year-old boy talked about how her son

enjoyed taking part in martial arts through the use of a virtual reality headset:

They enjoy their dancing, taking part in dance moves and they were playing some games, because he's currently learning martial arts, so he could take part in virtual reality martial art.

In one example from the SA data, a mother commented in a telephone interview on her daughter's enthusiasm for dancing:

I would say it brings out joy because I can see when she watches the dancing videos and re-enacts it, she proudly comes and shows us, because she also records herself. She comes and shows us what she has done, but she is not allowed to post these. She is not active on any social media platform apart from WhatsApp. She is not allowed to post without our permission. It brings a lot of joy when she gets these sequences and dance choreography right.

This joy was also evident in shared experience of dancing together, as the photograph that captured Karabo dancing with his father during one of the home visits demonstrates (Figure 120).

Figure 120: Karabo and his father dancing together



Digital media might also motivate children to engage in physical play in other ways. For example, the UK parent of an 11-year-old boy identified how watching YouTube encouraged him to incorporate certain skills into his own practice:

He actually does a lot of football. Because what he does is watch it because he's into football, so obviously he'll watch clips for football and football training and then he will check that into his routine. So he will watch clips of football training and all what they do, like Cristiano Ronaldo would do some skill, and then he'll put that into his own routine or do that on the football field.

In UK Family 9, a family member captured a video of a 2-year-old boy, Kamal, joining in as an older brother engaged in a workout using YouTube. Kamal stamped his foot along with the trainer in the video and watched his brother's movements. In UK Family 5, the tennis trainer who worked with the children in the family talked about how the young people who attended his class use their Fitbits competitively.

Technology was used creatively in other physical ways beyond being guided by games and apps. Eshal (7) (SA Family B) provides an example of integrating technology into her physical play. Eshal engaged in a physical and imaginary game of frog play while using the GoPro to film herself. She moved, hopped and leapt around the lounge and explained how her movements were like a frog. She bounced and changed the angle and perspective of the GoPro as she played. Her sister also participated in this activity and lay on the ground at times trying to see how the play was being recorded with the GoPro.

Figure 121: Eshal and frog play with a GoPro



This area, however, seemed to be underdeveloped in relation to its potential. With the advancement of wearables and advancements in GPS technologies, it might be expected that there would be more evidence of the link between digital and physical play than was identified in this study. This has implications for the children's media industry, which could focus more attention on the development of links between digital play and physical skills.

5.3.3 Cognitive skills

The study outlined how digital play develops children's cognitive skills in a range of ways. An important stage in children's cognitive development is the ability to concentrate on stimuli, and sustain this attention over time. There were numerous examples in the study of this occurring, particularly in relation to game play. Most of the children most frequently engaged in competitive play with videogames (although this also prompted and combined with other forms of play). It was therefore of particular interest to note the ways in which this competitive play appeared to particularly support the development of the creative habits of being persistent and disciplined. The competitive aspect of the play involved in many of these games, in order to achieve a high score, motivated the children to continue even when the rewards were relatively low value 'in-game' sounds and rewards. Even where the visual design of these games was limited and there was no link to a known or favourite brand, the children did return to them and it appeared that the level of difficulty and short duration of the games was key to this. It is important to acknowledge here that, in the design of most videogames, apps and online games, the visual elements, duration, difficulty and functionality all aim to encourage this repeated use to ensure the game is commercially successful. Roblox and Fortnite are 'free to play' but focus on in-game micro-transactions for revenue. Whereas traditional games secure profit at the point-of-purchase, the 'freemium' or 'games-as-service' model depends on player retention in order to encourage in-platform spending using virtual currencies that are bought with real money, making the value of practising persistence in these cases costly. Much richer examples of competitive digital play came from engagement with videogames, where the purpose was primarily pleasure, rather than learning. Consistently in the data we found children playing with videogames such as Mario Kart, where they developed the habit of persistence by playing repeatedly despite frequent failure in order to improve their skills.

It is also the case that play with technology offers opportunities for executive function to be strengthened, which is important for learning. One element of executive function is working memory, which refers to the ability to store and manage the information required to undertake tasks. Some of the games played by children required a complex range of information to be managed, with information presented both visually and aurally. The ability of children to manage dense screens that contain a range of icons, symbols, texts and still

and moving images was evident across datasets, and children demonstrated the capacity to integrate new information on the screens with established knowledge to perform tasks. In addition, some of the games required the completion of a quick sequence of steps, which children frequently memorised so they could complete early levels of games in order to get to the next levels.

In addition, watching videos and television programmes and films sometimes prompted critical thinking and questioning, as the UK parent of a 3-year-old boy noted in relation to the programme *Thomas the Tank Engine*:

When he's been watching something that happened in Thomas, and then one of his engines was sad, because he was watching in the morning and he said, 'Oh, he doesn't ... he was sad because he didn't like the snow. And then he went up to his mum, his grandma, and he was saying, 'You don't like snow as well, so you're sad.' And then he was asking her about it as well. So I think it does help him to question things more.

Critical thinking is the process of making judgements about various forms of digital content and applying it in everyday living, and there was much evidence of this in the study. Many children were able to search for activities or tutorials online, then execute those activities in non-digital play spaces in the home or other physical spaces, such as the previous example of Sophia (11) (SA Family D), who filmed a cooking lesson on a wearable camera. Hence the move from digital to non-digital or vice versa demonstrates how comfortable children are as they move across these domains with the specific purpose of making sense of content and applying it in their daily lives.

Second, certain apps and games enable children to develop skills such as concentration, problem solving and flexible thinking. These were more likely to be evident when using open-ended games and apps, such as Minecraft and Roblox, as this example of Mallison (6) indicates:

Mallison had learned a lot about playing Minecraft since the previous visit, and it was interesting to see how quickly he was picking up new techniques and implementing them. A standout example was that during the visit he figured out how to make a 'bench' through contextual block placement. For those unfamiliar with Minecraft, certain blocks change their shape when placed depending on the

location on the target block that is selected when placing. A 'stair block', for example, looks like a regular small set of stairs if placed on the top of another block, or can be placed upside down if placed on the bottom of another block. However, if placed in a corner, the stair changes shape completely to follow the topography of the corner. Mallison learned this technique and immediately used it to make 'a bench', by deciding to put two corners on a length of stairs. He learned the rules of the simulation through accidental discovery before figuring out how he could use those rules to create something new.

(Field notes, Family 1, Visit 2, 28.9.19)

Figure 122: Mallison creating a bench in Minecraft



Videogames such as Minecraft have been the subject of a number of research studies demonstrating potential for collaboration (Burnett & Bailey, 2014) and identity work (Dezuanni et al., 2015), but what is clear in this context is the way that the design of videogames, the creative mode in Minecraft or role play mode in Roblox, can disrupt expectations and intrigue players to the extent that being inquisitive becomes the key mode of engagement. This would suggest that games designers should not be afraid to take risks in relation to creating content for children that breaks with the usual generic

conventions of games, and it demonstrates that regular changes and new aspects of game play can create more opportunities for being inquisitive. What is more, it is clear that educational games with rote learning as a key underpinning pedagogy can be quite limiting in terms of prompting curiosity, as was observed in this study.

Other types of videogames can also enable children to develop higher-order thinking skills. Karabo (10) (SA Family F), who spends a lot of his time gaming, talked about how Fortnite developed his ability to strategise in order to stay alive. He was able to identify how the learning he experienced playing this game was different from learning to play a musical instrument, and was distinct from the passive nature of watching videos. There was also an implicit acknowledgement of the time it takes to develop this ability, which he did not have when he began playing the game:

Okay, so I like learning on those things more than playing my recorder and guitar. Because when watching stuff, like I said earlier, all I have to think about is what video I'm gonna watch next. And for games, most of the time, I don't need to strategise, but in Fortnite, I need to strategise a lot with my team against 100 other players, including us though, and we have to strategise where we going and ... So after a few minutes, there is a place that you have to go in order to stay alive, cos um, when the game progresses, there is a storm, a deadly storm. And if you stay in that storm, you will take damage and eventually you will die. And so you have to stay in the eye of the storm. And you have to scout certain places you're going to land at first, and certain places you want to avoid, like back before Fortnite entered this new stage, chapter two. There was Fortnite, there was this place called Token Towers. And I wasn't very good at playing Fortnite back then. So I would always avoid that because that is a popular spot with lots of people. So I would avoid it. And at all costs sometimes even if I had to travel in the storm, I would avoid it.

In the following interview excerpt, Eshal (7) (SA Family B) demonstrated her higher-order thinking skills when, unexpectedly, she took on the role of the researcher and surprised the adults in the room. Fully aware of what the research practice entails, she turned the roles upside down and started interviewing the researcher with her wearable camera. This was an example of how creative tools can prompt activities which involve children being resourceful and inquisitive – important aspects of critical thinking. In the interview, she not

only asked investigative questions, but also enquired into the concepts of teaching and knowledge and challenged the idea that her teacher is as 'equal' as her interviewer. In fact, the conceptual enquiry that ensues is a philosophical play with ideas.

Eshal:

Okay, I wanted to know what you call her, so is it, do you call her Teacher Noreen.

Eshal:

We call her, we call her teacher or Ms Windfall.

Eshal's Sister:

Or Noreen Windfall...

Interviewer:

It reminds me of my work that I'm doing, because now I see her being a teacher, teaching children like you.

Eshal:

So, do you know more stuff than our teacher?

Interviewer:

Hmm, that's a very interesting question. I don't think I...

Eshal:

Or does she know more stuff than you?

Interviewer:

Well I think there might be some things that she knows more and there might be some things that I know more, it depends.

Eshal:

Or are you equal or not?

Interviewer:

I think that we're equal.

Eshal:

Why?

Interviewer:

Eh, I think that Noreen and I are equal because we are part of the same species.

Eshal:

What does that mean?

Interviewer:

We are both humans.

Eshal:

And...

Interviewer:

Do you think that we're equal?

Eshal:

No, I think because you taught her, you taught her lots of stuff, so you're supposed to know more stuff than her, 'cos you learn so you taught her stuff, so she also know the same as you, so you learning more than her.

Figure 123: Eshal in the role of researcher



This example is discussed further in sections 5.3.5 and 5.4.

Digitally enabled toys were something we expected to be of interest in terms of prompting curiosity and critical thinking, due to their relatively recent appearance. However, their impact seemed limited. In UK Family 3, for example, Stephanie (9) and Saskia (6) enjoyed showing off their robot, but as in a number of the other families who have such devices, there was some dissatisfaction. Stephanie mentioned an app she could use, in theory, to programme the robot to follow a map, but this was not something they had used or played with it because 'it costs money'. Other families shared similar frustrations which related to under-use or limited use of devices due to poor internet connection, often referred to as 'lagging', and other functional issues (although it should be noted that this is sometimes used as a parental strategy for closing down or limiting use of technology).

As outlined previously, voice activated devices or speaker assistants were used by the children in the study as a tool for answering questions or undertaking web searches for information, and supported the children to act on questions that arose from their own interests. These devices foster a great deal of inquisitiveness in children, which is important in terms of learning and development (Chouinard, Harris & Maratsos, 2007).

5.3.4 Emotional skills

Many parents identified that digital play led to strong emotional reactions from children. In South Africa, one of the teachers talked about the daily 'emotional outbursts' of a child she had to deal with in her preschool class. On the drive to school the child would be playing games on her mother's phone and would refuse to give the phone up. The emotional effects were felt for the rest of the school day. However, not all adults felt that such emotional outbursts were always negative. For example, a parent of a 7-year-old boy in the UK felt that this could be helpful in developing the ability to understand and manage emotions:

You can see every emotion in the world, you can see anger, you can happiness all at the drop of a hat. It's like one minute he can be, 'I love this Pokémon, it's amazing, it's done me that.' And the next minute it's, 'that Pokémon is so rubbish, why couldn't it help, why couldn't it do what I need it to do at this particular moment?' And there has been times when things have been thrown because you

know that they've either lost the battle or they've not found the right Pokémon in the right place or anything like that. The emotions are good and bad, but I personally think that's a good thing, I don't see that as negative, I think that's something that will teach them what life is and it also sort of what it's going to be like in the real world ... perhaps that's going to teach them in life that although they've done what they need to do they're not always going to get out of it what it is that they want to get out of it.

The UK parent of another 7-year-old boy had found videos that helped the child to deal with emotions:

It can be useful, depending on the content of the videos and games he plays, to help him come up with a way to relate his emotions. He does do this thing, which we're trying to get him out of, when if he's frustrated he will growl at you and we're trying to come up with better methods for teaching him how to deal with his frustration. But some of the videos we've recently found on the internet deal with emotions and try and teach you some productive ways to use them.

The development of emotional skills includes developing the ability to stay motivated in the light of disappointments and challenges. There were numerous examples in the data of children persisting in the light of challenge, as the parent of a 7-year-old girl noted:

Interviewer:

So, when playing with technology, how far do you feel that she enjoys trying things out and making improvements in general?

Parent:

I think she very much likes doing it. One of the games on my husband's Samsung tablet is you have to get a character from one side of the river to the other, and you've got to get a pathway and almost code it, programme it in. And she always used to ask for my help with that, our help with that, but now she's trying to do it on her own a little bit more. And you can see when she gets nearer or she can manage a more basic one, she's really happy with that. I think she really gets a lot from it. She does sometimes get a little bit impatient if she can't do things, or if she's not successful at a particular game. It does cut her off a little bit. But we say to her, you've got to keep trying. You can't just give up on things. So, she does like to keep challenging herself a bit.

As mentioned previously, there was also evidence that digital play activities can mediate the emotional well-

being of children, as it allows them to bond and spend time with family members. This is evidenced by an excerpt from a SA focus group where the children talked about playing with siblings, which provided a space for meaningful interaction.

Child 1:

My favourite game on PlayStation 4 is FIFA19. I verse my older brother then I win him then he get cross with me and if he wins me then I also get cross with him

Interviewer:

And what do you like about playing with your brother?

Child 1:

It's fun because, I don't really have friends but I spend time with him and play games.

Child 2:

Because I'm watching Anime with my brother me and my brother love Anime and that's how we bond, like we bond when we play games and when we get new games and that and when we on our phones. This one time when we were playing subway surfers and it was load shedding [a power cut] so we made a contest who can make the most money so I won.

These examples are from a setting which is located in an area plagued by gangsterism, drugs and a high incidence of violent crimes. This raises the question as to what extent children adopt protective roles in these hostile spaces. In another example, a teacher described a child's choice to come to school dressed as a superhero for Occupation Day rather than a conventional occupation.

He was the only one that that came dressed as Superman. So I've asked him 'So Sihle, why're you Superman?' He was like 'Well, so policemen don't do their job. So I'm going to be the vigilante.'

The discourse and practice of vigilantism is strong in some South African communities who feel that the police have failed them and have taken 'policing' into their own hands. This is one example of how digital media can have an important role in fostering the mental well-being of children.

There was extensive evidence across both countries, therefore, that digital play has an important role to play in the development of emotional skills.

5.3.5 Creative skills

Creative skills are considered key skills for the 21st century and research suggests that when children are taught in environments which nurture creativity, higher academic attainment is achieved (Davies et al., 2013). Although the concept 'creativity' remains a broad, complex, multi-faceted and fuzzy one (Aguilar & Pifarré Turmo, 2019), there seems consensus in that it requires individuals to be innovative and imaginative when bringing together pre-existing knowledge with new knowledge in the creation of things that did not exist before. Creative thinking is an important aspect of creativity and it is a kind of thinking that processes experiences and makes them meaningful (as opposed to critical thinking, which is more guided by truth) (Lipman, 1991). It is difficult to ascertain what exactly the sources are for creativity. It is not that originality, imagination and innovation are not important, but they are not the source, merely the product of creative thinking (Lipman, 1991: 193). Creative thinking is governed by the context (Ibid.), and in the case of nurturing creativity this means creating 'the problem conditions that the students will have to think through themselves if they are to become independent and creative thinkers' (Lipman, 1991: 199). The findings of this study suggest that the development of creative skills is observed in both digital and non-digital environments, as well as in the subjects' seamless moving in between these spaces. Often the transference of the physical world is mimicked in the online world as children in this study enjoyed building, constructing and drawing, and very often these drawings found their way into the digital world. Children are comfortable moving from digital to non-digital artefacts or vice versa with a specific purpose of making sense of content and applying it in their daily lives. The digital ecologies in the children's homes enabled this type of movement in both the SA and UK contexts.

Digital tools have a range of features that can foster creativity, although sometimes it was the apps and games themselves, not particularly the devices that the children played them on, that were important in this regard. The value of games such as Minecraft has already been discussed in relation to critical thinking, but such games foster creative skills, as a researcher's field notes from a visit to Family 8 indicate:

When asked if she ever learns anything from her play, Cerys said she has learnt to be 'more creative'. When asked how, she said, 'Well ... in Minecraft I can really make anything'.

Jeremy chimed in here and said he's sure he learns from playing, but also that he wasn't sure how; after a small pause, he said, 'Games are probably how I got my power of imagination'.

(Field notes, UK Family 8, Visit 5/6 11/12/2019)

Coding games and apps enabled the creation of new games that others could play. For example, we found examples of children who were able to code and build games quite quickly using their current devices, and often with free apps. Children were observed to build their own game play environments in Roblox as well as on the Xbox game console, and were able to play these games with family members. Some of the children had undertaken some animation and coding activities using computers at home, prompted by opportunities to learn how to use key pieces of software at school. In an example of animation production shared with the team, it was clear that a range of creative skills were required in order for Simon from UK Family 4 to complete the work. Simon¹⁵ explained that he had been taught how to create animations at school: 'In infant school we did it.' Although the data did not show Simon making the animation, there was evidence of the way the process prompted the development of imagination. It is very hard to create animation individually and when Simon attempted to make an animation at home he asked his mum and younger brother for help. He used LEGO figures to create his stop-motion animation in exploratory and intuitive ways: 'I use LEGO and just do random things.' Simon¹⁶ described how he used his hand to make the character look like he was falling and explained he made a second version because his mum showed him how to do it without having his hand in the frame, by placing the character at the edge of the shot. Simon interested Harvey in animation and they described liking things because 'You can make anything you want'. This more open-ended creative activity enabled the boys to explore favourite ideas and use their imaginations in ways that are not as possible using closed-ended apps and games.

This form of creativity is also demonstrated in children's forward-thinking abilities, as many of the children offered ideas for future technology which they would like in their daily lives. The teachers and other adults in this study created environments that nurtured creativity by provoking 'the problem conditions that students have to think through' (Lipman, 1991: 199). In the datasets we found various examples of children being in charge and

initiating creative processes. For example, when playing with LEGO bricks, Zuko (aged 6) guided his mother Carla (SA Family A) in constructing a new toy:

Carla:

You're having to take all my work apart, I thought I was doing it all wrong. Hmm, seems. That's okay, that's how I learn. Not that piece.

Zuko:

Wait, wait, wait, wait, wait, wait, wait, wait.

Carla:

Can those be the feet?

Zuko:

Yup. Yes, yes, yes, yes, yes and now do you know what you have to do? You have to make a diamond.

Carla:

A diamond?

Zuko:

Out of little LEGO guys.

Carla:

Look at that, I can see the diamond.

Zuko:

Yup. Half a diamond.

Carla:

Okay. I need to focus on making a diamond.

Zuko:

You need like one guy, two guy, three guy, four guy. You need to make four guys to make a whole diamond.

Carla:

So, I'm focusing on that.

Zuko:

Focus Mom, if you get distracted, you might just look at that and do your work and when you show me it, you might just make a rocket.

Carla:

Then we in trouble eh? Then we got trouble, I'll be doing the wrong thing.

Zuko:

Don't say that, you could just distracted by what you're talking about.

Figure 124: Zuko (6) is guiding his mother in creating a new toy



Creativity requires a safe environment for nurturing confidence and courage, as is clear in Zuko's dialogue with his mother. In the SA datasets we found quite a few examples of children's lack of fear in, for example, reversing adult/child roles (Eshal (7) role playing the interviewer (discussed in Section 5.3.3)) or creating their own ways of working with the materials brought in (as e.g. in the case of Henry's (8) ball in Family C) (see Section 3.1). It also shows that when there is a lack of resources, children are very capable of creating their own games with materials that are available to them, such as sticks, stones and paper, but also imaginary friends.

More open-ended digital tools, often associated with a particular creative process such as photography, appeared to offer the deepest engagement in developing a cross-section of creative skills. So, for example, when the children were using YouTube tutorials or more open-ended apps designed to support drawing rather than only colouring or cutting out, the possibilities for creative play were more expansive.

Simon, for example, from UK Family 4,¹⁷ was observed drawing while following a YouTube tutorial which he paused every few seconds to enable him to catch up with each line in his own drawing. In this instance he was drawing a 'Wimpy Kid' character and it was the series illustrator on YouTube whose tutorial he was following. The step-by-step structure of the tutorial and the ability to pause the phone ensured that Simon's picture was well crafted and that he was prepared to practise. As the tutorial progressed, however, he lost interest and began to do his own thing: *'I sometimes just draw something random.'*¹⁸ The YouTube tutorial seemed to offer more possibility for the crafting and improving involved in being disciplined, but also for the development of imagination which, in this case, led Simon to create something which had some originality due to the use of intuition. A similar pattern was seen in relation to music. For example, apps such Go Noodle provide a guided dance sequence which can be physically followed, which was popular with some children. There is a tendency for this sort of app to encourage iterative learning, which requires discipline and persistence – both important aspects of creative thinking (Lucas, 2016).

In relation to the visual arts and design, some of the girls in the study engaged with colouring or fashion apps, which often involved them in working with existing assets, so colouring in a line drawing, or cutting out an item of clothing and dressing a model with it. These apps are, perhaps, designed to be simple and accessible for younger children and their design enabled the children to gain strong satisfaction from the final product. Although there is clearly a value to these sorts of colouring apps, especially in terms of offering satisfying finished pictures, they offer relatively limited opportunities to progress in developing creative skills. It should also be noted that many of the apps observed were quite gendered in terms of visual design, using features that tend to be associated with appeal to girls and this, alongside the low levels of difficulty, means they are not providing sufficiently rich opportunities for developing creative habits of mind.

Cameras were another form of creative tool that was widely used in the study, partly because children were asked to take photographs and films using GoPro cameras, but also because many children enjoyed using the camera function of smartphones and/ or tablets. There are many examples in the data of the children taking photos and in some cases appropriating digital

devices such as audio recorders, used for the research, for their own ends, as was the case with Eshal (7) in SA using the camera as she took on the persona of a researcher. In UK Family 2,¹⁹ Chloe (4), one of the youngest children in the study, picked up a pink digital device shaped like a camera (but with other functions available) to take a photo of her dad and then looked carefully at the resulting picture. Without taking her eyes off the image, she walked back into the front room to show the researcher the image. She used a zoom lens and a colour filter, which she said *'makes it scary'*. In doing so she was being imaginative, practising her craft and using intuition to develop photography techniques, and using the affordances of the device to reflect on and alter meaning through her use of the zoom and the scary filter. She was also being inquisitive, acting on her ideas about how an image can be created to make meaning in particular ways, rather than following direction. As the person who was holding and controlling the camera, she was also playing socially but with mastery of her environment. This contrasted with her engagement with two musical devices on other occasions, where she more intuitively made noises into the mic to see how her voice changed, and hit the keys of a keyboard with the palm of her hand to make noise. In the use of the camera, Chloe's approach was more disciplined and intentional, and this is clearly an activity she returned to regularly, indicated by the number of photos and selfies she took using the device.

What we found in the SA data was many examples of creative play with one of the most popular devices: the cell phone. This kind of 'boundary crossing' between functions of one device has shown to be very productive for children's playful encounters on their own or with others around them – whether imaginary friends, peers, teachers or parents. We were particularly struck by children's ideas when adults facilitated through the asking of open-ended questions that inspired children to continue building on each other's ideas in the focus groups. Children's digital ecologies are entangled with the relationships they build with significant others and these include the researchers and the socio-material resources available to them.

Creativity did not always revolve around the digital tools used, of course. The ability to explore and express one's imagination through play is an important aspect of creativity. A considerable amount of the imaginative play observed in the project took place away from

digital devices and content, although these were often drawn on as cultural resources, or invoked as items from everyday life in sociodramatic play. Children described playing out scenarios from favourite videogames such as Minecraft in their offline play. In UK Family 2, for example, where the two sisters were in their bedrooms playing with dolls, they used YouTube to find YouTube vlogs about 'changing a diaper' to model their play. One video they watched was American and another Japanese, but they were similar in the sense that they shared or modelled play with commercially available dolls, explaining how they 'cry, poo and wee and are cute'.²⁰ It is interesting to note that this is not play which emerges from watching media content, as frequently found in Scott (2018a); rather, the girls were able to use their tablets to find media content that related to what they were playing in the moment. This mirrored their interest in the programme Paw Patrol, which also models play with toys, and this is a distinctive example where the children were actively seeking further cultural resources to enrich their imaginative play.

A further example of technology-inspired play related to the PS3 WWE Smackdown game, which Della (6) and Linton (6) (SA Family E) drew in their diaries. On the video we see the researcher discussing the diary with Della, and she asked about a hand shape on one of the pages. In response, Della turned the page and began to draw what became a second glove. Della's joy was expressed as she drew and allowed the drawing to gradually appear, rather than explaining. The researcher and her older sister played into her guessing game.

Figure 125: The researcher asked Della about the large hand on the page



Figure 126: Della silently drawing in response to the question



Della:

It's just for me and then you buy a glove like that.

Interviewer 2:

Is it a glove?

Interviewer:

Oh, it's a glove! Is it knitted?

Della:

Um, no.

Interviewer:

No. It's got jewels on it? Pearls?

Della:

Yeah.

Interviewer:

It's a glove with pearls on?

Della:

Yes. Real pearls. Real ones.

Interviewer:

Real pearls?! Wow! So you're gonna fill this whole thing with pearls?

Della:

hmm mmmm.

Interviewer:

Okay.

Linton:

[inaudible section], *the colour it's still white.*

Della:

Yes, I know.

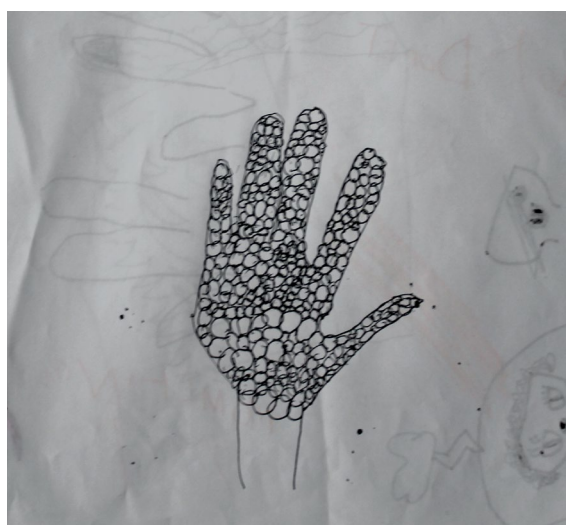
Interviewer:

Oh wow, I can see it coming now ... the pearly, pearly, pearly, pearly glove.

Della:

It will take a long time.

Figure 127: Della's WWE-inspired pearl glove



There was evidence of videogames providing an imaginative engagement, as children in both countries, for example, imagined themselves as footballers while playing FIFA. The value of games and apps as providing opportunities for play has been demonstrated (Marsh et al., 2015), but the particular opportunities for the development of imagination in relation to the creative have yet to be fully understood. On the surface, the playing of videogames such as Mario Kart or FIFA does not appear to invite rich role play, but on closer inspection they involve the adoption of existing fictional characters

and the exploring of the implicit social rules involved in being that character, and as a result offer opportunities for deep immersion and mature play, which is thought to be most important for cognitive development such as self-regulation (see Bodrova et al., 2013). Sicart (2013) claims that while it is impossible to 'be Messi' (a popular professional footballer who appears in the game FIFA and plays for Barcelona football club), it is possible to achieve what Messi achieves through impersonation. Here knowledge of actual players, the skills they are renowned for, their player position and so on, contribute to success in terms of competitive play, but they also deepen the extent to which this form of play becomes role play, dramatic play and deep play. In the FIFA game they are not only a player but are also involved as managers who lead a club to success or failure over the course of an entire season. Moreover, the game world may offer a relatively safe space to retreat to when a child's own team loses (e.g. you can have two of your own teams play against each other, so you cannot lose).

This protracted role play above provided the children with opportunities for what Dezuanni et al. (2015), drawing on Butler (2009), describes as bringing themselves into being in a game world where they have rich opportunities to be imaginative. This involves playing with possibilities, making connections and being intuitive in systematically procedural ways that are not currently readily available to them in the material world as children. Mitgutsch (2013) presents the 'playographies' of sports videogame players, arguing that videogames, hometown teams, passion for sport and physical engagement with football are all connected. Added to this is the importance for some families of sibling rivalry, and the way in which the videogame gives a different opportunity to be successful outside the physical game. Pretend play provides an important context for play and as Robson (2014) argues, this form of play is the most likely of any activity to lead to high levels of creative thinking, involving purposeful actions and self-regulation (Bodrova et al., 2013).

Voice activated devices also proved to be an interesting tool in relation to developing imagination. Often the devices were used to play music, and this supported imaginative and creative play, especially singing and dancing, as described previously. As ephemeral as much of this play appeared to be, the affordances of these devices seemed to offer considerable potential for being imaginative, at least in terms of playing with

possibilities, so that the children could use intuition and make what they themselves described as ‘random’ connections as a means of being funny.

For the Reggio Emilia inspired SA schools, it was clear that the children were treated as rich, resilient and resourceful (Rinaldi, 2006). The creative skills of the teachers to listen to the children and to use digital technology and the other ‘100’ languages (Vecchi, 2010) was the means to nurture creative skills in the children. This is discussed further in Section 5.4. Importantly, these skills are developed by listening to children’s interests in order to co-create – as indicated above – ‘the problem condition the students will have to think through themselves’ (Lipman, 1991: 199). One of the SA teachers explained it as follows:

Noreen:

Well, my choice in terms of how I, what I use for digital technology, is obviously based on my limitations of what I have accessible to me but based on what I have accessible ... I make my choices based on what the children are giving me so if they showing an interest in something, like some last week they started to show an interest in, we did flowers and the interest became about insects and their relationship to flowers and we read a book about insects, and I’ve been trying to do a lot of listening activities to get them kind of focused in on their listening. So, then that’s what that choice was influenced by, to then do a, find a YouTube clip with insect sounds. And so, there were still images there weren’t moving images about insects and still images of insects with the sounds accompanying it, so that the children could experience, the sounds, in that way, yeah.

Interviewer:

So, you would say that the technology gets brought into the process, um, once the children have started showing interest in certain things

Noreen:

Yes, exactly.

Interviewer:

So, it facilitates from that angle.

Noreen:

Yes, so it supports that, but it doesn’t kind of drive it.

These examples make clear that any investigation into children’s creative skills when using digital tools should include the role of the adult and the social more broadly speaking. This includes the relationships between people, communities and cultural artefacts (Glăveanu, 2010), which are generated in, and which promote, creative processes as not purely a solitary journey (Elisondo, 2016). The role of social and cultural influences in developing creative skills is increasingly acknowledged (Hennessey & Amabile, 2010) and this includes the questions we ask as adults. In particular when examining transcripts, we noticed that this interviewer’s questions made it possible for the child’s creative wondering about the world (and beyond!) to be expressed and extended. Taken from the home visit interviews, the interviewers’ questions in this transcript are emboldened to show the pivotal role they played in opening up and continuing the dialogue, leading eventually to Eshal suggesting an internet search:

Eshal:

Everything in the world. Why is the world green when you go to space? The world looks green on this side and the water looks blue. Why does the land look green?

Interviewer:

Do you know the answer to this one?

Eshal:

No, my mommy doesn’t even know.

Interviewer:

How do you think we can find out? Do you think I know the answer, is that why you’re asking me? So, I wonder, my idea is that, there must be grass or land.

Eshal:

I think, I think there’s another layer there in the sky, that’s what I think.

Interviewer:

Tell me a little bit more.

Eshal:

So, when you go up in the sky, then there’s another layer. So, then the third layer, I think it’s the green, at the top.

Interviewer:

So outside of the Earth you’re saying, there’s another layer.

Eshal:

On top of the sky. So, when you go way up, you go across a green thing. So, then there's another layer. Then you go up past the layer. So, for instance, make like this is South Africa. Here's the sky, now there's another layer, now you go up through the layer.

Interviewer:

Ah, so my hand's Earth, and then what did you do? With the next layer?

Eshal:

And then I put my hand here like there's green on top. And then you go up to space, like...

Interviewer:

And then where's the blue?

Eshal:

The blue, the blue is here.

Interviewer:

Inside, the Earth?

Eshal:

Yeah.

Interviewer:

So, is the Earth blue?

Eshal:

No, the Earth is blue on the inside because it's the sky and then on top.

Interviewer:

But if the sky is part of the Earth you're saying?

Child:

Hmm and then there's another layer on top of the sky, so like this is the Earth now. This is the Earth and the sky is around and then there's another layer that's the Earth around here.

Interviewer:

Whoa.

Child:

That's what I think.

Interviewer:

Now I'm wondering, how do we find out about the right information then? If your mom's got an idea, I have.

Child:

Let's Google it.

The responsive listening by the adult and the respectful relationship between the two makes it possible for the child to bounce off ideas and to create new ideas together. It also encouraged the child to take initiative and do further internet searches. Publishing the dialogue at length shows how clearly the adult's patience and genuine interest in the child's ideas made it possible for Eshal to express her theories about the world – a world that could become the next game world if children were involved in its design. The questions adults ask make it possible for children to become co-researchers, as is clearly exemplified here and as a salient research result further explored in Section 5.4.

The children themselves also set boundaries between what is possible and impossible. Commenting on his own work (gesturing to the Figure 128) one child commented: *My craft is these Teleporters that look like that.* After which the interviewer asked: *And what does it teleport?:*

Child:

It's like...anything that walks through it will come through the other end.

Interviewer:

So, the thing must be alive to be able to walk through?

Child:

Yeah.

Interviewer:

Okay. So, non-living things can't teleport?

Child:

So, like a brick can't go through.

Interviewer:

Ah, so there are some rules about what can teleport?

Child:

Yeah.

Figure 128: A teleporter

On the other hand, as a child in an SA Grade R class remarked: 'Anything can be possible if it's not possible.'

The same focus group questions invited imaginative and creative ideas about inventions. The children as a group worked in a democratic way to listen to one another, share knowledge and build on each other's ideas, as seen in the example below:

Interviewer:

So, I'm wondering, if you go to choose and make your own device, what would your device do?

Child 1:

I know, it can, it can tuck you into bed.

Interviewer:

Ooh, it can tuck you into bed. What would it look like then?

Child 2:

It could dress you.

Interviewer:

If you were building it, what would it look like?

Child 3:

It would look like a robot who can do anything for you, it goes like, I will do anything for you, Master.

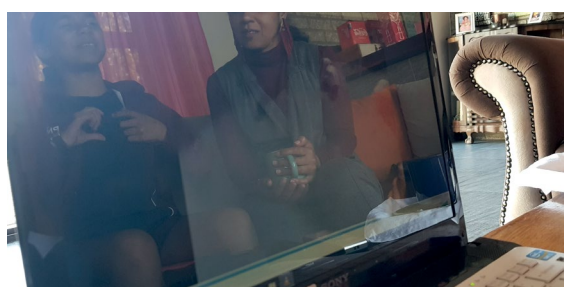
Interviewer:

Oh, so it would be a robot that could talk.

Child:

Yes.

In Figure 129 we can see Sophia and her mother from Family D through the reflection of them on the laptop screen. Michelle and her daughter Sophia had a vibrant discussion about how technology could help humankind, and at the same time how digital devices could be dangerous.

Figure 129: Sophia and her mother co-creating

The examples in this and previous sections confirm that digital play provides multiple opportunities for developing creative skills, although there are clearly some considerable differences between the types of offer that different devices and content make available that are worthy of note. The more open-ended and self-directed the digital play is, the more children are able to develop a range of creative skills, as was outlined in the UK data in relation to videogames such as Minecraft and coding games such as Scratch, but also in drawing and colouring apps.

Interestingly, counter to the usual discourse that schools lag behind technology used at home, there was evidence in some of the families that creative engagements with technology such as using Scratch to make games or stop-motion animation production was introduced at school and undertaken at home as a result. Schools can therefore play a key role in prompting sustained creative activity using applications such as Scratch and stop-motion animation, which enable children to undertake further digital text productions at home.

5.3.6 Holistic skills and transversal competencies

These examples indicate the range of holistic skills that children develop when engaging in digital play. UNESCO²¹ has developed a model they refer to as 'transversal competencies' which, in addition to some of the skills outlined above, such as critical thinking, creative skills and interpersonal skills, includes such competencies as media and information literacy, and global citizenship. There are numerous ways in which digital play can develop these kinds of competencies. Children develop key information literacy skills as they learn to conduct searches on the internet or organise information to place into a presentation. In terms of global citizenship, the networking element of the internet offers multiple opportunities for the development of an understanding of oneself as a citizen in a global, multicultural and

multilingual world. For example, a number of children in the study reported playing with unknown others from across the globe on console games and platforms such as Minecraft and Roblox, with friendships being struck in some cases with children from other countries, thus providing the opportunity to learn about other cultures and develop tolerance towards others. At the same time, the inclusion of SA in this study creates crucial awareness of digital inequality (van Dijk & Hacker, 2003). Certain parts of the world are more privileged than others in terms of infrastructure, digital tools and internet access, and many children are excluded from such opportunities in less affluent countries. (For a discussion about this 'digital divide', see Section 4.1; see Appendix 1 for how this divide influenced the research methodology.)



5.4 Digital play in the classroom

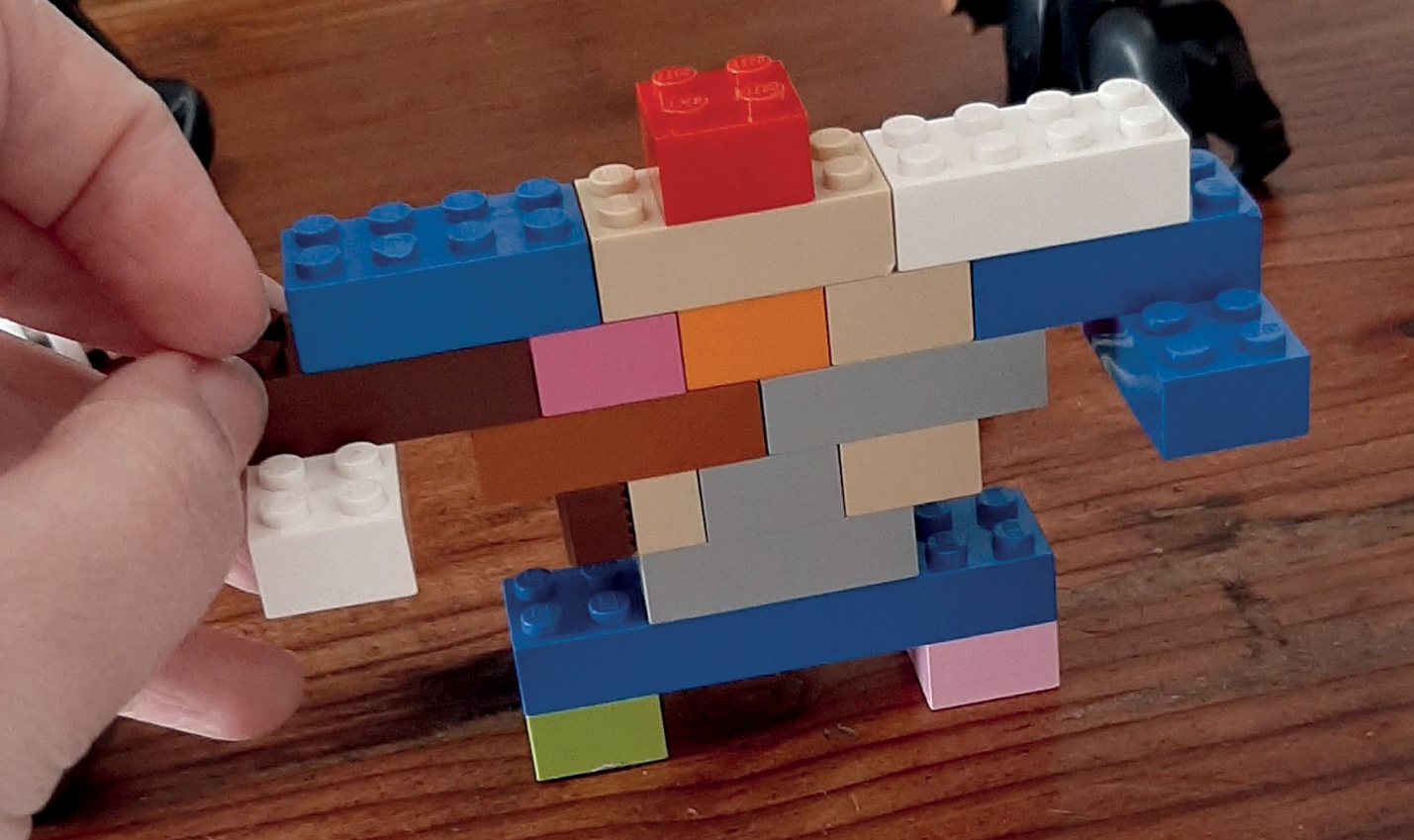
Schools across both SA and the UK offered children a range of opportunities for engaging in the use of digital technologies in the classroom. In the UK, there was a marked difference between the school practice in relation to the use of educational technology in this study as compared to a study conducted five years ago on play and technology in young children's lives (Marsh et al., 2015). However, in some cases, there did appear to be an over-reliance on programs that offered limited opportunities for play and creativity, and were largely focused on drill-and-skill activities. In addition, in some schools, teachers were not knowledgeable about children's home uses of technology and so did not build on this prior knowledge in effective ways. On the other hand, in both countries, there was evidence of teachers learning from children in order to create an emergent enquiry-driven curriculum that includes children's own ideas.

In South Africa, for example, Zuko's teacher (SA Family A) and Henry and Eshal's teacher (SA Families B and C) (Henry and Eshal are in the same class), both work in government schools. The two schools are located in socio-economically distinct neighbourhoods but both teachers are inspired by the Reggio Emilia approach to early childhood education. Both teachers are also trained in Philosophy for Children and the two approaches resonate with one another (Murris, 2016). Technology is one of what Loris Malaguzzi would call 'the hundred languages of children'. The metaphor of 'The Hundred Languages' is the title of a poem with the same name written by Malaguzzi. It is inspired by a political discussion in the 1970s in the city of Reggio Emilia (Northern Italy) about the reasons for, and consequences of, privileging two languages only: reading and writing (Dahlberg & Moss, 2010). The metaphor refers at one (practical) level to the introduction of material-discursive tools for meaning-making in schools, such as visual arts, physical movement, video, digital cameras, augmented realities and computers. At a symbolic level, the hundred languages are, as early childhood educator Carlina Rinaldi (2006: 175) puts it, a 'metaphor for crediting children and adults with a hundred, a thousand creative and communicative potentials'. Creativity exists in all languages, including mathematical and scientific languages (Rinaldi, 2006: 176), and Reggio-inspired schools orchestrate a wide range of cognitive and poetic

languages (especially the visual; see Vecchi, 2010). Rinaldi reminds us that the physical space is another strong language that constitutes thought, although its 'code is not always explicit and recognisable' (Rinaldi, 2006: 82). She points out how reading 'spatial language is multisensory and involves both the remote receptors (eye, ear and nose) and the immediate receptors for the surrounding environment (the skin, membranes and muscles)' (Ibid.).

In the South African datasets, it is possible to discern the attentive listening of two teachers in particular and how they use the technology at their disposal as another language. The technology (mainly camera, video and computer) is used to compose the curriculum. The ideas expressed in the first instance by the children (and which are constantly changing) are taken up by the teacher, who uses photography and video to make children's learning visible so she can share that with the children themselves, who in turn become aware of how they learn and what they have learned (higher-order thinking) and in turn generate new ideas for further learning. The teacher who, like everyone else involved in the educational process, is there to learn together, shows different potencies of the technology that is present in the classroom, even when it is not directly mobilised with the children. In an interview, one teacher explained her use of technology to create the curriculum in this Reggio Emilia manner:

I don't use a lot of technology in the class, but I use my phone – my phone's always on me, and I'm always taking pictures, and it's, it's interesting because children are aware of that, and they'll like ... if I've left my phone behind for art, someone will run back like 'Mr Joseph!' especially if you've left your phone. Because he knows that I like to take pictures, and I'll print them, and they'll go on display at the back on the back wall there. So I take pictures of them, learning and then they engage with that. So they don't engage with it through the phone, well they do because they've been photographed. Then they engage with the pictures that are then printed and put on the wall. And we're constantly changing those. And so, in terms of curriculum, I'm taking what's in the curriculum or what's, like the theme or the phonics we're learning about. And then I'm trying to find ways through technologies to find inspiration. We don't have much technology in the class,



other than my phone, but we have just very recently got a fancy thing called the Illuminator, and it's like a modern day, overhead projector. So then I set it up yesterday. No two days ago, I set it up.

There was also evidence in some of the UK schools of teachers using technology in creative ways to foster learning. Hanif (9), in UK Family 9 was observed in the Forest School area of his school, where the children made films on iPads. The observer's field notes make clear how this exercise was set up by the teacher to enable the children to be independent in the use of the devices:

The class topic was the Romans and the children, working in groups, were invited to make a trailer to encourage people to join the Roman army. The teacher reminded the class that last year they had learned how to use iMovie. At the mention of iMovie members of the class called out 'yeah!' excitedly. She then said she was going to show them a video of a 'man' that would hopefully remind them of how to use it: 'There shouldn't be anything new.' She let the class know that this video was made for teachers, so might be instructing adults about what to do with their students. She started to play the film on the class smart board from her laptop, stopping it at points to reaffirm what the presenter was saying. She began by saying that the app should be in 'trailer setting', and this was very important. She said they should select a trailer for 2–6 people. The video recommended putting it on 'Family' setting. Hanif was sitting watching the screen attentively at this point. The teacher told the class that when making their trailers they should adopt a fake name so that she could put

them on the school blog: 'You can't use your name'. The teacher paused the video to talk about the storyboard and went through the kind of shots they would be doing, e.g. landscape, action, close-up. She said that the app would put it altogether for them. When the presenter mentioned icons on the video as he was doing the walk through, the teacher would walk over to the screen and point to them so the children were clear about where they were. Their task was to create a trailer to encourage people to join the Roman army.

(Field notes, 21.11.2019)

Because the teacher scaffolded the learning in this session effectively, the children were able to work independently in the Forest School, producing films that demonstrated a good understanding of the design and editing process. After every section filmed, Hanif's group watched back what they had recorded, deciding whether or not to film that section again, if there had been a mistake, if they didn't like what had been filmed, or the shot was wrong, e.g. missing someone's head off the film. This level of critical reflection had been made possible by the framing of the session.

Teachers also used technology to plan for lessons, as this SA teacher noted:

Okay. So, so a lot of the sort of inspiration I get for the planning I do is inspired by other teachers so I love to follow like other teachers on Instagram, for instance, and teachers, I follow like Reggio tags and I follow specific teachers, and I follow something called calm classrooms

and Yoga for Children and all those things. And being exposed to the broader network of teachers through technology allows me to kind of see other ideas that I might not come across and then I implement them or implement parts of them. And then, part of the being part of Instagram community I guess is that I also do a lot of the Instagram-ing for our schools ... I put a lot of stuff up, and then getting responses back from people with discussions from people.

This use of technology was reiterated by the other teacher (SA Family A):

I mean a very practical thing is our planning is all on Google, the Google Drive, so as teachers, we all plan once a week, and we insert our planning into that. Our termly plan is also put on there. So that's a very practical thing. I mean, we show videos, we do use YouTube videos, and that helps ... we've got a website...

In the UK, teachers also collaborated to drive forward practice, as Heather, the teacher of Noah (9) in UK Family 10 noted:

I think we're quite lucky here in that if there is something exciting that we find as a school, it's very quickly rolled out within the school. If, if it works for you and your class we, we tend to have ... each teacher will be running their own research project as they're teaching, and it can be anything. But alongside that, if you find something useful, it's then shared out ... So there's all sorts of websites and things that we've noticed that are good, so you might mention it in a briefing to, to go on this website, or you'll mention that there's a free sign-up for this, you know, something else that ... will often get passed around.

Heather was one of the teachers in the UK study who built effectively on children's digital knowledge and skills acquired outside school, and let children bring in digital products they had created at home to show the class. She also could respond effectively to needs and create an IT curriculum that could challenge children, as was the case with the teaching of coding:

When I realised how much they could pick up, because it was very quick ... very quickly discovered that actually they, if they could have these basic core skills then they could apply them all over the place, and they were using much higher levels of, of code and, um, of pattern programming that perhaps I, we'd, anticipated ... So then

I had to go away and have a look and see, actually, do you know what, they could probably handle... And they created a whole game ... We did the flowcharts, and the if/then, whatever. The variables, they all decided... And I didn't think they'd be able to... I mean, that's in the Key Stage 3 curriculum [for 11–14-year-olds]... So then we had to dip into that. Yeah, we had to dip into that to then go, do you know what, let's push. If they can handle it, let's go for it. And obviously it's some more than others, and we scaffolded it quite a lot. But seeing how fluent and fluid it was, and how easy it was for them to keep going, and how they got it, and the problem solving, the debugging that they did, we went with it, we rolled with it, and we did a whole different scheme that we didn't realise we were going to do... So we kind of had to go back to the drawing board, re-plan it, and come back.

This approach, which recognises the range of skills and knowledge children bring with them to school from home and community, and responds effectively to that, is one that is needed increasingly in a time in which the nature of learning is being transformed through the opportunities children have for digital play. When, for example, children can fact-check their homework on devices such as Alexa, Google Home and Siri, then the kinds of tasks they are given by teachers to extend their learning outside of school need to take these practices into account.

5.5 Summary

This study offers extensive evidence that digital play can foster the development of subject knowledge, digital skills and holistic skills. Inevitably, the extent to which digital play episodes support such learning is constrained by factors such as adult–child relationships, the context in which the activity occurs, and access to and the quality of the digital resource being used. In relation to context, for example, it is recognised that children’s playful learning is enhanced when they receive appropriate adult support (Zosh et al., 2017), but there was also evidence that solitary digital play can be a valuable means of learning. However, as the examples and analyses in this section suggest, individual competence depends on certain learning environments in and outside the home. Not only human intervention, but also the digital tools, can offer the scaffolding and support that children need in order to learn, if it is designed effectively. What this section also shows is how the development of holistic and other skills depends on adult intervention and the creation of environments that are relatively free of fear, both inside and outside the classroom. Examples of classrooms where teachers and other adults listen to children’s speculative wonderings and ask open-ended probing questions offer an idea of what can be possible, even in resource-challenged environments. Learning through digital play depends on the relationships children build with significant others, and that includes the quality of the material resources available to them, as well as the kinds

of questions teachers ask in class to create an enquiring and democratic learning environment. Some teachers involved in this study used technology as another ‘language’; that is, another means to co-construct new knowledge with children and made possible through the digital. One of the findings is that connectivity does not only depend on infrastructure, finance and internet access, which is severely compromised for children living in poverty. It also depends on human connectivity, e.g., peers and adults in meaningful co-play, co-researching with the children, thereby nurturing and developing holistic skills. This section includes powerful examples of children’s courage and creativity as they move seamlessly between digital and non-digital environments, even when living in poverty.

The desirable design features of technology vary according to the device and context, but the principles of universal design that lead to effective learning (CAST, 2011) need to be taken into account in any use of technology for learning purposes. There is also a great deal of incidental learning that takes place when children play on digital devices. Nonetheless, this does not mean that an approach in which children are left to always play on their own with devices is advocated. Sometimes, children need this independence in play but at other times optimum learning will occur when adults co-play. This is discussed in more detail in Section 7.



Section 6: The five characteristics of learning through play

As identified previously, the LEGO Foundation's Learning Through Play Experience Tool led to the development of deductive codes that were applied to the data,²² and it was evident from this analysis that all five characteristics can be identified in digital play, as the following overview indicates.

6.1 Joy

Play can engage the emotions in a range of ways. Ultimately, play must be satisfying for the individual and offer pleasure. Play must also be motivating if the player is to sustain interest in it, and it is worth bearing in mind that this might be after experiencing initial frustration. An achievement is often even more satisfying and joyful when preceded by a determined effort to succeed or solve a problem. This kind of satisfaction is closely linked to tenacity and flourishing. Joyful play is sometimes challenging to discern, as external bodily signs may not necessarily be in evidence, particularly when children are using technology. Frequently, when children are using tablets or screen-based devices they can be observed focusing intently on the screen, with no visible indicator of joy, yet the children would identify the experience as joyful. Therefore, when analysing the qualitative data in this study, the team was careful to avoid making judgements about emotional engagement using only bodily indicators. Instead, the team identified joyful encounters with technologies through observations of physical reactions (e.g. smiling, engaging others), but also through a process of talking with children and parents about children's engagement with technology in play, and through observations of the play episode itself.

Across the datasets in both countries, there was extensive evidence that digital play brings much joy to children. This occurred even when, as we have

suggested, external indicators of joy were absent, as this parent noted in Family 2 when she and a researcher were observing a child's play:

Interviewer:

Looking at Chloe (4) now, she's completely engaged.

Parent:

No expression. But there's not too much expressions of emotion here, it's just a real concentration and an intensity I would say there.

Interviewer:

Does she ever sort of shout out or say stuff like, 'Oh I've got this!', or you know is there any sense of pride or?

Parent:

Yeah. When she achieves something you'll hear her hoop and yay about it and try and explain it to me and show me what she's done.

Throughout the data, parents and children used the word 'love' frequently to describe digital play, as well as non-digital play that was related to the digital world. In the same home visit as above, the parent noted that she allowed Anna (6) and Chloe (4) to watch unboxing videos on YouTube:

They love all of that and they even imitate that when they're playing together. They'll play Kindle, because it's a Kindle Fire that they've got so one of them will sit on a chair holding the Kindle, pretend, and one of them will sit there going, 'Hey guys, so today we're going to be doing this' and imitating the voices and I'm trying to convince them that they're actually British, not American and it's 'rubbish', not 'trash', 'diaper', it's actually a 'nappy'.

Other key terms that emerged when talking about playing with technology were 'enjoy', 'passion', 'fun', 'happiness', and so on. There were numerous occasions on which children got pleasure not simply from engaging in play with technology themselves, but guiding siblings in such play, as was the case with UK Family 1:

Essa (4) doesn't know the answer so it's a, it's him [Mallison] saying 'Do you want to press the buttons and I'll tell you what to press?' and he'll say 'Yeah' and then he'll say 'Press this, this, this, enter' and then Essa will love that because he's like getting a reward for getting it right [NB: on the school's scoreboard] but then he's [Mallison's] the one that's actually getting it, telling him what to do. It's like a big brother thing, I suppose.

Using LTPET as a means of analysis, much of the digital play could be identified as being located most frequently in the categories of **Exploring** and **Owning** and **Recognising** in terms of levels of agency. The affordances of technology are particularly valuable in this respect. For example, children are able to engage in creative play and capture their experiences on camera, enabling them to demonstrate pride in their accomplishments. This was particularly the case in relation to the GoPro cameras which children often used to record activities they wished to share with others. Even when children experienced challenges in their play with technology, such as when they found it hard to complete levels in games, they enjoyed the experience. When those situations became too challenging to be enjoyable, children moved on to other activities.

The majority of children also **transferred** their joyful experiences in that they were enthusiastic about engaging in further digital play (to the extent that some parents did raise concerns about the length of time their children spend playing with technology, which is discussed in the next section). Sometimes **transfer** was observed across contexts; for example, when what they learnt through digital play was transferred to the home environment.

There were numerous examples of joy that occurred when children found something surprising in the digital play episode. For example, there were occasions on which apps and games presented children with unexpected opportunities which were responded to with delight, and the inquisitiveness and experimentation that followed were enjoyable for them. This, as explored in the previous section, was valuable for learning.

Play with technology also helped children deal with more negative emotions, such as anger and anxiety, at times. For example, parents described children using technology to 'calm down' when they were upset. At other times, the use of technology created frustration and anger. This was the case when children were asked to stop using technology by parents who were concerned about the amount of time children spent on it, such as in UK Family 4:

Parent:

I think that's why I'm really reluctant because it makes them angry. If I ask them to stop it or turn the telly off when they don't want to they get very cross about it at times. Simon (8) gets a red cheek. He's always got it. When he was little he used to get it, but he gets it now if he's been doing something quite intense for a while, it's quite weird.

Interviewer:

Yeah. So is that kind of the predominant sort of emotion that comes out when they're playing with tech?

Parent:

Yeah. I mean obviously they have fun while they're doing it and you can hear them laughing and giggling while they're doing it, but yeah when it's time to turn it off it's definitely... the anger inside comes out I think.

Interviewer:

Why do you think that is?

Parent:

I'm ruining their fun! I don't know, I mean they get so absorbed in it don't they, to the extent that if you ask them something sometimes they don't even answer.

The intensity of emotions felt when playing on touchscreen devices and gaming hardware can, therefore, be both positive and negative in terms of affect at times. Parents, however, often focused on the

negative effects. This was sometimes based on a lack of familiarity with the technology or on the basis of hearsay (media). For example, a SA parent in a telephone interview shared her concerns about TikTok, but this was not based on an assessment of the downloaded app:

So, she gets TikTok dance videos from her friend, but we haven't allowed her to download the physical app because of the negative side of TikTok. So, we have explained to her why she cannot download TikTok, although she has asked quite a bit. So, to answer your question, yes there are negative and positive apps, and I think as parents you need to be aware of it.

The adult worker in the after-school club that a child in UK Family 9 attended reported on emotions such as fun and sadness being present in the same play episodes:

Interviewer:

So, they're quite physical when they're playing.

Adult worker:

Yes. There's some children that are stood up all the time playing. They don't sit down. They stand up. Especially for, like I said, the racing one, because they're going through the motions... As though they're really on the racing track.

Interviewer:

What other emotions do you see them express?

Adult worker:

The sadness kind. The main one for that if the experience has been a negative one is when you might get the odd child when the time slot is up and they come off. I've just got to this and I've just got to that. But your time slot's up. I'll say your 20-minute time slot's up.

Such powerful emotions are aroused that self-regulation becomes a challenge if children are asked to stop their digital play. In South Africa, one of the teachers talked about the daily 'emotional outbursts' of a child she had to deal with in her preschool class. She reported that, on the drive to school, the child would be playing games on her mother's phone and would refuse to give the phone up. The emotional effects were felt for the rest of the school day. In both countries, there was some evidence of parents fostering self-regulation. When parents actively intervened to help children manage these emotions, then children were able to enhance their self-regulation skills. However, many parents and

teachers expressed strong views about wanting to be in control of children's use of technology. For example, one SA parent in a telephone interview expressed the following strong view about the risks involved:

Yeah [dopamine hits, which is addiction] and that is why we are trying to limit what he watches and when he watches. So, that is why I don't allow him to watch anything before bedtime, because then it is like the second wind hits. So, [we are] strategic so we can structure what they watch.

In contrast, SA Family F were working with Karabo (10) to build an awareness of his tendency to become engrossed in gaming to the exclusion of all else. They had placed restrictions on his play during the week but there were no restrictions on the weekend. He was also part of conversations about a friend whose levels of play had become addictive, so he knew why his parents were worried. His father had ongoing conversations about this with him and his parents draw attention to the behaviour. He then went on to play other non-digital games. It is important to note that self-regulation is a process that happens over time and altering a pattern of behaviour requires discipline and time. What this example illustrates is the open and ongoing communication between parents and child required in relation to digital play, and this reinforces the point that regulation can be supported by families.

There was some indication in the study that digital play was particularly helpful for the emotional regulation of a child with additional needs. For example, the UK parent of an 8-year-old girl stated:

Parent:

To be honest with you, she's actually got ADHD, so she tries to play on our iPad and her Nintendo Switch, and she'd do it [?] at the same time. So for her it's kind of... I don't know. I think she just enjoys it. It helps her zone out a bit.

The UK parent of a 10-year-old boy felt that he needed to oversee his use in case he was over-using technology when he felt anxious:

Interviewer:

How often do you allow him to play on the Xbox, for example?

Parent:

Daily.

Interviewer:

Would you have a limit on that, timewise?

Parent:

I've tended not to limit it because he tends to self-regulate. Now, I know if he's on it all the time that he's feeling a bit stressed. So, I've figured out when he's relaxed and when he's stressed. And, actually, I don't object if he's stressed and he needs that as an outlet. And that's fine. But I find on a weekend that he'll play for a bit on his games and then he might do a bit of LEGO, and then he might watch TV, and he might play out for a bit. So, as a general rule, he would self-regulate, so I've rarely needed to step in. On a weekend, if it gets to afternoon and he's been on it all morning, I might say come on, you need to come off it now and do something else. Yes.

Interviewer:

You've just said that you can tell when he's feeling stressed because he's on there a lot more often; why would you think that is?

Parent:

I suppose it's the escapism, isn't it, because I can sense when he... He is a kid who's got a higher level of anxiety than normal, so I can sense...

Similarly, the family of James in UK Family 8, who had a diagnosis of autism, felt that digital play was very helpful for him, but also recognised that he needed help at times to manage it effectively. There were also occasions when technology itself helped self-regulation of emotions, such as Anna in Family 5, who used her iPad as a diary in order to help her be more in control of her feelings. Certain features of apps fostered self-regulation of emotions, such as the ability to undo actions or return to a lower level, thus reducing feelings of frustration. In addition, some apps and games also supported self-evaluation, which is an important aspect of self-regulation, particularly games that enabled children to check on their own progress.

6.2 Actively engaging

As the previous section indicates, there was extensive evidence of children actively engaging with digital technology in play. Children could frequently be observed **exploring** (focusing on the activity) or **owning** (immersed in) the experience, the latter particularly observed in relation to game play. As Preston (2017: 205) has noted, 'Sustained absorption in the game world is tied to the development of player cognitive skills, and to the game world's perceptual environments, interactive functions, and narratives, including challenges and archetypal characters.' Parents frequently referred to the fact that they placed time limits on children's play, thus in effect cutting off active engagement, as this UK parent of a 7-year-old boy noted:

He's very much engaged and very much into it and sometimes we can have the argument of, okay, half-an-hour's up, 40 minutes up, we need to come off now. So, he does very much enjoy it and I give him a maximum of 30 to 40 minutes usually because he likes to get to a certain level.

However, there were other types of digital play that also proved to be particularly engaging. For example, children focused on drawing using a tablet for long periods of time. The data from this study confirmed data from the first technology and play study (Marsh et al., 2015), which indicated that the quality of the app or game itself is pivotal in the quality of play that emerges from the encounter with it, as is the level of match between an app/game and a child's abilities, which was pointed out in Section 4. The UK parent of an 8-year-old girl, for example, commented that games that enabled creativity were better for engagement than games that required only the completion of tasks/levels:

Parent:

With the ones where she can use her imagination, like the LEGO Worlds, she engages really well with that actually, because she can create whatever she wants. So, personally, I think she engages with them more than the ones, like, she just got Incredibles, but sometimes she'll lose interest just flying around.

Interviewer:

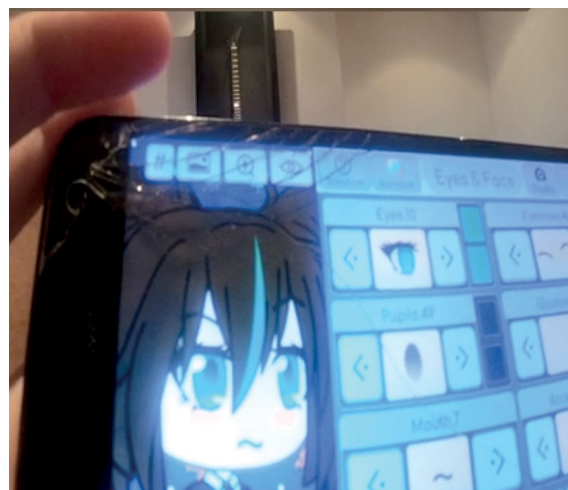
Why do you think she would lose interest in 'The Incredibles', then, for example?

Parent:

Because once she's... So, when you have the levels, she likes that, but then, at the end, when you have to collect everyone, she gets a bit bored. Whereas on the LEGO Worlds she can create whatever she wants constantly. She doesn't have to earn anything.

If the fit between child and app is right, they can experience the 'flow' identified by Csikszentmihalyi (2008), which was observed in numerous activities in both countries. For example, in SA Family J, Gemma (8) actively engaged in creating her anime avatar using an app on her phone. Paula, Gemma's mother said: 'So she does a lot of that type of thing, creates her own characters and draws, and does like stop photography and, and puts them to music and makes like little things and she does that or she draws.'

Figure 130: Gemma (8) actively engages in creating her anime avatar using an app on her phone



Gemma played with a range of apps that scaffolded children's learning through the provision of oral and visual cues, and the structure and sequence of steps involved. In terms of those occasions when the digital world was a stimulus for non-digital play, the quality of the source was less important. Data from observations and children's and parents' reports indicate that all kinds of sources provided rich material for children's play, such as unboxing videos, vloggers' videos, and so on. This aspect of play is discussed in relation to the **meaningful** characteristic.

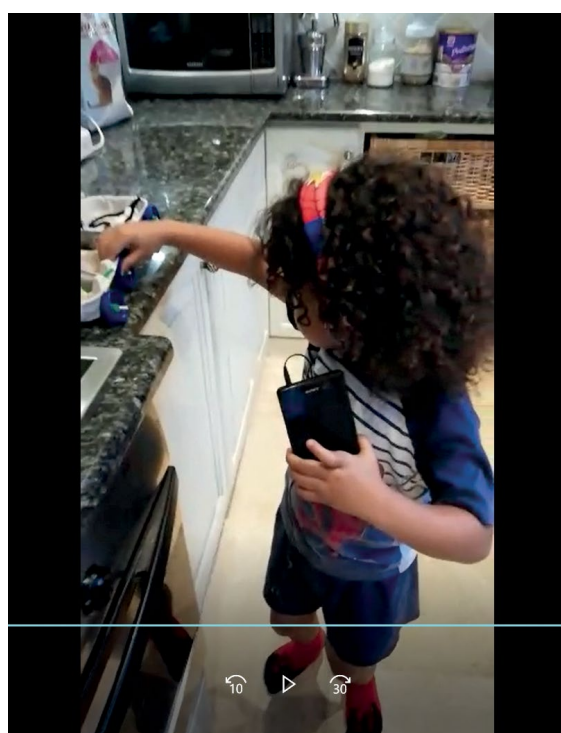
The category of **recognising** was also much in evidence, as children revealed investment in the digital play experience, demonstrating at times deep insights into these experiences in their discussions with researchers. Investment was most apparent when children were strongly agentic in their play, able to manipulate the appearance of avatars, for example, or create items in virtual worlds.

Transferring was also made obvious through children's expressions of their desire to play again, or to play for longer periods the next time they used a device, and so on. One might wonder, therefore, if digital play leads to *too much* active engagement, which is certainly the impression that some parents had. However, we would suggest that this approach runs the risk of placing the blame on technology, when the disadvantages of technology use relate to human oversight and management of it. Given that digital play is absorbing for children and their active engagement is a defining feature of much of it, as apps and games are designed to engage, adults need to find ways to make judgements about when this level of active engagement becomes potentially harmful or limiting. This is particularly important when considering that this characteristic of play can be transferred to educational contexts – making education arguably more entertaining and less boring.

In the dataset, there was an example of a child who had a special needs diagnosis. He found the use of digital technologies to be very appealing but it also laid open his vulnerabilities at times. His mum described an occasion when the child was so engaged in playing a videogame that he did not go to the toilet and so soiled himself. Incidents such as this may arise from procrastination and children frequently try to avoid other activities as they do not wish to tear themselves away from enjoyable activity of any kind, but this may also happen due to lesser sensory awareness among some children with specific diagnoses. Following that experience, the child's family placed rules and checks on his use, to the extent that he learned to self-regulate his time on the game. This is an extreme example but it indicates that with careful management, the high level of active engagement engendered in digital play does not need to be harmful, as many parents fear, and also suggests that parents of children with special needs should be mindful of the need to monitor their children's digital play in order to support their self-regulation.

Active engagement in non-digital play is also frequently enhanced by the use of digital technologies. For example, Kamden (4) (SA Family H) wore headphones to listen to music and sing and dance while holding a mobile phone connected to the headphones (see Figure 131). At the same time, he played with a car, enjoying the multi-sensory and semiotic affordances technology enables, alongside the sensory-motor skills that are fostered in play with toy vehicles.

Figure 131: Kamden's multi-sensory play



As in many others areas of learning and development, and as discussed in Section 4, some devices, apps and games were more likely to lead to active engagement than others. Apps and games that fostered active engagement were often designed to engage a range of senses, making best use of the multimodal affordances of devices, supported open-ended and creative play, and enabled personalisation, so that they are operated at an appropriate level of challenge.

This suggests that parents and adults should reflect carefully about the provision offered for digital play in order to ensure it provides a rich and meaningful environment.

6.3 Iteration

Iterative play with technologies was evident throughout the qualitative datasets. The pattern in this characteristic was different in relation to the previous two characteristics in that there were fewer examples of **transferring**. Children demonstrated that they could **respond** and **explore** in many aspects of digital play, trying out games and adjusting their approach in order to achieve success, but the structure of some apps and games they played did not allow for more complex modelling to occur. This may be the reason for the slight discrepancy with the quantitative data, which suggested that parents did not recognise this characteristic as strongly as others. This may be because the relevant question on the survey asked parents if children enjoyed making improvements as well as trying things out. As pointed out, many apps and games are fixed in content and do not allow this iterative process to take place. This was much more likely to occur in creative apps. Where **owning** happened, this was quite often in games that offered levels and challenges that children had to overcome. Children frequently enjoyed this level of iteration:

Interviewer:

So what's the game that you're playing?

Child:

Mario Brothers.

Interviewer:

Mario Brothers. And is this the final level did you say?

Child:

No, I'm on the first level of the first thing.

Interviewer:

Aha. Why does it look so creepy?

Child:

Because I'm on a dangerous world. Whoa ... oh. I'm so stupid. I could have completed a level. So that's the world there. And this sounds good, this is [unclear] and that's World 7 and World 4 to go... I want to kill you pumpkin. He's on fire now ... But this game's quite hard though.

Interviewer:

What do you like about this game?

Child:

That you just have to do it all over again and again and again and again.

Interviewer:

That sounds like you find it a bit frustrating. No? How do you find it?

Child:

It's just quite hard.

(Simon, aged 8, UK Family 4)

The child finding the game hard is an example of both iterative play and joyfulness. Some children did find such challenges frustrating, as indicated by this parent of a 5-year-old girl, although frustration operated alongside enjoyment in this iterative process:

Interviewer:

When she's playing with technology, does she ever challenge herself? Does she try out new things and make improvements?

Parent:

She certainly tries to improve what she's doing. A good example would be there's a tree swinging mini-game and you are swinging on the game. Then, you have to let go and see how far you can jump. Now, she's spectacularly awful at this because she's poor at timing the release point but yet, she still tries and tries and tries. She doesn't get annoyed by it, because it's funny when you land and bump your head or what have you. She definitely enjoys it, but she definitely keeps trying and trying to improve her score on that.

Implementing the LTPET, iteration at the level of **transforming** was most likely to be demonstrated by older children, who were more able to verbalise their efforts to solve problems or reflect on and describe what was not working for them. For example, Jeremy (11) (UK Family 8) spent some time playing on Roblox with his sister (8) who was in another room, and as he played, he provided a narration about his actions, which involved problem identification and problem solving, verbally described in a way that would have proved difficult for younger children.²³ Younger children demonstrated an ability to set their own goals and address problems in their digital play but were not

always able to verbalise these. Yet there were numerous instances in which young children demonstrated the ability to revise their original creations – an observable feature at the **recognising** stage of LTPET – and this is made much easier for them by the capacity of some apps to enable children to save creations at a particular stage in order to return to them, or to undo actions in their creations (such as drawings), which also offers them an opportunity to trace their creations over time.

The digital play that most often led to the higher categories of iteration occurred in relation to creative apps and games such as Minecraft and Roblox. The UK parent of a 9-year-old girl, for example, identified how she actively sought out challenges and used iteration as a tool to solve complex challenges:

So she likes improving on what she's done. Similar, back to the digital devices, if she builds something on Roblox or Minecraft she'll then go back to that same saved world, or saved area, and, say, extend a house, because she's seen something outside which has stirred her on to add an extension to her digital house, or she has little villages that she creates on Minecraft so she'll add and improve this village, create a zoo on it or a hotel. So she's always looking back at what she's done and trying to improve it. She likes drawing as well, and it's the same structure with that. She'll keep going with something until she gets it right. Even though we think it's quite good she might screw it up and throw it away because she said it's awful. But then she'll start again and improve it and improve it. So she's quite focused in that regard.

In addition, some games deliberately include in the design the ability to iterate models between the physical and digital world, which is a specific type of iterative play, as this UK father of a 9-year-old boy reported:

On his mobile phone he's got a couple of apps that would promote him maybe not playing with toys, but being a bit more active, like dancing and that kind of thing and that's like TikTok on his mobile phone. There is also a couple of games that he's had, one that he had for his Xbox, which was LEGO Dimension and it comes with the little figures and you place them on a portal and when you put them on the portal they go into the game. So, that encouraged him to pause the game, build the LEGO and then play with that a little bit and then go back to the game online as well. That one was one that encouraged quite a bit as well.

In the following example, the exploration of children's senses was worked on in several ways and this iterative process led to a transference of learning. Technology and other materials are allied in the work of Eshal and Henry's teacher (SA Family B and C). Noreen (the teacher) made connections between the previous lesson and those that followed (see also Section 4). For example, the subject of insects had started in a previous class through the reading of a book. In the class to which this observation refers, the theme continued to be explored along paths that involved children's senses, such as hearing, touch, sight, by using a video from YouTube on datashow and, in the sequence of activities, taking the children to art class. The episode demonstrated the importance the teacher gave to the role of the creative arts as part of learning, as well as her sense of the need for technology integration. Further, the time she planned for these activities seemed to take into account the time it takes for students to perform them. In the interview excerpt, the teacher commented on that experience:

Teacher:

Well, I mean I think yesterday's example, of looking at real insects and then transferring that into an art project, we they started off with facts about insects okay, how many body parts how many legs. You know, and then it went into a creative arts project and then some kids got really creative, they went beyond that and some of the insects, and then some were, stuck really true to what they had seen, they made sure there were three body parts, they made sure there were six legs and so on.

Interviewer:

Yeah, yeah, okay, and learning? I suppose it's not necessarily separated there, of learning.

Teacher:

Of technology and learning. Yeah, I mean I think it all integrates.

Iterative digital play, therefore, was evident across home and school settings, although in home contexts, children frequently had greater agency to revisit digital texts and artefacts.

Figure 132: Insect made by Eshal at art class



Figure 133: Insects made by Henry at art class



6.4 Meaningful

There was little doubt from across the datasets that digital play is meaningful to children. As much of the data previously discussed has indicated, children drew on their engagement with characters, programmes and films they had encountered on digital devices in their everyday lives. These interests permeated many aspects of their lives, and were a source of great pleasure and interest. Dyson (2016) reported on a global project in which it was clear that, across the world, children's play with popular culture and media was an important contributor to their agency and identity work. In this project, similar patterns were found across the two countries, although there were differences in relation to the range of digital texts that could be accessed and incorporated into play. There were some digital media forms that resonated in children's lives more strongly than others. As has been identified in previous research (Marsh et al., 2019), YouTube is an iconic platform in children's lives. A parent in the telephone interviews reported that his children's experiences with YouTube resonate well beyond the actual experience of viewing it:

Interviewer:

Do you think that their play with technology is meaningful to them and their interests outside of that play? So, just generally more in their lives.

Parent:

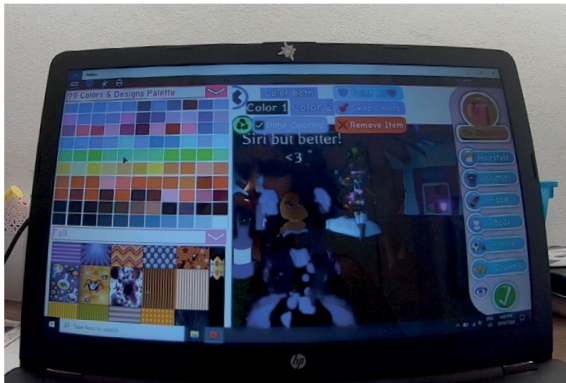
Yes. I think it definitely a big part, that's the focus as soon as they come through the door, it's like, can we go and YouTube, can we play this game, can we see what's happening in that community? If they're watching what's happening, what's the latest on YouTube, they know that I [unclear] because I know that section...

As noted throughout the report, the integration of digital and non-digital was a feature of play. Children found meaning in particular texts and practices that were then transferred to new contexts. Eight-year-old Gemma's (SA Family J) parent commented on a video of her play:

Well look at her, she does a little bit of story writing and her drawings and stuff and it's all actually moulded by the games that she plays, so when she draws pictures, she will draw like her classmates, she did a series last week when her classmates were writing Roblox characters. So when

she draws, I can definitely see how it's influenced by the anime. She's experimenting a lot with anime drawings at the moment.

Figure 134: Gemma's coding and experiments with anime drawings



Parry and Scott (2019) argue that focusing on children's play holistically, rather than on their play with a particular gadget in a particular moment, is key to recognising the way in which children play with ideas or use imagination in their pretend play. Children's play is always part of their wider experiences. In the UK case study families, bedrooms especially were full of toys and costumes relating to Disney princesses, Star Wars spaceships and Marvel superheroes. Play based on these transmedia brands often combined with other forms of play including sociodramatic play, supporting creative activity, such as the construction of LEGO bricks as spaceships, wands or robots in symbolic form. Gemma's example illustrates that children frequently replay in the physical world what they experience digitally, and they reproduce in digital worlds some of their offline experiences. For example, children discussed taking tips and tricks from the FIFA game, or YouTube videos of professional footballers, to their physical football play. At the heart of these global brands is a series of characters that occupy a fictional world that children engage with in multiple ways, including when they engage in digital play, functioning as a narrative web (Marsh, 2004). Children transfer meanings from these varied texts and practices as they participate in new play episodes, regularly making connections as the narrative (digital and non-digital) infuses their play imaginaries. An example of this was in UK Family 8, where 9-year-old Cerys had an interest in wolves. Cerys shared a drawing of an imagined avatar,

created in her play diary, with a researcher (see Figure 135), which was then commented on in the field notes.

Figure 135: Cerys' imagined avatar



The figure is essentially the same in the same colours and represents how Cerys would like her game avatar to look in Minecraft if she could create it on the Xbox. Because she didn't know how to make it, she had drawn it. The figure is female and mostly blue, white and red, has devil horns and wolf tail, as wolves are one of Cerys's special interests.

...Cerys shared some of her other drawings from last visit – graphic-style wolves in silhouette not in the play diary, and Denise asked her if she wanted to show us how she draws using YouTube. Cerys showed me a list of videos that teach viewers how to draw wolves, and explained these are the sites that she uses. She put on a video of a picture that she was interested in trying out.²⁴ and we watched it while I filmed. While she didn't draw it at the time, she said that when drawing she would watch then pause while she copied what she'd watched on the screen.

...She enjoys playing a game called Wolves' Life which is on Roblox. In it, you design your own wolf character and

play as a wolf. The options for design include fantasy elements such as wings, etc. She said that the best part of the game was being a wolf. The player can move their wolf character around the landscape and try and find other wolves to interact with. Cerys found another wolf and set her character off in pursuit but the other wolf (player) appeared not to want to interact and ran away. Cerys draws wolves using YouTube tutorial videos and has drawn some in her play diary...

(Field notes, Family 8, Visit 2, 28/10/2019)

Most of the examples fell into the **exploring** and **owning** categories. Children invest much of themselves in digital play and can recall experiences through the use of videos and photographs, although for younger children it is challenging to verbally express the level of meaning in this for them, as might be expected in the **recognising** and **transferring** categories. In the data there are rich examples of transference through multimodal embodied interactions, for example, visual, gesturing and spatial. However, children made many connections in their digital play and older children often recalled their previous experiences with specific games, for example, in order to apply them to new games. Therefore, as these examples demonstrate, in the UK digital play is integrated into the fabric of children's everyday lives and draws on their wider experiences.

However, as mentioned previously, the situation in SA is more complex. There are aesthetic, political and ethical issues relating to the lack of cultural relevance of many media/digital texts for South African children. The Western nature of these narratives as the norm is problematic and can make these digital play experiences less meaningful as a result. Of course, for the BAME UK children in the study, these issues were paramount also. UK Family 1, for example, commented on the lack of diversity in media. Unless children's media content producers take up the challenge to produce resources that represent the diversity of contemporary childhoods, the extent to which digital play can be meaningful to children will be severely limited.

The qualitative data, therefore, demonstrated strongly that play with technology was meaningful to children, deeply connected to their everyday lives and interests. It was therefore surprising that this characteristic was, along with the iterative characteristic, less widely recognised by parents. This may be because parents were making judgements themselves about what is and is not meaningful, and as the child's technological interests may not be related to parents' own daily practices and a sense of what is important, they may be dismissed as activities with little meaning.

6.5 Socially interactive

Play in this category was dependent on the type of device used for play and the context of each play episode. Some digital play can be very individualised in nature, if children are playing a game independently. This should not be viewed negatively, as individual play with technology can be pleasurable and lead to the acquisition of a range of knowledge and skills. However, some apps and games encourage socially interactive play and there was much evidence of this in the data. Social play occurred with all types of technology but particularly when children used console games such as Super Mario, FIFA, and so on. Tablet and smartphone play is more likely to be solitary because of the smaller screens involved.

Across the datasets, there was much evidence of children **responding** and **exploring**. In terms of **owning**, some social digital play is competitive in nature and so co-operation was not always in evidence. However, there were occasions when siblings demonstrated co-operative play, such as when Essa's (4) older brother in UK Family 1 searched YouTube for animals when Essa was involved in animal play both with his plastic animal figures and on his tablet.²⁵ It is notable, however, that Essa did not appreciate his brother's help after a period of time and demanded to have the tablet given back to him! There was also evidence of co-operative play as siblings and friends played games such as Minecraft and Roblox together.

In a further example, Elisha (7) (SA Family A) was acting as a teacher. She was socially engaged in the play episode and, through the use of the GoPro, read a book to the researchers. She engaged with the book as a teacher would with a class of children. She faced the book at the GoPro as she read the sentences upside down and at times even sideways. Her mother repeatedly told her to turn the book around but Elisha persisted in her efforts to engage socially with the GoPro and the researchers. In this example, we can discern her **recognising** the rules of this particular game in that she had previously viewed many examples of videos in which a presenter directly addressed the audience in this way. This allowed co-operative play with both the researchers present in the room and the absent, remote, imagined audience.

Figure 136: Elisha reading to the GoPro camera



All devices could be used both socially and individually. For example, a child in a UK Year 6 (aged 9–10) focus group outlined how her family played with people from around the world using Alexa, but the game could also be played individually:

What we did, we were playing like ... you had like a genre of music or like a year of music, and what you did was like you'd guess the song and the artist. And like you'd play against people from like the other side of the world, or like you could play it just by yourself and like Alexa would give you like points.

However, it seemed that games consoles in particular fostered social play, particularly games that allowed multiplayer (although children played together using handsets at times). For example, in SA, one focus group participant, aged 10, relayed how he played Xbox games with his family:

Interviewer:

And don't you get tired when you play with your cousins and you win?

Child:

Like me and my cousins when my cousins come over, then we have a challenge, then we see who can stay the longest on. Like if we have a free-for-all match then there's like a lot of players and then you must shoot and then we learn our girl cousin, she's now going to college so we teach her how to play because she doesn't know how to play because all she does at home is sit and watch her brother play.

This kind of familial intergenerational play is important, as mentioned in Section 5 when South African children reported how digital play with family members was used as a form of bonding with siblings.

There was also evidence of **transferring** as children shared with others using social media. Children created videos that they placed on YouTube or TikTok, for example. Some children created videos that were intended for YouTube but which were not placed on there, either because the child did not have an account or parents did not want the videos shared. Hanif (9)'s family (UK Family 9), for example, sent a video²⁶ via WhatsApp of a video filmed two years ago, in which he took part in the Ice Bucket Challenge and addressed the audience as if the video were on YouTube. Therefore, an *intention to transfer* was sometimes present in children's social play with technology, even if the context could not support the transfer.

6.6 Summary

There was evidence across all datasets that digital play enables children to experience the five characteristics of learning through play. While the characteristics have been separated in this analysis in order to explore each one in depth, it is important to note that they are frequently co-present in digital play episodes. For example, a complex example of joy in digital play is included in the discussion on iteration because joy needs to be understood in the broad sense to sometimes encompass some level of frustration or anger when things do not work out the way one had hoped. Overcoming a challenge in digital play can offer great joy. Similarly, when children found digital play activities meaningful to their everyday lives, they were more likely to be actively engaged. There were some apps and games which were more likely to promote four or five characteristics than others. These included open-ended, creative apps and games, in addition to apps and games that fostered social interaction, as outlined above. This meant that some technologies were more likely to lead to multiple characteristics being present in play, such as tablets and games consoles. In terms of levels of agency in digital play, the data were clustered towards the upper levels of the continuum which signalled that children frequently experience and own activities, and don't simply passively respond to them. This may be one consequence of the digital divide in that in some families parents were not aware of how to engage, which limited opportunities for parents to support children's play and learning. This signals the important role of adults in fostering children's digital play. In the next section, we move on to consider the role of the adult in mediating children's digital play.



Section 7: Adult mediation of digital play

7.1 Introduction

Children's playful learning with technologies takes place in a range of contexts. For many, particularly the youngest in our societies, home is perhaps the most important social context although school, wider family and community contexts begin to play an increasingly important role as children grow older. In South African households, children often share household labour and childcare responsibilities. Also, caregiving for the youngest is often shared beyond the primary caregiver/mother to include other adults and older children. In contrast to the UK, child-led households are not uncommon in South Africa. In 2018, 0.3% of children were living in 'child-only households' (Hall, 2019), thereby positioning children as more resilient and independent than their Western counterparts. Moreover, families tend to be less nuclear and more extended as the norm.

This study considered the roles played by adults within these very different social and cultural contexts, focusing primarily on parents but also adults beyond this (grandparents, schoolteachers, adults online and others). Adults are, of course, not the only ones playing important mediating roles in children's playful learning with technologies. While the focus of this analysis was adults, some discussion of the important roles played by other children is also included below.

A good deal of research has already considered parental attitudes (positive and negative) towards their children's technology use and parental mediation of it. Mediation tends to be researched through self-report survey (e.g. Nathanson, 1999) or interviews (e.g. Valkenburg et al., 1999). Our study investigated the roles played by adults through analysis of interviews with parents and other adults, and also close analysis of video observation data.

As Livingstone and Helsper (2008) suggest, the term 'parental mediation' has long been used to describe the way that parents manage the relation between children and media, both in terms of minimising perceived disadvantages and maximising perceived advantages. A tripartite model of parental mediation has been firmly established in the field, with scales such as Valkenburg et al.'s (1999) television mediation scale detailing the categories of restrictive mediation, active mediation and co-use. This model is still influential, with more recent works (e.g. Livingstone & Helsper, 2008; Zaman et al., 2016) retaining these categories. For the purposes of this study, we have adopted a framework for analysis based on the LEGO Foundation's play facilitation framework (Jensen et al., 2019), as well as the work of members of the team (e.g. Chaudron et al., 2017 and Scott, 2018a). In contrast to many previous frameworks, Jensen et al.'s (2019) framework puts a greater emphasis on the potentially meaningful roles adults can play in actively engaging with and shaping their children's playful learning with technologies, rather than simply mitigating potential harms.

Adult views are firstly described, based on analysis of the interview data. Secondly, the practices and roles adopted by adults in family contexts in the present study are discussed, based on both the analysis of interview data and the analysis of video observations. Finally, the roles adopted by adults in school and community contexts are discussed, based on both the analysis of interview and observation data.

7.2 Adult views about children's use of technologies

Parents expressed a range of positive attitudes towards their children's technology use. As outlined previously, the prevalent opinion was that children learned valuable skills that would serve them well in the short- and longer-term future, many noting that technology is used in school and they wouldn't want their children to fall behind. Parents also spoke about their children's futures beyond school, noting that technology skills would be important for future employment. Often, in all communities, for example the Afrikaans-speaking and English-speaking parents, the views tend to be positive when the technology use was educational. For example, an Afrikaans-speaking parent of a 10-year-old boy commented, 'There is a curriculum game on the tablet, it's about maths and English. It encourages him to continue playing and I will sometimes put a price for a completed exercise game.' Similarly, an English-speaking SA father of a girl (8) and a boy (9) noted:

Look, ... in most kids these days they are sitting on tablets and cell phones – I don't deem it harmful per se, but it can be interpreted differently. I am not only talking about my kids, but also the kids in my community, that I know, these days is that too much of a phone or a console game can actually damage your child and make him an introvert. Them not being able to play with other kids because they are used to playing alone. Often when you ask them something you get a delayed response because they are so busy with what they are doing. Depending again on what game they are playing it can be educational, which will then be good. Like if it is just a normal game or something like that, I am not much of a fan.

Although UK parents spoke particularly about intentionally educational apps including Spelling Shed and Times Table Rock Stars, several parents spoke of specific skills they attributed to games typically perceived as just for fun, such as fighting or strategy games. This finding echoes that of Marsh et al. (2015), that a wide range of apps support playful learning and creativity. Parents also spoke about some social and emotional dimensions of technology use, from simply observing their children's happiness using devices to the sense of satisfaction and empowerment they felt their children exhibited in relation to mastering certain technologies. For example, Halima (Family 9) explained that her sons' friends all had PlayStations and playing PlayStation at home allowed them to share this

experience with their peers. Miles (Family 5) wanted to share aspects of culture from his own childhood with his children, such as *Star Wars* characters.

It was notable that parents focused largely on learning and development in terms of the perceived benefits of digital play. In terms of the holistic skills discussed in Section 5, many parents placed less emphasis on the social, emotional, cognitive and creative skills that can be developed in digital play. This correlates with the quantitative data, which indicated that parents did not value the benefit of play with technology for well-being as much as they valued learning outcomes. This may be because some parents do not recognise that technology does have wider benefits, or it may be that their concerns about technology outweigh their views on its benefits, and so they limit their considerations to education. In addition, many early years settings and schools emphasise the learning benefits of technology, which are powerful messages, and parents are generally not receiving similar messages about the benefits of digital play for holistic skills.

Beyond the perceived benefits, parents' motivations for allowing or encouraging their children to engage with technologies varied. Parents talked about allowing or encouraging use to incentivise or reward good behaviour. Parents also said that they used technologies to calm down or simply entertain their children, enabling them to manage their time as a family.

The negative attitudes that parents exhibited in relation to technology tended to relate to a characterisation of some technology use as either 'inactive' or less social. As such, some parents felt that some types of technology play were simply a waste of time. For example, television and games consoles were frequently mentioned in this context, as this SA parent of a 10-year-old girl commented:

Watching movies and playing games all the time. Watching TV, I don't think cartoons help his mind grow, but instead they make him not concentrate/focus on his house chores.

As Scott (2018a) notes, there is a historic tendency for television to be characterised as less active, with many failing to consider the rich discussions and play

that television may stimulate. The parents in the study tended to differentiate between active and inactive technology use but had different opinions on what active and inactive meant. UK Family 3's Katie had observed her daughter's play with the mobile app Helix Jump and felt more favourably towards it because it was playful and interactive. Katie conversely perceived YouTube unboxing videos as 'mind-numbing'. Other families complained about children watching videos of other children play, with a common thread being an inability to understand some of contemporary children's practices with YouTube. This is in contrast to Marsh's (2016) account of unboxing videos as enabling children to participate in 'affinity spaces' (which, according to Gee (2018), are spaces where people join together to focus on common interests), or the comparison of watching videos of play with the traditional practice of children observing other children play in spaces such as nurseries (Marsh et al., 2019).

Some parents demonstrated a tendency to generalise based on external factors, such as media reports, rather than their own experiences. For example, this father stated concerns in a telephone interview but when asked about his own child's use of technology, talked about it in very positive terms, emphasising that it enabled her to learn and made her happy. A number of parents demonstrated this bifurcation of views (i.e. that their own child is fine, but digital play is bad for other children):

Parent:

Children learn a lot from what they see, and where, as an adult, you already know some of the things you see on TV are not real ... then most children, they don't know that yet. They view everything they see on TV as real. So sometimes when I see other kids on TV having extra toys, they think it's real in a way, it's not real, and then it has a negative effect on their well-being. They start having mental breakdowns. They are depressed because they don't have all those toys they see on TV. It does affect children and it can also affect them in a good way. They can learn from what they see as well.

Interviewer:

What's one of ways do you think technology use can affect them a good way?

Parent:

They can learn to stuff by themselves. My little girl, she learnt to tie her shoes from TV. I never taught her that.

Interviewer:

When your child's playing with technology, what's the emotion that you most often see in them?

Parent:

Happiness.

This kind of cognitive dissonance is a pattern seen in other studies, such as that conducted by Buckingham (1993), in which children stated that other children watched too much television, but denied that this was the case for them. It is a phenomenon that arises from making generalisations about the world that are not based on one's own experience.

Concerns about digital play were often culturally framed. For example, some of the SA parents lived in areas with high levels of violence, as explained previously. This led to concerns about the negative role that violence in games could play, as the father of an 8-year-old boy commented: *'Violent games, our society is a very violent one so I do not want my child to be exposed to that.'* Conversely, some parents took some comfort that their children were at home playing games in order to avoid crime, as the SA mother of an 11-year-old boy noted: *'I live in an area with a high rate of crime, therefore I am at ease knowing that he is at home playing his games.'*

For some parents, there was very much a sense of being in a 'runaway world' (Giddens, 2002) in which they struggled to keep control of their children's engagement with technologies, as they stated that they lacked confidence and expertise themselves in what they perceived as a world that was changing too rapidly. In addition, some parents were themselves fearful of the content available on the internet, which impacted on how they managed children's access to technologies, as identified by this SA parent:

Yes, and the video calling. I don't like the children to have phones. You know things I have seen on the phones. It's just too much. Things I've seen on the phones. They actually scare me. I know cannot protect them forever, but we still can when they are young. So I don't approve of giving them the phone.

In line with much past research (e.g. Livingstone & Helsper, 2008), parents also spoke about anxieties about the risks of their children being online, with many children across the SA datasets not being able

to go online, as was the case with Eshal (7) (SA Family B). Denise (UK Family 8) was concerned about her daughter Cerys (9) uploading her own videos to TikTok, noting that it was hard for a parent to keep up with the affordances of different platforms, e.g. how public the videos posted on TikTok are. She was also worried that Jeremy (11) would find inappropriate content online. In Section 5, parents' concerns were framed in terms of teaching children self-regulation and emotional skills. It is important that parents engage in dialogue with their children, rather than impose rules that might be barely understood by children, or easy to circumvent (Chaudron, De Gioia & Gemo, 2018; Chaudron et al., 2017).

Parents enunciated various strategies for restrictive mediation during the interviews. Many explained their strategies for restricting access to any age-inappropriate content, e.g. setting up parental controls on devices. Some parents also attempted to restrict access to content that they perceived of little value or that they felt encouraged undesirable behaviour. Serena (Family 1) felt that there was no value to Mallison (6) watching other people play Minecraft on YouTube and so aimed to restrict this. Susan and Craig (Family 2) felt the children's shows *Peppa Pig* and *Horrid Henry*

encouraged bad behaviour and thus stopped Alison (5) and Chloe (4) from watching them for a period of time. Parents of some of the younger children in particular placed restrictions on any technology that enabled any contact with others. Parents in the study tended to have some rules about particular devices but these varied from family to family. While some banned their children from using their smartphones, others allowed this. Most parents also restricted children's time spent using technology or a particular platform or device.

There was evidence that there were different rules set by different parents, as noted in Chaudron et al. (2018). Della and Linton's (6) mother (SA Family E), for example, said that she did not allow them to use the GoPro, as the children were fighting about whose turn it was to use the GoPro. When the researchers asked who was fighting over the GoPro, the children told them that they were not fighting, but enjoying it. The mother tended to try to control the children's behaviour more than their father. She told the researcher that their father 'allows them to do whatever they like!' and described the messy state the flat was in when she returned, if the father had been staying at home with the children. If parents were separated, children sometimes exploited the different rules set by the two households for their own benefit.

7.3 Adult mediation in family contexts: parents

The practices and roles adopted by adults in this study were analysed based on the survey, interview and video observation data. The data were gathered as part of a broader programme of research and, as such, the following limitations to the data should be noted. A great deal of play with technologies was demonstrated for the researchers during field visits as part of a constructed programme of research. It is likely, therefore, that some adults may have been less involved in children's play during field visits than might normally be the case. A study that is longer in scope and employs more ethnographic approaches to fieldwork is likely to uncover more typical adult mediation. It is also the case that some of the adults requested that they not appear on camera. In these cases, researchers ended filming during moments when parents played a significant role in their children's technological play.

Parents in this study demonstrated a range of approaches to mediation of their children's technology use. A number of additional factors are likely important influences on parental mediation. Firstly, the focus children involved in the study varied a great deal in age (ages 3–11). Past studies have shown a good deal of parental interaction with very young children's technological play (e.g. Scott, 2018a and 2018b). As children get older, they tend to experience greater independence in their technology use, with parental monitoring decreasing in the early teenage years (Ofcom, 2019). Secondly, all of the focus children aged 3–11 in the study had siblings, who serve as an important social context to children's technological play. The age range for siblings in the study was wider, ranging from 2–14 years. For example, UK Family 9 comprised 4 brothers ranging in age from 2 to 14. The three older boys in the family served as a very significant social context to each other's playful learning with technologies.

In the following section, the forms of adult mediation discussed in Jensen et al., 2019 are addressed.

7.3.1 Free play

A great deal of the playful learning with technologies observed in this study was categorised as 'free play' – unstructured play initiated by the child and centring on the child pursuing their own interests. Much of this

was coded as 'no adult role'. Indeed, the children in the study demonstrated a great deal of autonomy in their playful learning with technologies. For example, Anna (7) from Family 7 noticed that her mum, Marina, had deleted her (free) hair-styling game apps from the tablet and decided to download them again ('Mummy got rid of them, I might load them again, it's easy').²⁷ Parents at times expressed some surprise at the digital skills their children had developed, with and sometimes without the support of other adults. As outlined previously, Simon (8) from UK Family 4 had designed his own simple games and animations using Scratch. His mother, Diane, seemed surprised about where these skills had been developed. Simon said he made the games 'at home and school, at study club'. Simon had received some adult support at school but had also engaged in significant work on the games on his own, including a 'missile launcher' game made 'by myself', which he demonstrated for the research team.²⁸ Diane characterised the household as 'very tech [...] considering we're not'. Children's sophisticated abilities with technologies are doubtless a testament to how motivated children are by technology. Of course, it may also be true that adults are not always aware of how much they have unwittingly contributed to their children's skills development.

There were times when children's physical free play led to digital co-play, and vice versa. For example, this SA family attempted to distract their daughter's free play on music apps by engaging her in non-digital musical activities with her father:

Parent 1:

We do, sometimes, battle sometimes to get her off stuff.

Parent 2:

That's where I come in

Parent 1:

Yeah, so when it's past bedtime and I ask her why are you not in bed, I just want to finish this video I just want to, it's almost done dadadada so it's not completely ... we still try but it doesn't always work so well.

Parent 2:

I'm the old school so I bring in the tempo and get her to hold things, you know, and feel things, so music and she does play a bit of the violin so has a bit of, but look you know like I'm involved in a lot of music so even in music there's two pathways ... technology that's brought it to another level but there's also that organic old school playing in time and making music and that and I don't think that will ever die. There's also a new way of doing things with technology.

In line with Scott (2018a), adults in this research spent a good deal of time observing or listening to their children's free play with technologies without intervening. The nature of this observing or listening varied a great deal. Some parents frequently multitasked – attending to other business such as housework while remaining observant of what their children were doing. However, some parents would spend much more dedicated time with their children, paying close attention to their playful interactions with technology and engaging in conversations about what the children were doing. While both ends of the spectrum may not be seen as particularly notable mediation, this regular interaction means that parents develop knowledge and awareness of their children's interests, abilities and practices with technologies, which many may be unaware of. This knowledge enabled parents to play a role in facilitating play, e.g. providing children with the technologies and materials required and scaffolding their operational digital literacies with technologies, for example responding to requests about how to get a videogame started.

Parents also participated in children's free play with technologies through joining in. As mentioned in a previous section, in UK Family 7, Anna (7) discovered roller coaster simulator videos through YouTube on the family television. Anna's mum (Marina) and brother (John, 4) frequently spent time together watching these videos as a family, sharing in the pleasure of the sensation.²⁹ In UK Family 2, mother Susan and siblings Alison (5) and Chloe (4) took turns selecting and emulating the dance moves shown on screen in Just Dance.³⁰ In the interviews, parents particularly talked about joining in with reference to console games. For example, in SA Family J, Gemma (8), often asked her mother Paula to play with her on the Xbox, as mum commented:

I mean we do try if she is on the Xbox and she says, 'Mom, please play with me', then I'll try to do that or she'll say ... we do try and engage her.

It also appears that the play activities parents engage in also lie within in their own comfort zone and strengths, which sometimes embed gender stereotyping, as Paula's comment indicates:

So I played the LEGO games with her and then dad plays the sport games because I can't kick a ball to save my life.

While co-play was often on games, other interesting examples included shared filmmaking between Anna (7) and her grandmother (UK Family 7) and the inclusion of parents in a WhatsApp group by Cerys (9) (UK Family 8).³¹ Joining in also related to shared family knowledge of digital texts. In UK Family 9, Halima recounted that she had sometimes joined in with performing the 'L word dance' with her sons.³² The dance, denoting 'L' for 'Loser' originally derives from Fortnite and is also used in one of the boys' favourite games (FIFA) to antagonise rival players. Similarly, in SA there were examples of free play that parents joined in with and of course such play episodes can then move into guided play if the parents begin to try to shape it.

Parents detailed many types of restrictive mediation in the interviews (see above). They also discussed particular circumstances in which they would close down play – when they disapproved of content, when the play descended into arguments, and when they felt children had spent enough time on a particular activity. Despite this, very little intervention in the form of closing down, stopping or ending free play was observed. This may relate to the methodological approach, as outlined above, in that much of the data is derived from adults talking about and/or sharing their views about children's use of, and access to, digital technology. However, extensive filming took place in many homes in the UK and these kinds of interventions were minimal.

7.3.2 Guided play and game play

The analysis also revealed a moderate amount of 'guided play', with adults supporting children to achieve particular goals within the context of play. Much of the guided play observed was coded as 'adult scaffolds learning' when children were using apps and games. A lot of adult scaffolding related to improving children's operational digital literacies (Marsh, 2015), i.e. helping

children to operate devices and achieve particular goals in a digital context. There was great variation in the skills and knowledge supported in adult scaffolding of children's operational digital literacies, highlighting the range and complexity of skills needed for children to successfully exploit technologies.

In the interviews, parents demonstrated a range of confidence in their own technological capabilities. Interestingly, adult scaffolding of their children's playful learning with technologies was not always reliant on parental digital skills and knowledge. Even parents who had little confidence in their own technical abilities supported their children's playful learning with technology. In UK Family 4, mother Diane expressed a lack of confidence in her own technical abilities. However, son Simon (8) later explained how his mother had helped him to improve the quality of his stop-motion animations. Simon recalled struggling to make a LEGO character 'fall' in an animated fight scene without his hand appearing on screen. Diane suggested positioning the LEGO character at the edge of the screen, which enabled him to create the illusion of a falling figure, unsupported by his hand.³³ This finding is important since many parents lack technical knowledge, but this need not be a barrier to supporting and scaffolding their children's playful learning with technologies.

There were some examples of parents guiding children's digital play with apps by asking challenging questions that enabled children to extend their learning, such as the parent in SA Family A who asked her child, Zuko (6): 'What's holding all those pieces in a row there together?' and 'How did you make such a long piece like that?' However, sometimes Zuko resisted this kind of scaffolding, his mother noted:

Like I say, he can do that but he doesn't love to do that. He's like, can't I just do my own thing? Yeah, that's kind of his usual orientation with learning is let me make my own thing, let me try it myself, why do I have to follow instructions?

The data also contained notable examples of parents **extending** their children's playful learning with technologies, on both a small and larger scale. **Extending** (Scott, 2018a) relates to moments of guided play in which an adult or peer draws on a child's existing media interests to engage them in new activities or learning, either digital or non-digital. UK Family 2's Alison (5) loved

drawing and colouring, an interest which extended to her love of YouTube drawing tutorials.³⁴ During an interview, Alison's father Craig spoke of his intention to support Alison in making father-and-daughter drawing tutorials that they would upload to YouTube. This concept built on their experiences watching the drawing tutorials of American father-daughter YouTubers and also drew on existing family practices. The data also contained examples of a parent relating content to a child's life, which happened frequently. **Relating** (Scott, 2018a) describes moments in which an adult or peer draws a child's attention to a connection between their media or non-media interests and something else (digital or non-digital). In UK Family 1, Mallison was playing Minecraft on Spelling Shed and was struggling to spell the word 'hopeless'. Serena prompted Mallison to '*think about how you spell hope, then add on less*', reminding Madison that a girl in his school class is called Hope and prompting '*how do you spell her name?*'³⁵ Similarly, the parents of Gemma (8) (SA Family J) noted how the father related jointly viewed television content to his own dietary habits:

Interviewer:

Do you ever initiate play using technology with Gemma? I mean in terms of initiating like saying 'come let's use the computer'?

Paula:

Mostly I don't because I think it's more a practicality thing by intentional design I think it's okay so if it's a time crunch for me certainly so I will find it quite difficult and eventually I do fall behind with that but, interestingly enough, dad will say to her 'come and watch this thing'.

Jai:

I was just going to say that I use this here a lot as a discussion tool [Father points at the TV]

Interviewer:

The television?

Jai:

Yeah, so I was watching what was it knives or forks, forks or knives. No, sorry, What The Health.

Paula:

It's a programme about veganism and the movement towards moral and ethical and health.

Jai:

She saw the footage of pigs online and ...

Paula:

And the cows.

Jai:

And she goes, 'Dad I have to watch this thing again' because she had to go and do something. But she was totally fascinated you know I had to explain to her because I'm vegan now and I was explaining to her why that is not good for you and at the same time not forcing her to take a position ... anything that you watch ... you could have a conversation, discussion, debate.

While this is not an example of guided play, as television viewing cannot always be viewed as a play episode,

it offers an insight into how digital media can enable parents to relate children's experiences in a way that fosters reflection.

Children frequently chose existing games to play with parents, primarily console or app-based games. Parents chose existing games for their children, too, for example Alison's grandmother in UK Family 2 selected the Holodraw virtual fashion design game for her, and her mother, Susan, helped her to use it.³⁶ Parents were observed explaining the rules of games to children. For example, when Essa (UK Family 1) wanted to 'kill the pigs' in The Incredibles game on Nintendo Switch (because he had seen Mallison kill pigs in Minecraft), Serena explained to him that this is '*not part of the game*'.³⁷ Little of the playful learning with technologies observed in this study was categorised as 'creating games' with parents.

7.4 Adult mediation in family contexts: adults beyond parents

Although adult mediation studies tend to focus on the role of parents, adults beyond parents play an important role in mediating children's technological play. The most notable example in the UK study was the role played by Anna (7)'s grandmother in UK Family 7. Anna's grandmother downloaded apps in the relevant age category from the app store on to her tablet for Anna to use.³⁸ She was observed scaffolding Anna's learning; for example, prompting Anna's spelling with the CBeebies Alphablocks game.³⁹ She was also involved in Anna's playful filmmaking.⁴⁰ As with previous studies (Plowman et al., 2008; Scott, 2018a), it is also true that siblings play an important role in mediating children's technology use.

Adults beyond the family also play a role in children's playful learning with technologies in the home context. There were a number of instances in which an adult accessed through digital means scaffolded children's learning, such as adults on YouTube who taught

specific skills. In UK Family 4, Simon (8) used a 'How to Draw' tutorial on YouTube. When he reached the end of the video (and completed his drawing), he restarted the video, commenting that he hoped to improve the second iteration of the drawing through watching again.⁴¹ Simon was able to control the speed of the support he received, pressing pause on the video to pay more attention to a particular area of the drawing from time to time.

As noted previously, recent advances in the type of artificial intelligence made available in family homes appeared to be making an impact on the children involved in this study. Children showed evidence of interest and ability in using these devices, with parents demonstrating scaffolding of their children's abilities. This development represents something of a change in the way children are empowered to achieve tasks at home, supported by an adult-like intelligence.

7.5 Adult mediation in school and community contexts

As might perhaps be expected, the analysis of school data suggests that adults in school contexts sometimes play a more directive role in children's learning with technologies. In one of the class observations, Mallison's UK class teacher was observed guiding Mallison (6) in a task to learn how to use the Google search bar. The teacher helped Mallison to plan the activity, scaffolding by modelling an example of thinking for search terms, and then modelling typing and searching. Later, Mallison's teacher instructed Mallison and his classmates to search for everyday metal objects. Mallison was captivated by a search result about gold bars, as this related to his Minecraft interests. At this point, Mallison's teacher intervened, encouraging Mallison and his partner to follow the instructions more exactly. In other examples, use of technologies was more directed, as outlined by the teacher of Zuko (6) (SA Family A):

Yeah, I think it's more in the imaginative, I almost feel like I suppose that maybe what has changed over the years with regards to players that imaginative play has changed because of what they've been exposed to, and the possibilities of what is out there. So when activities are set out, I think it's, it's still very much based on what materials we put out for them as to how they engage with it. There are I mean, simple little thing, they went through a stage of really enjoying or suddenly noticing what a photocopier does, and being quite fascinated by photocopying. So they'll come and say, I really like this page in the book, I'll go and take it in, and then go photocopy it, and then they come back, and they come back to this and come up with them, or they want to find some information other than that. So I think they know what we have access to, in the class if someone talked, a mom here spoke to us about the other day, the Amazon dolphins, that they're actually pink, but she didn't have a picture of it, so then we were able to go and look online for a picture of it. And so I suppose it's, the children that know what they have access to. And it is very much adults, I think just because of their age, it's still very adult dependent.

There was evidence of guided digital playful learning, rather than guided digital play, in schools. This is a valuable pedagogical approach which Parker and Thomsen (2019) refer to as the use of 'integrative pedagogies', such as active learning, inquiry-based learning and problem-based learning. When these pedagogical strategies were used, teachers were able to support children's learning through the use of technologies that offered children opportunities to explore, experiment, and learn through trial and error.

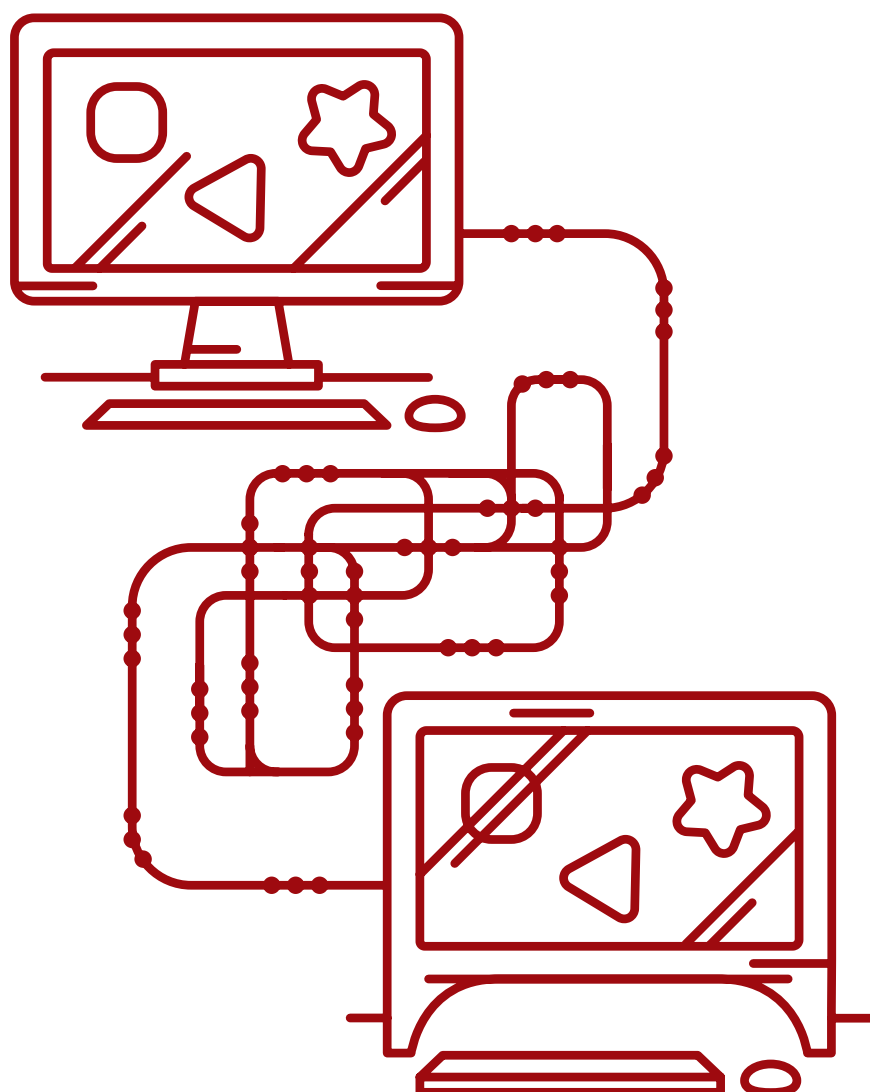
The nature of adult roles observed in early years settings suggested slightly less directive roles, although perhaps more directive than in many of the home contexts. For example, UK Family 6's Alfie (3) was observed using an iPad in nursery. His early years practitioner (EYP) guided him towards particular educational games, asking him if he would prefer 'numbers' or 'drawing'. However, Alfie was able to explore a number of apps and select what he wanted to play. The EYP then supported his play with a quiz app, responding with encouraging words of praise.

The research also included observations of children's learning with technologies in community settings. Adults played a range of roles in community settings. One notable example relates to UK Family 3. Stephanie (9)'s cornet teacher used the music education software, Charanga, to aid the children's learning. Stephanie's teacher adopted a variety of roles to support Stephanie and her peers' learning with Charanga. He played alongside the group (joining in, following the notation displayed by Charanga on the whiteboard). He also scaffolded learning by selecting short passages from the piece for more intensive practice.

7.6 Summary

Adult mediation of children's digital play is similar in nature to their mediation of non-digital play in terms of some of the interventions they make, as this analysis has shown. However, there are some distinct differences. Firstly, some adults are less likely to play digitally with their children than non-digitally, and this was particularly the case with regard to mothers. In many families, children and parents stated that it was the father who played with them on games consoles, for example, not mothers. Secondly, adults are more likely to engage in co-play when using technologies when the focus for the activity is perceived to be educational in

nature, whereas families described a range of types of non-digital play, including outdoor sports, construction play (e.g. with LEGO) and the use of board games. It is of interest that some of the more relaxed, non-educational digital co-play that took place in the study was between grandparents and children. Finally, little of the digital co-play that was observed involved some of the more productive and creative uses of technology, such as coding, or making films and music. There is obviously scope to provide support for adults in engaging more widely in this type of co-play.



Section 8: Conclusion

8.1 Summary of key findings

The study had six research questions. The findings in relation to each of the questions are summarised below.

8.1.1 What is the relationship between children's use of technology and their play in everyday life?

Technology is embedded in children's everyday play lives, but in South Africa children have much less access to digital devices than children in the UK. The data from the survey demonstrated the significant differences in access. Whereas in the UK, 94% of children have access to tablets and 84% have access to smartphones, the same is true for only 34% (tablets) and 41% (smartphones) of children in SA. Moreover, in the UK, 48% have access to a smart speaker, such as Amazon Echo, Apple HomePod or Google Home, 28% have access to a wearable technology, 17% of children have access to virtual reality equipment and 15% have access to a smart toy, whereas less than 10% of South African children have access to the same technologies. In turn, this has significant implications for the extent to which children can play and learn with these new and emerging technologies.

Important factors that influence access to technology are household income, race (apartheid legacy) and gender. However, there are observable differences according to the type of technology used. For example, more affluent households are much more likely to provide access to smart TVs, laptops, electronic toys and tablets, while the differences for standard TVs and smartphones are small. Further, far fewer South African children engage with any of the brands that the survey asked about than the children in the UK. For example, 27% of children in the UK played racing games, and more than a third played Minecraft. In comparison, while a similar proportion of children in South Africa played racing games, other games (e.g. Minecraft, Roblox and Fortnite) are played by less than 10% of children.

The survey demonstrated similarities across the countries also. Boys are more likely to play racing games, while the gender gap across other games is much smaller. However, girls are far less likely to play multiple types of games, such as Fortnite and Minecraft in South Africa. In the UK, Roblox is popular with girls.

Children's digital ecologies were studied by taking into account gender, class, age, child's interests, environment, relationships with significant others (siblings, etc.) and parents' own histories with technologies as all impacting on children's digital ecologies. We return to these important socio-cultural aspects of the research project in Section 8.1.6.

Most commonly, children's play appears to transition from the digital to the non-digital, and less frequently from one digital device to another. In South Africa, children also more often used one device (the smartphone) for various functions (photography, filming, Google, WhatsApp, YouTube, games, listening to music, calculator), as opposed to the UK where the children were involved in more digital play using multiple devices. From the data collected in the case studies, discussed in Section 3, it can be seen that the division between digital and non-digital play is in reality rather artificial, as children spend a lot of time integrating digital and non-digital games and artefacts in their play. There were few children in the case study families who played primarily with technology, most moved across the resources outlined in Table 8, whereas in the survey, parents reported a significant minority of children playing mainly with technology. This discrepancy may be accounted for by the difference in methods. In surveys, parents are likely to generalise based on their overall perceptions, whereas in the case studies, detailed observations were undertaken of play.

The many examples of games children referred to in the research are largely developed in the West and the global North. This largely Euro-American-centric hegemonic, heteronormative representation of a modern power structure is of particular importance because digital media is woven into fantasy and imaginative play (media imaginaries). While children created their own digital media imaginaries regardless of these limitations, this is, we would suggest, not good enough, and this is a challenge that needs taking up by producers of digital media products for children. We return to this point in Section 8.1.6.

Across both countries, the case studies show how digital play activities can mediate the emotional well-being of some participants as it allows them to bond and spend time with family members. As can be seen from the examples in this report, engaging in digital game activities provides a space for meaningful interaction. These interactions include contact with extended family members as phones are used for communication such as messaging, sending voice notes and videos, and children ensure these encounters are playful in nature. Some parents and teachers believed, however, that digital play impacts negatively on children's well-being, with some offering evidence of their own children's responses to, for example, being asked to stop using technology.

The study also confirmed previous research that has indicated how the types of play that appear in children's non-digital play are also apparent in children's digital play (Marsh et al., 2016). There was a difference, however, in the survey and qualitative data relating to transgressive play. This kind of play occurs when children deliberately circumvent the intentions of digital media producers in order to adopt devices and apps for the play episode. Few parents in the survey reported that this took place, perhaps because they were not sufficiently familiar with the concept, but there was evidence of transgressive play in the case studies. This kind of play when using devices might be seen as 'hacker play', as it involves some of the approaches involved in hacking, such as adapting devices and systems for one's own purposes. However, it is acknowledged that this is a term that might not be acceptable to many parents and teachers, given its negative connotations. We would argue that the term needs to be reclaimed in the context of children's play, as it recognises the creativity that occurs as children adapt digital devices and apps to forge new play experiences.

The study confirms findings of other studies of play in that there are both continuities and discontinuities with play in the past (Marsh & Bishop, 2014). Children are as creative as ever in relation to play, always drawing on and adapting their environment as they play. The forms of play identified, for example, in the iconic work of Iona and Peter Opie in the second half of the 20th century, are prevalent in homes and schools today, as was found in the recent 'Playing the Archive'⁴² study in the UK. In terms of discontinuities, this study identified that children's play has extended into newer forms of technologies, such as wearable devices, virtual reality equipment and smart assistants, albeit taken up in different ways, with some children having limited access to such technologies. However, there was substantive evidence of engagement with Alexa, Google Home and Siri in children's play in the UK, with some evidence of this in South Africa, and these devices fostered a wide range of types of play, such as language play, imaginative play, role play and social play.

Given the findings of this study, it is clear that the play landscapes of contemporary childhood can be framed within a post-digital lens (Jayemanne, Nansen and Apperley, 2016). The 'post-digital', like 'post-human' does not point at a time after the digital but foregrounds how the digital and the non-digital are always already in relation (Knox, 2019). In some ways, the distinction between these becomes less stark as children move fluidly across digital/non-digital, online/offline domains in their play, as this study has demonstrated. Nonetheless, in highlighting the potential for flow between the analogue and the digital (Marsh, 2019) we suggest that there are some important distinctions between digital and non-digital play that relate to the designed affordances of digital devices and digital content. This places a particular responsibility on those who produce digital products for children to ensure that these devices and content are appropriate for needs.

Finally, it is clear that the relationship between play and technology in children's everyday lives is complex, containing risks embedded relating to issues of content, potential excessive use and so on, but this study found evidence of the positive nature of children's digital play. It has a beneficial impact on knowledge, skills, creativity and family relationships, as discussed below.

8.1.2 What skills and knowledge do children develop in their play with technology?

The data revealed that digital play can develop children’s knowledge and skills in a number of ways. Table 10 provides a summary of the kinds of knowledge and skills developed.

Table 10: Knowledge and skills developed in children's digital play

Subject knowledge	All areas/disciplines, including language, literacy, mathematics, science, art, humanities, and so on.
Digital skills	Technical and operational skills (e.g. operating devices and navigating apps); critical digital literacy skills (e.g. information and data literacy, content creation, safety).
Holistic skills	Social, physical, emotional and creative skills.

Importantly, digital play fosters the integration of these areas so, for example, children may acquire digital skills as they engage with apps and games that enable them to develop subject knowledge such as mathematics and learning to read and write. Further, children secure through their digital play the kinds of transversal skills that will be essential to engage as a global citizen as the 21st century advances. Digital citizenship in an international context will be critical to future societies and, through digital play, children can connect with remote and both known and unknown others, learning how to connect in a digital age. However, there is a need to develop systems and practices that can support children as they enact their digital citizenry – an issue which we return to when we consider the implications of this study for policy and practice.

The study confirmed that learning through digital play can be both intended and incidental. Children learned a great deal through television programmes, apps and games designed specifically for that purpose (as outlined by parents, and observed on field visits, both discussed in Section 6) but they also learned much

when playing with overtly non-educational games and devices. Learning occurred most strongly in digital play when the app, game, programme and/or device was appropriate for a child’s needs, and when the context in which the interaction between child and device took place was conducive to learning. This did not mean, for example, that adults always had to be present when children learned through digital play. Indeed, there was extensive evidence of children learning when playing in a solitary manner using a range of devices. In these cases, what was important was the quality of the particular content and the ease with which children could use the device.

Learning occurred across all devices but the device that dominated in the UK in terms of learning through play was the tablet. This was confirmed in both the surveys and the case studies. The tablet is an extremely versatile device, which means that a range of games and apps can be accessed to support learning. In South Africa, there was less access to tablets but smartphones offered important sources for playful learning. Game play was the most common form of play on most devices except for television, but children did use tablets in the UK for creative play. Television lent itself primarily to imaginative, role and physical play, while games consoles were particularly generative for social play. This led to differences in the kinds of learning that took place in relation to devices. Children learned subject knowledge through their engagement in television-related play but they also developed a wide range of knowledge and skills through imaginative play, because such play enables children to relate knowledge and understanding of the world to their own contexts. Console game play developed a range of digital skills as children navigated quite complex screens, but it also provided opportunities to strengthen holistic skills, such as physical and social skills. Some forms of digital play developed some skills and dispositions for learning in a more pronounced way; for example, children demonstrated the ability to be persistent when engaged in competitive games. Indeed, competitive play on games was particularly linked to observations of persistence, which offers a contrast to the more negative views of such play held by some.

Tablets were used to support formal learning of school subjects but they were also significant in the development of the whole range of digital and holistic skills through play, although more limited than television and games

consoles in relation to physical play. The data suggest that, if children have access to a variety of devices, then this variety supports learning across all areas outlined in Table 10. This, of course, has implications for those families and schools that cannot afford to purchase a range of technological tools, which is very much the case in South Africa. We need to be cognisant of what we might term a 'digital play divide', which was strongly evident in this study in an international context, and attempt to address this through programmes that aim to develop a more equitable context for digital play. Importantly, the provision of digital tools to schools should be accompanied with the right kind of guidance and pedagogical know-how.

This study found evidence that digital play supports the learning of children with additional needs. Some children with, for example, sensory awareness challenges appear to find the playing of games a calming process, and such experiences can contribute to the development of holistic skills, particularly in the emotional domain. Children with additional needs are also vulnerable to the more harmful aspects of digital use, which creates additional challenges for parents and teachers in terms of choosing devices and apps, and supporting this use. Children with specific needs also acquire the range of skills and knowledge outlined in Table 10, but for them, the benefits of digital play may be particularly enhanced in relation to emotional self-regulation, as was seen in the UK data.

In terms of digital play and learning in schools, there was positive evidence of developments in this regard. Technology for some teachers is another 'language', in addition to reading and writing. For example, inspired by the Reggio Emilia approach to early childhood education, teachers in two SA schools and some of the UK schools used technology (such as display boards) to record and to make learning visible for the children as well as the parents and other teachers. Implicated in children's digital ecologies were adults' high expectations of children as independent and creative thinkers/doers, despite the lack of material resources in relation to the SA schools. Teachers generated many examples of children's deep thinking, playing with ideas and a display of rich variety of holistic and higher-order thinking skills. There was evidence of playful digital learning in which teachers guided children as they deployed 'integrated pedagogies' (Parker & Thomsen, 2019) (such as experiential learning and project-based

learning). However, it is important to note that, while gamification and integrated pedagogies were a feature of school use of educational technology, other forms of digital play were less evident in schools, such as the use of augmented reality, for example. Given the influence that schools had on digital play in the home, in that many apps used and promoted by schools were used at home, there is an opportunity for schools to broaden conceptions of learning through technology which could impact positively on home experiences.

Finally, the study identified how important it is to listen to the voices of children on this matter. The majority of the focus group children challenged the assumption that play, learning and technology were three separate concepts. Repeatedly, the children presented experiences in which digital play and learning were experienced in an integrated manner at school or in their homes.

8.1.3 How far does children's play with technology demonstrate the five characteristics of learning through play?

The five characteristics of learning through play, as outlined by Zosh et al. (2017) (joyful, active engagement, iterative, meaningful, social) could be mapped across all types of digital play. In this sense, there is much synergy between the characteristics as they are embedded in non-digital and digital play.

There were some patterns in the analysis that raise interesting points for further consideration. There were slightly fewer instances of the social characteristic than other characteristics but this was primarily a result of the study's methodology, in that home and school visits were of a restricted length, and for some of this time children wished to demonstrate their individual interests and talents in digital play, or were asked to demonstrate the use of a specific app and/or device by researchers. However, children can learn a great deal through solitary play using digital technology, if the content and device are appropriate for their needs. We observed many individual play episodes using digital devices that were enjoyable, productive, challenging, and led to all kinds of learning. However, there were also a range of rich social interactions that took place around all kinds of devices in the case studies and these provided opportunities not just for individual learning, but the kind of 'interthinking' that Littleton and Mercer (2013) note is important for group learning.

Further, there were fewer instances of some of the higher-order aspects of iterative play noted, such as complex problem solving. This was sometimes due to the kinds of apps and games that children used which were at times limited in design and so did not promote open, creative play. Apps and games that were more open-ended, such as Minecraft and Roblox, provided many more opportunities for iterative play and these episodes led to new knowledge and skills being developed.

There was some discrepancy between the quantitative and qualitative data in this respect. Parents primarily recognised the characteristics of being joyful and actively engaged in the data and placed less emphasis on the other three characteristics. While this may reflect the qualitative findings in relation to the characteristics of social interaction and iteration in play, it does not do so in terms of digital play being meaningful to children, for which there was widespread evidence. Indeed, the extent to which this was the case might be characterised as 'digital deep play', drawing on Geertz's (1973) notion of the kinds of deep play that can be apparent in cultural practices. Digital deep play draws on, and feeds into, children's social and cultural identities and informs their lifeworlds in a profound manner. It is perhaps an indication of the limitation of surveys that this characteristic was not more widely recognised by parents, as they may not have understood fully what was intended by this term.

8.1.4 What is the relationship between play with technology and creativity?

There is little doubt that digital play fosters creativity in all of its forms – cognitive, artistic, and so on. The key finding in the UK data this regard, as outlined in Section 5.3, is that the more open-ended and self-directed the digital play is, the more children are able to develop the full range of creative habits of mind.

Imagination is a key aspect of creativity and there was much evidence that digital media fostered imaginative play. Digital media sources informed children's imaginaries as they played being their favourite characters, acted out scenarios related to programmes and games, and imbued dolls and soft toys with the characteristics of superheroes, princesses, and so on. Digital devices also offered a means of children exploring and expressing their imaginative thoughts, and this kind of play was often highly creative. The study found

that YouTube was a significant source for children's imaginative play, both as a prompt and inspiration for such play, but also as a repository for it. There was evidence with regard to older children that TikTok was also a popular source for play, although most parents expressed reservations about the safety of the app.

The relationship between specific kinds of devices and particular kinds of creativity is of interest. For example, as noted above, apps and videogame play fostered cognitive creativity, whereas television led to physical and imaginative play. Smart assistants were notable for their facilitation of language, musical, physical and imaginative play. Tablets and smartphones enabled creative production, such as drawing and making films.

Finally, the study found a correlation between creativity and the kind of mediation that occurred. Mediation was considered in relation to both human and non-human aspects. So, the affordances of devices children used (that is, what actions they enabled or constrained) and the quality of the app or game were as important as aspects of human mediation, such as the attitude and input of parents, the questions asked by adults, and so on. When both human and non-human mediation are in alignment with each other, thereby enabling agency in the digital play episode, then creativity can be found in abundance.

8.1.5 How do parents and other adults facilitate children's play with technology, and what are their views on this issue?

As outlined in Section 7, parents and other adults held a wide range of views about digital play. Taking both contexts into account, the views about the usefulness of digital play for learning are on the whole positive, but also balanced by some important reservations. Adults often remarked that digital play is a reward or a distraction from the 'real' important things in life, such as work. It is fair to say that most parents held mixed views about the use of technology for learning. Parents, community leaders and teachers agreed that engaging in digital play may assist with the development of subject knowledge, e.g. through the use of online apps, so perhaps more explicit messages are needed about digital play and how it can explicitly help with the teaching of literacies and numeracy alongside broader skills.

While parents often recognised the benefits of technology in terms of its importance for educational development, concern was frequently expressed about its perceived negative aspects. In particular, parents drew on the discourse of digital ‘addiction’ and were concerned about content and contact risks. Parents held both positive and negative views simultaneously, recognising the multi-faceted aspects of the digital. UK parents also sometimes outlined views on a range of negative aspects of digital play when it was clear that digital play in their own households was generally well balanced. This may have been a case of some parents reflecting dominant views in the media on children’s uses of technology, which Plowman and McPake (2013) characterise as ‘myths’, as the views are not always supported by robust research evidence.

Technology was a central aspect of family life. Parents used digital play as a family management tool, as has been found in previous studies (Chaudron et al., 2017). Parents used digital play as a reward, incentive, calming mechanism and distraction tool, for example.

The play theorist Brian Sutton-Smith noted the ‘triviality barrier’ (1970) that often occurs in relation to adults’ views of childhood play, in which they consider play to be too inconsequential to take seriously. It was evident in this study that the triviality barrier was enhanced in relation to digital play. Some parents did not recognise digital play as play at all, or felt that children were engaged in meaningless, time-wasting activities. There was evidence of a generational gap in this regard, in that parents frequently shared their feelings of perplexity and/or ignorance in relation to their children’s uses of technology. This was often a barrier to them engaging in co-play.

There were some differences between the survey data and case study data in that respect. Parents in the UK survey, for example, demonstrated a stronger desire to engage in digital play than some of the case study parents. This may be because parents who complete an online survey are more confident in the use of technology than the case study parents, some of whom expressed a lack of confidence about their own use of technology. Console games were used particularly for family play, and there were gender differences in that fathers were more likely to be engaged in game play, while more mothers supported creative play, such as using drawing apps.

As noted in Section 7, adult mediation of children’s digital play is similar in nature to their mediation of non-digital play, but there are differences. Mothers were less likely to play digitally with the children than fathers, particularly in relation to some technologies, such as games consoles. Parents were particularly keen to engage in digital co-play to support learning rather than broader holistic skills, whereas in terms of non-digital activities, co-play focused on creative (e.g. LEGO) or physical (such as outdoor sports) play. In general, parents took few opportunities to engage in activities such as coding, making films or music.

In guided digital play, the adult quite often focuses on providing scaffolding for the more operational digital literacies, rather than creative digital skills. This is particularly the case in schools, where adults generally undertook a more directive role with regard to digital play. The role of adults other than parents, such as grandparents, is also of value and indeed these adults can be more permissive about some forms of digital play than parents. In addition, teachers are important mediators of digital play, as discussed in the previous section on learning.

The LEGO Foundation’s work on the adult mediation of play focuses on three main modes: free play, guided play and game play. As outlined, in this study, free play was much more in evidence than guided and game play, for a complex range of reasons. However, primarily it is the case that many adults have less familiarity with play with children in a digital context than non-digital co-play, and so are less likely to join in digital play. However, the quantitative data did indicate a correlation between the two domains, in that parents who engaged in digital play were also engaged in non-digital play. Therefore, it is perhaps more appropriate to focus on the notion of ‘playful parents’, who are confident at supporting children’s play across domains.

8.1.6 To what extent is children’s play with technology shaped by socio-cultural contexts?

In this study, the UK and SA team used a similar research design, mirroring as much as possible each other’s use of research tools and instruments. Despite some variations that are mainly pragmatic, but also contextual, this particular research set-up turned out to be unexpectedly rich. Although not a comparative study as such, it was through the different socio-cultural contexts that a great deal was learned about what

it means to research children's play across different contexts as well as about children's digital play itself. Most childhood research assumes Western notions of childhood as laid down by the United Nations (UNCRC) as vulnerable, fragile and in need of protection. African childhoods are rarely conceptualised or investigated (Penn, 2005; Murris, 2019). Especially in a continent plagued with HIV/AIDS, there is a distorted picture of what childhood is like for many children, obscuring their capacities and the contributions they make in caring for siblings and other family members (Kesby, Gwanzura-Ottmoller & Chizororo, 2006). Because Western research practices in early childhood and the conditions that make them possible tend to be hegemonic and the standard by which research findings elsewhere are judged (Dahlberg & Moss, 2005), the two research teams made sure that any deviation from the Western norm was not regarded as 'being less' or inferior. In Appendix 1 we outline the details of the difference the socio-cultural context made for the methodology adopted by the SA team.

The difference between socio-cultural contexts had profound implications for the online survey in the study (see Appendix 1 for details). The survey questions were devised by the UK research team, including the LEGO Foundation and Dubit. The SA team adapted the survey and hard copies also had to be printed. WiFi is expensive and not often available for all parents in SA. Student researchers were recruited to go into the field and help respondents to complete the survey. The survey was conducted one-on-one. Given the context of South Africa, we were mindful that approaching individuals to invite them to participate in a survey was going to be a challenge as it is very difficult for people to trust strangers. The survey was administered to parents at various places where parents took their children to play, and these included the schools as parents waited to fetch their children at the end of a school day; shopping malls; play parks; beaches and other spaces where parents observed their children play.

The multilingual reality of South Africa needed to be taken into consideration. English is not the home language for the majority of people in South Africa, thus it was necessary to adjust the language in the research tools to be accessible for research participants. Only 8% of South Africans speak English at home. Thirty parents from the survey were selected for interviews based on their gender, language, income, where they

lived and the age of their children. Thirteen of the 30 parent interviews were conducted in isiXhosa and later translated into English by the interviewer and transcriber. Afrikaans-speaking parents preferred their interview in English when given the option by the interviewer. Therefore, while the study provides a range of rich insights into the digital play lives of South African children, further research is needed that focuses more specifically on the linguistic aspects of play. This is also the case in the UK. While the UK study identified a range of similarities across the experiences of children from different cultures, there were differences in relation to the extent to which children could access material that reflected their own identities. In addition, while some heritage language resources could be accessed, for example through YouTube, there were more limited games and apps in a range of languages, which places constraints on children's digital play with family and friends who speak the same languages.

The flows of digital play across home, school and community varied in both sites. In the Cape Flats, safety issues, infrastructure and parents' financial resources prevented children from taking their playful learning with them easily from one space to another. In the UK, digital play was embedded in almost all rooms of the homes of children, but took place most frequently in shared spaces. Schools used a range of apps to support learning, and these were often played with by children in the home. There was little use of digital technologies in many of the community spaces and after-school activities children attended, and so to a large extent it was schools that offered children opportunities to build on their digital interests outside of the home. However, children had few opportunities to take their own digital play practices into schools, apart from two schools that successfully engaged with children's home practices. This is an area that could be further developed.

8.2 Implications of the study

The findings of the study have a number of important implications for a range of stakeholders – researchers, policy-makers, the children's media industry, teachers and parents. Each of these stakeholder groups is addressed separately below.

8.2.1 Implications of the study for research

There are a number of implications of this study for further research:

- First, there was clear evidence that the five characteristics of learning through play are evident in digital play. However, adults are not always aware of how these characteristics can be fostered so that learning through digital play is optimised. Further research should focus on the development and implementation of best practice guidance in this area, which can then be fully evaluated in order to enhance practice. Some of the barriers of implementation in South Africa are language, resources and infrastructure, differences in culture, traditional teacher-centred pedagogies, and the current national curriculum that is content-driven, text-based (worksheets and textbooks) and is highly prescriptive. It is clear that the legacy of apartheid in South Africa still deeply affects the same communities and despite new schools being built, as was the case with some of the schools in the study, there is still a lack of service delivery and access to technological resources. The sheer number of children in these communities who need to attend school means oversized classrooms and space being limited for what is perceived to be extra-curricular (art rooms, computer lab, school hall or playground). It is also the case in the UK, in particular England, that play-based learning has been under threat for some time (Roberts-Homes & Bradbury, 2016). There is, therefore, a need to ensure that these barriers are taken into account in any initiative that attempts to drive forward this agenda. In addition, this study was undertaken in Cape Town and the Cape Flats in South Africa, but research is also needed in non-urban, rural settings.
- The study indicates that there is a need to undertake a longitudinal study in order to consider the development of digital play over time in families, tracing learning journeys in depth, and enabling researchers to build good quality, long-term relationships with the children, parents/guardians, teachers and community leaders. Such work, in order to be most insightful, needs to be ethnographic in nature and draw in the voices of children as far as possible. This research should also engage with racial, ethnic and linguistic minorities in a way that is broader than working with a few groups in South Africa. Such research needs to study children's digital ecologies across different contexts of their daily lives, but also to investigate how intersectionality has an impact on access in relation to the LEGO Foundation's *Five Characteristics of Learning Through Play*.
- Further, the vast amount of digital content children are accessing is in English, which is not the home language of the majority of children in South Africa or other parts of the world. What needs further exploration are the ways in which children's digital play moves across languages as children interact with multilingual cohorts, the extent to which they move between languages where home languages are available, and the ways in which their play and ability to make meaning transcends language in digital spaces.
- Many studies on play are focused on younger children, as it is assumed play is more important or relevant to them, but the data suggest that this is not the case. There were many older siblings in this study who were involved in digital play. A study could be undertaken to explore this play, and to consider how secondary schools can value and incorporate digital play.
- There needs to be further consideration of the value of digital play for intergenerational learning and socialisation. There was much evidence of intergenerational digital play in this study but we need to understand outcomes in a more detailed way.

- Finally, the study confirmed that researchers' own questioning and interviewing skills can substantially influence the data collected. Children's responses may open up or close down depending on the interview approach. Further research at meta-level could focus on the difference these skills make when investigating digital play. There is also a need to consider a broad range of modes in data collection. This study did include language, videos, images, drawings, concept maps and models but there are other modes and methods which would be of value in research on digital play, and more inclusive ways of engaging children as co-researchers in a topic which is of central interest to them.
- There needs to be greater emphasis on the quality of technologies, products, devices and software solutions for children's digital play. Governments could set standards and apply kitemarks, or lists of approved products, which could offer valuable guidance to parents.
- Teacher education programmes need to be developed that address the issue of digital play and how schools can build on children's home digital play practices. Schools have made great strides in terms of the use of technology to support learning but play is limited to the use of gamification strategies, in which apps and games are largely used to develop functional skills. A broader pedagogical approach to digital play is required – one that fosters more open-ended and experimental approaches.

8.2.2 Implications of the study for policy

- One of the key messages to policy-makers arising from this study is that digital play has significant value for children's learning, as outlined above. Digital play is largely ignored in terms of policy development, yet it informs many aspects of children's learning across home, school and community domains. Policy-makers need to consider how digital play is conceptualised and embedded in curriculum documentation.
- Further, policy-makers need to listen more closely to children's own voices about their digital play. Children in this study had many significant things to say about their play and such insights can be used to inform policy-making. This needs to be undertaken in way that is representative of various communities and is not tokenistic in nature.
- The study points to the need to develop a policy approach to digital well-being that is much broader than a focus on online safety and the management of risks, such as health risks. Technology permeates many aspects of children's lives and, therefore, a holistic approach should be taken to digital well-being which recognises the role of digital play in children's learning and development. As well as learning how to manage their digital use and become competent and confident digital citizens, children also need to learn how to develop and manage a digital play portfolio that is fulfilling for them, and fruitful for their friendships and family relationships.
- One way of starting to address digital inequality is to lobby for a reduction in data costs for developing countries. South Africa has the most expensive home fibre internet connections of any country, according to a recent survey.⁴³
- Finally, there should be more support for parents on how to mediate digital play. Parents frequently feel that this is a world outside of their own understanding, and so family digital play and learning programmes could be undertaken in which parents are introduced to strategies which can be used to strengthen the educational outcomes of digital co-play.

8.2.3 Implications of the study for the children's media industry

- The children's media industry should work to develop a set of standards for technology and play. These standards would need to be broad enough to include devices, apps, games, online services and software solutions. The standards should emphasise the need for goods and services to, among other factors: (i) be age appropriate, (ii) foster learning, (iii) meet a diverse range of learning and development needs, (iv) be culturally and linguistically diverse, (v) enable children to play safely, (vi) cultivate creativity and imagination, (vii) give children sufficient choice and autonomy (viii) promote sustainability, and (ix) be tested appropriately with children before release.

Products should have the best interests of children at their core.

- The study identified that there is a lack of cultural relevance in many media/digital texts provided for South African children. The Western nature of these narratives is the norm and researching the design, production and use of digital tools that are culturally appropriate for the culture and context is urgent. There is a need for African games, practices and narratives that include the sound and rhythms of Africa and its musical instruments to be developed and disseminated, with minimal cost implications.
- A lack of diversity in digital play products is also of concern in other countries, including the UK, and producers should focus on the development of toys, games and apps that represent the diversity of contemporary childhoods. This would include the development of toys, games and services that are diverse in terms of racial/ethnic representation, but also in relation to representations of gendered identities and disability, for example. In addition, many children live in families with LGBT+ parents and/ or wider family members, and/or live in single parent families, or with extended families who co-habit, or live in foster or adoptive homes, and so on, and so games should reflect this diversity of family life.
- In the study, children made insightful comments about digital play products that could have informed the design of such products. Where possible, the industry should do more to engage children in digital toy/play design. This could be through the use of extended observations of play, but also talking to children about products, either individually or in focus groups. Diverse methods should be used, such as visual methods (including the use of point-of-view cameras), use of concept mapping, classifying and sorting and storying (developing narratives around products). However, more innovative approaches could include co-development of products from the design stage through to production.
- Given the current context in which post-digital play takes place across analogue and digital domains, more products could be developed

that integrate online/offline play, some related to traditional forms/genres/titles, which extend their possibilities. In addition, products in this area could pay attention to ways in which devices can foster physical, outdoor play. There was evidence from this study that children are using wearable devices such as Fitbits to compete against each other, for example, but toys could create opportunities for competitions, leagues, and so on.

- The value of family play was reconfirmed in this study, as digital play served to reinforce emotional ties and foster intergenerational understanding. There is a need to develop more games and devices that foster family play, as there appeared to be an over-reliance on a few titles, particularly in the UK. The games should pay attention to the ease of on-boarding (becoming familiar with a game and its potential) and should consider imaginative ways to interface not just with televisions but also smart assistants.
- There was limited take-up of virtual reality games, but this may be because affordable technology is relatively new. In addition, more attention should be paid to fostering storytelling and narrative in VR, as advocated by Yamada-Rice, Mushtaq, Woodgate et al. (2017).
- Finally, digital play involves content creation and some of this content is focused on toy and game brands and apps. While quality is variable, there is little doubt that such content drives children's engagement with these brands. Companies should, therefore, think of imaginative ways to engage positively with this user-generated content that moves beyond appropriating popular genres (e.g. unboxing) for their own ends.

8.2.4 Implications of the study for parents

- The study has numerous implications for parents. It is clear that there is still much work to do in terms of persuading parents that digital play is valuable, and providing them with support and guidance. Key messages about the value of digital play need to be framed in a way that is easily accessible and across languages. Involving parents in the production of these resources would be of value.

- Parents should be given information about the way in which digital play not only develops cognitive skills and impacts on learning, but also develops holistic skills including physical, social, emotional and creative skills.
- Parents need a means of becoming familiar with how to engage in more digital play with children that is child-led, and focused on creative production, rather than limiting co-play to games, although this is also of value.
- Parents should be encouraged to talk to their children in meaningful ways about their digital play, as it is through such communication that shared understandings can be developed. This can include conversations about managing risks, but should not focus on this aspect at the expense of considering the opportunities.
- The five characteristics of play have great value, as outlined above, and therefore parents could be introduced to ways to ensure that the five characteristics of learning through play are fostered.
- Parents could be offered advice about how to link digital to non-digital play, to encourage play across the domains. This could be of particular importance to parents who feel that their children spend too much time in the digital world.
- Teachers should use technology as an additional language to express and communicate meaning and to co-create a curriculum that takes children's interests as a starting point for learning. Technology in Reggio Emilia inspired schools is an essential part of pedagogical documentation and the creative exploration of concepts.
- Teachers should acknowledge the way in which digital play not only develops cognitive skills and impacts on learning, but also develops holistic skills including physical, social, emotional and creative skills. This message could be usefully offered to parents.
- The provision of pop-up or permanent makerspaces in schools (specific areas that contain a range of digital and non-digital resources for making and tinkering) has been found to promote digital play, experimentation and innovation.⁴⁴ Schools could consider how such spaces could be developed and implemented, perhaps with the support of local businesses, charities and trusts.
- This study demonstrated clearly that schools play an important role in encouraging digital play at home, which is particularly important when children's home experiences of technology might otherwise be limited in nature. Schools should consider how this aspect of their provision could be extended through, for example, offering workshops for parents on how to support children's learning through digital play.

8.2.5 Implications of the study for school

- While great strides have been made with regard to the use of educational technology in schools, there is room for the development of more playful approaches in some classrooms. There is a need to broaden the experiences of children so that there are more opportunities to engage in creative production in which they can play and experiment with devices. This would require additional time and resources for schools.
- Teachers should introduce a broader spectrum of pedagogy for digital play, with the use of approaches that operate along a continuum between free play and direct instruction.
- The five characteristics of the LEGO Foundation's *Learning Through Play Experience Tool* can inform the development of playful pedagogies, and guidance could be developed for schools on how to ensure that these characteristics are embedded in classroom practice.
- Many schools hold after-school activities and the playful use of technology in these activities could enhance children's experiences. Where possible, schools could consider how this work could be supported through the provision of training and short-term loans of equipment.

8.3 Concluding comments

This study's contribution to the field of the study of play has a number of elements. Firstly, it has offered insights into the nature of contemporary digital play in South Africa and the UK, outlining the similarities and differences in practices, and identifying the underlying patterns in children's digital play episodes as they take place across multiple sites and times. Secondly, the study provides evidence that digital play can lead to knowledge and skills development in ways that are engaging for children. It outlines how the five characteristics of learning through play, developed by the LEGO Foundation (Zosh et al., 2017), are present in digital play, and thus have the potential to be developed further by adults who understand how to support children's digital play in ways that foster agency and self-efficacy. Thirdly, the study outlines how digital play can enhance creativity, developing creative habits of mind through both consumptive and productive digital practices. It offers evidence about the kinds of digital play that are most creative. Fourthly, the study has led to new understandings about the role of adults

in children's digital play. One of the conclusions of the study is that connectivity depends not only on material resources, such as infrastructure, finance and internet access, which are compromised for people living in poverty. It also depends on human connectivity; that is, peers and adults who engage in co-play, join in with meaningful digital play, co-research and nurture higher-order thinking skills. Social relations can be reinforced through digital play, leading to the strengthening of family and other ties and, although technology can limit family time, it can also extend it in ways that are only now beginning to be recognised. Finally, the study has also demonstrated that research on digital play is most effective when participants have an opportunity to engage in digital play as part of the methodology. Our playful use of a range of research tools, including GoPro cameras, WhatsApp messages and LEGO bricks, enabled us to build a rich dialogue with children and their families that informed our understanding and, at the same time, offered them powerful opportunities to reflect on their digital play lives.

References

- Aguilar, D. & Pifarre Turmo, M. (2019). Promoting Social Creativity in Science Education With Digital Technology to Overcome Inequalities: A Scoping Review. *Front. Psychol*, 10:1474. Doi: 10.3389/fpsyg.2019.01474
- Arnott, L. & Yelland, N. (2020). Multimodal lifeworlds: Pedagogies for play inquiries and explorations. *Journal of Early Childhood Education Research*, 9(1), 124–126.
- Bell, J. & Mckay, T. M. (2011). The rise of 'class apartheid' in accessing secondary schools. *Southern African Review of Education*, 17, 27–48.
- Blank, T. J. (2009). *Folklore and the internet: Vernacular expression in a digital world*. Logan: Utah State University Press. Accessed at: https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1034&context=usupress_pubs
- Blum-Ross, A., Donoso, V., Dinh, T., Mascheroni, G., O'Neill, B., Riesmeyer, C. & Stoilova, M. (2018). *Looking forward: Technological and social change in the lives of European children and young people*. Report for the ICT Coalition for Children Online. Brussels: ICT Coalition.
- Blum-Ross, A., Kumpulainen, K. & Marsh, J. (2019). *Enhancing digital literacy and creativity: Makerspaces in the early years*. London: Routledge.
- Bodrova, E., Germeroth, C. & Leong, D. J. (2013). Play and self-regulation: Lessons from Vygotsky. *American Journal of Play*, 6(1), 111–123.
- Bornman, E. (2016). Information society and digital divide in South Africa: Results of longitudinal surveys. *Information, Communication & Society*, 19(2), 264–278.
- Bourdieu, P. (1986). The forms of capital. In Richardson, J. (Ed.), *Handbook of Theory and Research for the Sociology of Education*. New York: Greenwood.
- Braun, V. & Clark, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Buckingham, D. (1993). *Children talking television: The making of television literacy*. London: Routledge.
- Burnett, C. & Bailey, C. (2014). Conceptualising collaboration in hybrid sites: Playing Minecraft together and apart in a primary classroom. In C. Burnett, J. Davies, G. Merchant, & J. Rowsell (Eds), *New literacies around the globe: Policy and pedagogy* (pp. 70–91). London: Taylor & Francis.
- Butler, J. P. (2009). *Giving an account of oneself*. New York: Fordham University Press.
- Center for Applied Special Technology (CAST) (2011). *Universal design for learning guidelines* (Version 2.0). Wakefield, MA: CAST.
- Chaudron, S., Di Gioia, R. & Gemo, M. (2018). *Young children (0–8) and digital technology: A qualitative study across Europe*. Joint Research Council, Accessed online at: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC110359/jrc110359_young_children_online.pdf
- Chaudron, S., Marsh, J., Navarette, V. D., Mascheroni, G., Smahel, D., Cernikova, M. & Soldatova, G. (2017). Rules of engagement: Family rules on young children's access to and use of technologies. In S. Danby, M. Fleeer, C. Davidson, & M. Hatzigianni (Eds), *Digital childhoods: Technologies and children's everyday lives* (pp. 131–145). Singapore: Springer.
- Chouinard, M. M., Harris, P. L. & Maratos, M. P. (2007). *Children's questions: A mechanism for cognitive development*. Chichester: Wiley-Blackwell.

- Connolly, P. (2007). *Quantitative data analysis in education: A critical introduction using SPSS*. London: Routledge.
- Csikszentmihalyi, M. (2008). *Flow: The psychology of optimal experience*. New York: HarperCollins.
- Dahlberg, G. & Moss, P. (2005). *Ethics and politics in early childhood education*. London: Routledge.
- Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P. & Howe, A. (2013). Creative learning environments in education – A systematic literature review. *Thinking skills and creativity*, 8, 80–91.
- Dezuanni, M., O'Mara, J. & Beavis, C. (2015). 'Redstone is like electricity': Children's performative representations in and around Minecraft. *E-learning and Digital Media*, 12(2), 147–163.
- Dixon, K. (2020). Searching for mermaids: Access, capital, and the digital divide in a rural South African primary school. In E. Morrell & J. Rowsell (Eds), *Stories from inequity to justice in literacy education: Confronting digital divides*. New York: Routledge, pp.15–33.
- Dixon, K. & Janks, H. (2019) Researching a child's embodied textual play. In J. Rowsell, G. Falloon & N. Kucirkova (Eds), *The Routledge International Handbook of Learning with Technology in Early Childhood*. New York: Routledge, pp. 88–106.
- Dockett, S. & Perry, B. (2011), Researching with young children: Seeking assent. *Child Indicators Research*, 4(2), pp. 231–247.
- Dyson, A. H. (2016). *Child cultures, schooling and literacy: Global perspectives on composing unique lives*. New York: Routledge.
- Eberle, S. G. (2014). The elements of play: Towards a philosophy and definition of play. *American Journal of Play*, 6(2), 214–233.
- Elisondo, R. (2016). Creativity is always a social process. *Creativity. Theories–Research–Applications*, 3(2), 194–210.
- García-Peñalvo, J. (2018). The utopia of the technological revolution. Editorial Preface. *Journal of Information Technology Research*, 11(4), v–viii.
- Garud and Karnoe (2005). Distributed agency and interactive emergence. In Floyd, S. W., Roos, J., Jacobs, C. D. & Kellermanns, F. W. (Eds) *Innovating strategy processes*. Oxford: Blackwell Publishing, pp. 88–96.
- Gee, J. (2018). Affinity spaces: How young people live and learn online and out of school. *Phi Delta Kappan*, 99(6), 8–13. <https://doi.org/10.1177/0031721718762416>
- Geertz, C. (1973). Deep play: Notes on the Balinese cockfight. In C. Geertz, *The Interpretation of Cultures*. New York: Basic Books, pp. 412–453.
- Giddens, A. (2002). *Runaway world*. London: Profile Books.
- Giorza, T. & Haynes, J. (2018). Beyond words: Materiality and the play of things. In K. Murris & J. Haynes (Eds), *Literacies, literature and learning Abingdon*: Routledge, pp. 101–123.
- Glăveanu, V. P. (2010). Paradigms in the study of creativity: Introducing the perspective of cultural psychology. *New ideas in psychology*, 28(1), 79–93.
- Global Systems Mobile Association (2018). *The mobile economy: Sub-Saharan Africa 2018*. London: GSMA. <https://gsma.com>.
- Hall, K. (2019). *Child-only households*. *Children count*. Cape Town: University of Cape Town, www.childrencount.uct.ac.za
- Haynes, J. & Murris, K. (2019) Taking age out of play: Children's animistic philosophising through a picturebook. *Oxford Literary Review*, 41(2), 290–309.
- Hennessey, B. A. & Amabile, T. M. (2010). Creativity. *Annual Review of Psychology*, 61, 569–598. <https://doi.org/10.1146/annurev.psych.093008.100416>
- Hilbert, M. (2016). The bad news is that the digital access divide is here to stay: Domestically installed bandwidths among 172 countries for 1986–2014. *Telecommunications Policy*, 40, 567–581.

- Hughes, B. & Melville, S. (1996). *A playworker's taxonomy of play tips*. PlayEducation.Organisation
- Hughes, B. (2002). *A playworker's taxonomy of play* (2nd edition). London: Playlink.
- Jayemanne, D., Apperley, T.H. and Nansen, B. (2016) Postdigital interfaces and the aesthetics of recruitment. *Transactions of the Digital Games Research Association*, 2 (3): 145–172. <http://todigra.org/index.php/todigra/article/view/56/104>
- Jensen, H., Pyle, A., Zosh, J. M., Ebrahim, H. B., Zaragoza Scherman, A., Reunamo, J. & Hamre, B. K. (2019). *Play facilitation: The science behind the art of engaging young children* (White Paper). The LEGO Foundation, DK. https://www.legofoundation.com/media/1681/play-facilitation_the-science-behind-the-art-of-engaging-young-children.pdf
- Kabi, J. S. (2016). The evolution of resources provision in basic education in South Africa: A projectile with diminishing returns. *Southern African Review of Education*, 22, 81–97.
- Kafai, Y. B. & Fields, D. A. (2013). *Connected Play: Tweens in a Virtual World*. MIT Press
- Kesby, M., Gwanzura-Ottemoller, F. & Chizororo, M. (2006). Theorising other, 'other childhoods': Issues emerging from work on HIV in urban and rural Zimbabwe. *Children's Geographies*, 4(2): 185–202.
- Knox, J. (2019). What Does the 'Postdigital' Mean for Education?, *Postdigit Sci Educ* 1, 357–370 <https://doi.org/10.1007/s42438-019-00045-y>
- Kucirkova, N. (2017). *Digital personalization in early childhood*. London: Bloomsbury.
- Latour, B. (2011). Networks, societies, spheres: Reflections of an actor-network theorist. *International Journal of Communication* 5, 796–810. <https://ijoc.org/index.php/ijoc/article/view/1094>
- LEGO Foundation (2017). What we mean by learning through play. https://www.legofoundation.com/media/1062/learningthroughplay_leaflet_june2017.pdf
- Lipman, M. (1991). *Thinking in Education*. Cambridge: Cambridge University Press.
- Littleton, K. & Mercer, N. (2013). *Interthinking: Putting talk to work*. London: Routledge.
- Livingstone, S. & Helsper, E. J. (2008). Parental mediation of children's internet use. *Journal of Broadcasting & Electronic Media*, 52(4), 581–599.
- Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, 29(4), 278–290.
- Mackey, M. (2006). *Literacies across media: Playing the text* (2nd edition). London: Routledge.
- Marsh, J. (2019). Researching young children's play in the post-digital age: Questions of method. In G. Falloon, N. Kucirkova & J. Rowsell (Eds) *Routledge International Handbook of Learning with Technology in Early Childhood*. London: Taylor & Francis.
- Marsh, J. (2017). The Internet of Toys: A posthuman and multimodal analysis of connected play. *Teachers College Record*, 119(12), 1–32.
- Marsh, J. (2016). 'Unboxing' videos: Co-construction of the child as cyberflâneur. *Discourse: Studies in the cultural politics of education*, 37(3), 369–380.
- Marsh, J. (2015). The digital literacy skills and competences of children of pre-school age. *Media Education Studies & Research*, 7(2), 197–214.
- Marsh, J. (2005). Ritual, performance and identity construction. In J. Marsh (Ed.), *Popular culture, new media and digital literacy in early childhood*. London: RoutledgeFalmer, pp. 33–50.
- Marsh, J. & Bishop, J. C. (2014). *Changing play: Play, media and commercial culture from the 1950s to the present day*. Maidenhead: Open University Press.
- Marsh, J., Law, L., Lahmar, J., Yamada-Rice, D., Parry, B., Scott, F., Robinson, P., Nutbrown, B., Scholey, E., Baldi, P., McKeown, K., Swanson, A. & Bardill, R. (2019). *Social media, television and children*. Sheffield: University of Sheffield. Accessed at: https://www.stac-study.org/downloads/STAC_Full_Report.pdf

- Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J. C., Lahmar, J., Scott, F., Davenport, A., Davis, S., French, K., Piras, M., Thornhill, S., Robinson, P. & Winter, P. (2015). *Exploring play and creativity in pre-schoolers' use of apps: Final project report*. Accessed at: www.techandplay.org.
- Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J. C. & Scott, F. (2016). Digital play: A new classification. *Early Years: An International Research Journal*, 306(3), 242–253.
- Mascheroni G. & Holloway D. (2019). Introducing the Internet of Toys. In: Mascheroni G., Holloway D. (Eds) *The Internet of Toys. Practices, Affordances and the Political Economy of Children's Smart Play*.
- Mignolo, W. (2009). Epistemic disobedience, independent thought and de-colonial freedom. *Theory Culture & Society*, 26, 159–181.
- Mirra, N., Morrell, E. & Filipiak, D. (2018). From digital consumption to digital invention: Toward a new critical theory and practice of multiliteracies. *Theory Into Practice*, 57(1), 12–19.
- Mitgutsch, K. (2013). Why sports videogames matter to their players. In M. Consalvo, K. Mitgutsch & A. Stein, *Sports videogames*. New York: Routledge, pp. 251–277.
- Muijs, D. (2011). *Doing Quantitative Research in Education with SPSS*. SAGE <https://dx.doi.org/10.4135/9781849203241>
- Murris, K. (2013). The epistemic challenge of hearing a child's voice. *Studies in Philosophy and Education*, 32(3), 245–259.
- Murris, K. (2016). *The posthuman child: Educational transformation through philosophy with picturebooks*. Contesting Early Childhood Series. London: Routledge.
- Murris, K. (2019). Children's development, capability approaches and postdevelopmental child: The birth to four curriculum in South Africa. *Global Studies of Childhood*, 9(1), 1–16. t.
- Nathanson, A. I. (1999). Identifying and explaining the relationship between parental mediation and children's aggression. *Communication Research*, 26(2), 124–123.
- Ng'ambi, D. & Bozalek, V. (2016). Learning with technologies in resource-constrained environments. In N. Rushby & D. W. Surry (Eds), *The Wiley handbook of learning technology*. Chichester: Wiley Blackwell, pp. 200–220.
- Ofcom (2016). *Children and parents: Media use and attitudes report 2016*. <https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/childrenparents-nov16>
- Ofcom (2019). *Internet users' online experiences and attitudes. Qualitative research summary February 2019*. https://www.ofcom.org.uk/__data/assets/pdf_file/0022/157153/online-experiences-attitudes-qualitative-summary-report.pdf
- Ohlendorf, R. (2016). Playing with the legend: Ostension and extra-textual production in Minecraft. *Heidelberg Journal of Religions on the Internet*, 10. <https://doi.org/10.17885/heup.rel.23547>
- Paley, V. G. (2004). *A child's work: The importance of fantasy play*. Chicago: University of Chicago Press.
- Parker, R. & Thomsen, B.S. (2019). *Learning through play at school*. LEGO Foundation. <https://www.legofoundation.com/media/1687/learning-through-play-school.pdf>
- Parry, B. & Scott, F. (2019). Researching children's play and identity in the digital age: A holistic approach. In O. Erstad, R. Flewitt, B. Kümmerling-Meibauer & I. S. Pires Pereira (Eds) *The Routledge handbook of digital literacies in early childhood*. London: Routledge, pp. 442–452.
- Pashapa T. & Rivett, U. (2017). Gender of household head and the digital divide in South Africa's settlements. *Gender, Technology and Development*, 21(3), 232–249
- Penn, H. (2005). *Unequal Childhoods: Young children's lives in poor countries*. London: Routledge.
- Plowman, L. & McPake, J. (2013). Seven Myths About Young Children and Technology. *Childhood Education*, 89(1) 27–33.
- Plowman, L., McPake, J. & Stephen, C. (2008). Just picking it up? Young children learning with technology at home. *Cambridge Journal of Education*, 38(3), 303–319.

- Preston, J. M. (2012). Absorbed in video game play: From immersion to the development of consciousness. In J. Gackenbach (Ed.), *Video Game Play and Consciousness*. New York: Nova Science Publishers, pp. 143–170.
- Preston, J. M. (2017). Games, dreams and consciousness: Absorption and perception, cognition, emotion. In J. Gackenbach & J. Bown (Eds), *Boundaries of Self and Reality Online: Implications of Digitally Constructed Realities*. San Diego, CA: Academic Press, pp. 205–237. (Online Abstract: <https://www.sciencedirect.com/science/article/pii/B9780128041574000116>)
- Rinaldi, C. (2006). *In dialogue with Reggio Emilia: Listening, researching and learning*. New York: Routledge.
- Roberts-Homes, G. & Bradbury, A. (2016). The datafication of early years education and its impact upon pedagogy. *Improving Schools*, 19(2), 119–128.
- Robson, S. (2014). The Analysing Children's Creative Thinking framework: Development of an observation-led approach to identifying and analysing young children's creative thinking. *British Educational Research Journal*, 40(1), 121–134.
- Rollins Gregory, M., Haynes, J. & Murris, K. (Eds) (2017). *The Routledge International Handbook of Philosophy for Children*. London: Routledge.
- Sayed, Y. & Motala, S. (2012). Equity and 'no fee' schools in South Africa: Challenges and prospects. *Social Policy & Administration*, 46(6), 672–687.
- Scott, F. (2018a). *Young children's engagement with television and related media in the digital age* (PhD Thesis, University of Sheffield). <http://etheses.whiterose.ac.uk/22928/>
- Scott, F. (2018b). Troublesome binaries: Play and learning on screen and off. In P. Smith & J. Roopnarine (Eds). *The Cambridge Handbook of Play Developmental and Disciplinary Perspectives*. Cambridge: Cambridge University Press, pp. 240–257.
- Sicart, M. (2013). A tale of two games: Football and FIFA 12. In M. Consalvo, K. Mitgutsch & A. Stein (Eds), *Sports videogames*. New York: Routledge, pp. 32–49.
- Sutton-Smith, B. (1970). Psychology of Childlore: The Triviality Barrier. *Western States Folklore Society*, 29(1), 1–8
- Sutton-Smith, B. (1997). *The ambiguity of play*. Cambridge, MA: Harvard University Press.
- Tarling, I. & Ng'ambi, D. (2016). Teachers' pedagogical change framework: A diagnostic tool for changing teachers' uses of emerging technologies. *British Journal of Educational Technology*, 47, 554–572.
- Titus, S. (2019). Engendering coloniality under the guise of fair play. <https://www.uwc.ac.za/News/Pages/Engendering-Coloniality-under-the-guise-of-fair-play.aspx>
- Tomanović, S. (2004). Family Habitus as the Cultural Context for Childhood. *Childhood*, 11(3), 339–360. <https://doi.org/10.1177/0907568204044887>
- Topping, K. J. & Trickey, S. (2007). Collaborative philosophical enquiry for school children: Cognitive effects at 10–12 years. *British Journal of Psychology*, 77, 271–288.
- Trickey, S. & Topping, K. J. (2004). 'Philosophy for children': A systematic review. *Research papers in Education*, 19(3), 365–380.
- Trilling, B. & Fadel, C. (2009). *21st century skills: Learning for life in our times*. San Francisco: Jossey-Bass.
- Valkenburg, P. M., Krcmar, M., Peeters, A. L. & Marseille, N. M. (1999). Developing a scale to assess three styles of television mediation: 'Instructive mediation,' 'restrictive mediation' and 'social coviewing.' *Journal of Broadcasting & Electronic Media*, 43, 52–66.
- Van Dijk, J. & Hacker, K. (2003). The digital divide as a complex, dynamic phenomenon. *The Information Society*, 19(4), 315–326.
- Van Deursen, A. & Helsper, E. (2015). The third-level digital divide: Who benefits most from being online? In L. Robinson, S. Cotten, J. Schulz, T. Hale, & A. Williams (Eds), *Communication and information technologies annual: Digital distinctions and inequalities* (pp. 29–53). Studies in Media and Communications, Volume 10. Bingley, UK: Emerald..

Vecchi, V. (2010). *Art and creativity in Reggio Emilia: Exploring the role and potential of ateliers in early childhood education*. New York: Routledge.

Willett, R., Richards, C., Marsh, J., Burn, A., & Bishop, J. C. (Eds) (2013). *Children, media and playground cultures*. Basingstoke, UK: Palgrave Macmillan.

Yamada-Rice, D., Mustaq, M., Woodgate, A. & Whitley, S. (2017). *Children and virtual reality: Emerging possibilities and challenges*. <http://digilitey.eu/wp-content/uploads/2015/09/CVR-Final-PDF-reduced-size.pdf>

Zaman, B., Nouwen, M., Vanattenhoven, J., De Ferrerre, E. & Looy, J. V. (2016). A qualitative inquiry into the contextualized parental mediation practices of young children's digital media use at home. *Journal of Broadcasting & Electronic Media*, 60(1), 1–22.

Zosh, J. M., Hopkins, E. J., Jensen, H., Liu, C., Neale, D., Hirsh-Pasek, K., Solis, S. L. & Whitebread, D. (2017). *Learning through play: A review of the evidence* (White Paper). The LEGO Foundation, DK. https://www.lego.com/r/legofoundation/-/media/lego%20foundation/downloads/foundation%20research/learning%20through%20play_web.pdf?l.r2=950397599

Appendix 1: Methodological approaches in the UK and South Africa

Data collection in the UK

The data collection was undertaken in three stages. In Stage 1, an online survey was completed by parents of 3–11-year-olds. In Stage 2, 10 case studies of families with children aged 3–11 were conducted. In Stage 3, focus group interviews were undertaken with children in five schools. In Stage 4, telephone interviews with parents of 3–11-year-olds were completed in order to explore some of the survey outcomes in further depth. Some of these stages overlapped in terms of timescale. In the following sections, further details are provided about each of these stages.

In Stage 1 of the study, an online survey was conducted by Dubit of 2,429 families with children aged 3–11 across the UK. The survey was devised by the whole research team, including the LEGO Foundation and Dubit. Survey respondents were recruited from an established panel in line with industry practice, and a structured sample was constructed to ensure distribution across age, gender, ethnicity, socio-economic class⁴⁵ and geography.

The profile of the sample was as follows:

Table 1.1: Profile of UK sample

Age	
3–7 years	51%
8–11 years	59%
Gender (of child)	
Female	47%
Male	53%

Ethnicity/Race (of parent)	
White (this includes all White backgrounds)	87%
Mixed	4%
Asian or Asian-British	6%
Black or Black-British	2%
Chinese or other ethnic group	2%
Socio-economic group (of family)	
A	11%
B	25%
C1	28%
C2	17%
D	13%
E	3%
Other/NA	4%

In Stage 2, 10 case studies of families containing focus children aged 3–11 were conducted. The families were recruited through established contacts of the research team, including contacts with schools and previous research study participants, which constituted a convenience sample. The families were diverse in terms of income, from low-income to high-income families, with one family dependent on state benefits. One of the children had special needs. The ethnic/racial heritage backgrounds of the families are outlined in pen portraits of each family, located in Section 3 of the main report. The families were visited six times over a five-month period. Parents and children were interviewed and videoed. Parents also filmed their children using technologies, and they and their children were asked questions about the videos. Parents shared images and videos with researchers using WhatsApp. In addition, children in the families were given diaries to record their use of social media and television, and used GoPro cameras to record their digital play. Children were invited to use LEGO bricks to build a toy they would like to be invented. They were also invited to create concept maps on a number of questions relating to play, technology and learning. Further, the children were observed in

schools using technology, and were also observed in a regular after-school club or community venue they visited. In each case, the child's class teacher and the community/after-school club leader were interviewed. On completion of the visits, families constructed photo books, facilitated by the researchers, in order to explore what the project had meant to the families and what play with technology meant to them.

In Stage 3, focus group interviews were conducted with 71 children aged 5–11 in four primary schools and one secondary school (37 boys and 34 girls). The schools served demographically diverse communities, including primarily White working-class communities and ethnically diverse communities. The children took part in focus group interviews. They also completed collages and created concept maps. In addition, the children were invited to use LEGO bricks to build a toy they would like to be invented. Information sheets about the project were sent out to all children in the targeted classes. In order to ensure a distribution of classes, two classes in each year group were targeted across the five schools. Those children whose parents agreed they could participate joined the focus groups.

Table 1.2: Focus group children profiles by ages and gender

	FS2 Boy	FS2 Girl	Y1 Boy	Y1 Girl	Y2 Boy	Y2 Girl	Y3 Boy	Y3 Girl	Y4 Boy	Y4 Girl	Y5 Boy	Y5 Girl	Y6 Boy	Y6 Girl	Y7 Boy	Y7 Girl
School 1	2	2	1	3												
School 2	6	2			9	4										
School 3											4	1	5	4		
School 4															1	8
School 5							6	6	3	4						
TOTAL	8	4	1	3	9	4	6	6	3	4	4	1	5	4	1	8

71

In Stage 4, telephone interviews were conducted with 30 parents of 30 children aged 3–11 – 15 girls and 15 boys. These were recruited by asking for volunteers from those families who completed the survey. Families were chosen to ensure diversity in terms of social class and ethnicity/race. They were given a £30 voucher for their participation.

Using these tools, a broad range of data were collected, as outlined in Table 1.3.

Table 1.3: Overview of UK qualitative datasets

Case Studies

	Names and ages of focus children	No. of home visits	No. of school observations	No. of visits to community spaces, and what they were	No. of interview transcripts (including from family, school and community, and total time of audios in H:M:S)	No. of videos recorded by the research team, and total time of videos in H:M:S
Family 1	Mallison, 6 Essa, 4	6	4	1 x football match 1 x horse riding lesson	43 10:43:25	47 1:51:55
Family 2	Alison, 6 Chloe, 4	6	4	1 x Rainbows 1 x musical theatre group	16 11:10:46	68 2:16:19
Family 3	Stephanie, 9 Saskia, 6	6	4	1x cornet lesson 1 x Rainbows	18 12:17:27	70 3:36:33
Family 4	Harvey, 6 Simon, 8	6	4	1 x after-school club	10 5:58:41	37 2:24:54
Family 5	Zander, 5	6	4	1x tennis club	9 6:36:47	73 2:54:27
Family 6	Leo, 5 Alfie, 3	6	4	1x Spanish language club	14 6:39:20	70 2:24:22
Family 7	Anna, 7 John, 4	6	4	1 x drama club 1x gardening club	24 13:49:10	165 4:31:33
Family 8	Jeremy, 11 Cerys, 9	5	4	1 x autism spectrum disorder children's club	30 8:52:09	30 2:19:47
Family 9	Hanif, 8	6	4	1 x after-school club	11 5:41:57	29 1:06:40
Family 10	Noah, 9 Jacqueline, 5	6	4	1 x after-school family meal	15 11:22:42	55 2:55:17

Focus Groups Data

Number of transcripts	54
Number of images (including of LEGO models)	140
Number of concept maps/drawings	82

	No. of videos recorded by parents, and total time of videos in H:M:S	No. of GoPro videos recorded by children, and total time of videos in H:M:S	No. of images taken by research team	No. of images taken by families (parents and children)	No. of drawing/ play diary pages by children	No. of field notes/ observations at home visits	No. of Whats-App messages sent by parents	No. of surveys completed
	3 0:19:02	16 1:44:49	108	39	13	6	16	1
	11 0:42:54	33 5:6:17	109	16	43	6	16	1
	3 0:06:32	17 1:52:36	121	18	21	6	10	1
	3 0:01:14	59 1:24:35	111	21	15	6	0	1
	10 0:11:57	0	143	6	32	6	1	1
	17 0:25:02	31 1:33:26	84	0	1	6	0	1
	15 0:10:05	20 0:17:26	67	62	5	6	0	1
	4 0:09:28	33 7:28:58	37	128	20	5	1	1
	26 0:55:25	25 0:47:26	38	0	2	6	35	1
	8 0:31:50	7 0:44:39	130	0	16	6	1	1

Data collection in South Africa

The data collection was undertaken in three stages. In Stage 1, an online survey was completed by parents of 3–11-year-olds in the locality of the schools. In Stage 2, 10 case studies of families with children aged 3–11 were conducted. In Stage 3, focus group interviews with children in five schools were undertaken. In Stage 4, telephone interviews with parents of 3–11-years-olds were completed in order to explore some of the survey outcomes in further depth. In the following sections, further details are provided about each of these stages.

The research design of the South African study took into account the different school calendar and the conditions placed on researchers by the Western Cape Education Department (WCED). Research is not permitted in government schools in the fourth semester of any calendar year. With each school year running from mid-January to the end of November, this meant in practice that all data collection in the schools had to be completed before the last week in September. In the UK, the project had started with the survey, then the work with case study children, not the schools. The fieldwork of both projects ran simultaneously, but mostly independent from one another.

In Stage 1 of the SA study, 10 schools were approached through established networks, either university partnership schools, or schools in which former student teachers were now practising teachers, which constituted non-probability sampling. One school dropped out (as explained in Section 3, Family K). In post-apartheid South Africa, equitable dispensation aimed at redress in the education sector meant that there were funding opportunities across various provinces to facilitate the distribution of resources in schools across socio-economic groups. To this end, national policies were shaped to accommodate provincial poverty quintiles that ranged from one to five (Sayed & Motala, 2012). In 2006, a 'No-fee policy' was adopted, and schools which fell in the lowest two quintiles were exempt from learners paying fees. Quintiles were based on the socio-economic status of the surrounding

community in which the schools were based (Kabi, 2016; Sayed & Motala, 2012). In 2009, the no-fee schools were broadened to Q3, ultimately prohibiting schools in quintiles one to three from charging school fees (Bell & McKay, 2011). In the South African context, schools were selected across the various quintiles to ensure that the contextual anomalies in society were also reflected in the sample.

Two of the case study children are located in Johannesburg and attend a non-government preschool (birth-to-five care and education is not provided by the state, and the Grade R year was only recently added to formal primary education). They constitute a convenience sample in that the family was known to one of the researchers through previous research and offered an opening into a particular demographic. The researchers themselves were recruited either on the basis of their academic expertise or their experience (early childhood education, educational technology, teaching, teacher education, etc.) and included several members who either worked or lived (or both) in the marginalised communities included in the research. These factors were an important consideration in the data collection because of the intersectional nature of gender, race, language and class in the South African context and the fact that racialised demographics still exist in the 'post-apartheid' context. Researchers who participated had access to communities and could be considered insiders. Capacity building was also a consideration, affording opportunities for data collection to new doctoral students and three visiting postdoctoral fellows from Brazil. In total, four researchers and five research assistants worked with research coordinators who met regularly on WhatsApp and other virtual spaces (e.g. Skype reading group meetings). Also, three two-day workshops were organised to support the communication and deliberations across the teams and to write the report together. In this collaborative space, most of the important decisions were negotiated and decided upon. This set-up also made it more likely for the research team to notice transfer of learning across

various contexts, such as school, home, community or other settings. Researchers also worked closely with the transcribers. The video and audio dataset is substantial and only relevant data were transcribed (and when appropriate translated) when directly relevant for answering the research questions. All transcripts and observation notes were coded, mostly using NVivo software.

During Stage 1, the research coordinators contacted either the principal of the school or the teacher. The Principal Investigator (PI) of the South African component also visited most of the schools at this stage and explained the purpose of the research to the principals who in turn selected the teacher(s) who would be most interested and/or had the time to be involved. The teachers in turn selected the children aged 3–11, as well as the children of the focus groups in collaboration with the researchers (and at a slightly later stage). The nine families were diverse in terms of income, from low-income to middle-income families. Although most of the parents had some kind of income, some families relied in part on social support grants. The racial and ethnic heritage backgrounds of the families are outlined in pen portraits of each family, located in Section 3 of the main report. The families were visited 4–6 times over a two-month period. Parents and children were interviewed and videoed. In SA, parents also filmed and photographed their children using cell (mobile) phones, and they and their children were asked questions about these visual images. In addition, children in the families were given diaries to record their use of social media and television and used wearable cameras to record their digital play. Children were also invited to build a toy they would like to be invented using a variety of media, including playdough and LEGO bricks. Further, the children were observed in schools using technology. Some were also observed in a regular after-school club or community venues they visited. In many suburbs, safety issues, infrastructure and parents' financial resources prevent children from taking part in out-of-school activities and constrained this aspect of data collection so the decision was made to use after-school clubs when available.

In Stage 2, focus group interviews were conducted in five primary schools. No focus groups were conducted with children in the sample who attended preschool. However, visual diaries were used with the younger children in particular, and this proved to be very

generative in catalysing rich research conversations about the children's conceptual engagement with their play practices. The parents of those children who participated in the focus group all provided individual consent. The children also completed collages and concept maps (see Section 4 for some examples). Information sheets about the project were sent out to all children in the targeted classes. The grades of children ranged from preschool (ages 4–5) to Grade 5 (age 11). The only grade not represented in this study was Grade 3. In line with the current move in education to accommodate transgender practices and to move away from discriminatory practices that require children to identify themselves as either boy or girl, no table is included with an overview of children's gender and age of the children.⁴⁶

In various ways, as was to be expected, the methodology and especially the quantitative data collection was affected by South African's lack of access to digital technology – what some people refer to as the 'digital divide' (Dixon, 2020) (see Sections 4.1 and 8.1.6).

The research tools used in the qualitative and quantitative phases of the South African study are similar to those in the UK survey. The changes were not substantial enough to justify publishing separately, but a summary of the changes made by the SA team in collaboration with the UK team is as follows:

1. The multilingual reality of South Africa needed to be taken into consideration. English is not the home language for the majority of people in South Africa, thus it was necessary to adjust the language in the research tools to be accessible for research participants. Only 8% of South Africans speak English at home, according to Stats SA's latest General Household Survey.⁴⁷ Thirty parents from the survey were selected for interviews based on their gender, language, income, where they lived and the age of their children. Thirteen of the 30 parent interviews were conducted in isiXhosa and later translated into English by the interviewer and transcriber. Afrikaans-speaking parents preferred their interview in English, when given the option by the interviewer.
2. Interview and survey questions were substantively revised to reflect the realities of South African families. For example, many children do not have their own bedrooms, and so questions related to

use of digital devices in bedrooms were removed. In addition, the majority of families in South Africa use public transport, so were not asked about car ownership. Although the survey was designed to be conducted online, as mentioned above, we printed the survey because of the high cost of data and because people could not access the online version. The survey was long and took an average of 20–30 minutes to complete.

3. South Africa is a society that is deeply divided. Currently, it is the most unequal society in the world in terms of the Gini coefficient. The majority of poor, unemployed and semi-employed people participate in a complex informal economy, in some cases including illegal activities. Suspicion, and a lack of openness is sometimes the result. The visiting of homes in SA is therefore controversial and stopping people at random in public spaces for surveys can be misconstrued and can invite hostile responses. It was therefore necessary to make sure that all interviewers were clearly identifiable as university students and wore T-shirts indicating they were taking part in a research project. Sites were carefully chosen: public, open spaces where parents and children tend to play.
4. Socio-cultural and other factors had to be taken into account for the focus groups, home visits and classroom observations. So, for example, the use of wearable cameras was of concern in some of the communities where the study was conducted. Leaving the GoPro at home with children who live in an area considered to be at risk became a danger to the safety of the child, the family and even the researchers. Thus, the decision to change the research protocol and not to work with GoPro cameras (except during the researchers' visits) in one of the case studies comes not only from what we can call methodological sensitivity, but also ethical and legal concerns about the safety of people involved. It is necessary to understand how research affects and can affect the community being investigated.

In Stage 3, an online survey was conducted of 1,286 families with children aged 3–11 across the geographical area that comprises Cape Town and its surrounds (called the Cape Flats). The survey

questions were devised by the UK research team, including the LEGO Foundation and Dubit. The SA team adapted the survey. Although the survey was designed as an online survey,⁴⁸ hard copies were also printed. The reason for this is that WiFi is expensive and not always available for all parents. Student researchers were recruited to go to the field and help respondents to complete the survey. The survey was conducted one-on-one. This was particularly important as not all parents had English as their first home language and the survey was in English. All the student researchers wore red T-shirts with a project label. A project site was designed and a URL was printed on the T-shirts. Given the context of South Africa, we were mindful that approaching individuals to invite them to participate in a survey was going to be a challenge as it is very difficult for people to trust strangers. Thus, the URL⁴⁹ on a T-shirt meant that anyone who wanted to check whether the project was legitimate could use the URL. The survey was administered to parents at various places where parents took their children to play, and these included the schools as parents waited to fetch their children at the end of a school day; shopping malls; playparks; beaches and other spaces where parents observed their children play. The names of the parents who completed the survey were entered into a draw to win a wearable camera – the same draw used for the follow-up interviews. An incentive was necessary but offering money (as per the UK study) to research participants was against policy and regulations at the University of Cape Town.

In Stage 4, telephone interviews were conducted with 30 parents of children aged 3–11. These were recruited by asking for volunteers from those families who completed the survey. Families were carefully chosen to ensure diversity in terms of social class, race and ethnicity. Initially, 10 families had been selected whose home language was isiXhosa, 10 Afrikaans-speaking and 10 English-speaking families, but in the end only 13 isiXhosa telephone interviews were completed (and subsequently translated) and 17 in English. The names of the parents who completed the interview were entered into a draw to win a wearable camera – the same draw set up for the survey.

The South African datasets are outlined in Table 1.4.

Table 1.4: SA Qualitative Data

	Family	Grade	Age	Child	Child	Child	Child	Child	Child	Child	Child	Child	Child
School 1	A	R	6	WB	WB	WB	IB	IB	CG	CG	IG	BG	
School 2	D	5	11	WB	WB	WB	WB	CG	CG				
School 3	B&C	1	7	BB	BB	BB	BG	BG	BG	CG	CG		
School 4	F	4	10	BG	CG	BB	WB	CB	WB	CB			
School 5	J	2	8	IG	CG	CG	CG	CG	CG	CG	WG	WG	WG
School 6	K	4	10	CG	CG	CG	CG	CG	CB	CB	CB	CB	

Focus group Sample in South Africa: 49 children, categorised according to age, gender (B= Boy; G=Girl) and Race (W=White; B=Black; C=Coloured; I=Indian)

	Names, ages of focus child/ren, and race	No. of home visits	No. of school observations	No. of visits to community spaces, and what they were	No. of interview transcripts (including from family, school and community)	No. of videos recorded by the research team, and total time of videos in H:M:S
Family A	Zuko, boy, 6 (Black)	3	4	1 Sports Hub	27	68 videos (1:56:02)
Family B	Eshal, girl, 7 (Coloured)	3	4	1 Local library	23	120 videos (2:58:49s)
Family C	Henry, boy, 8 (Black)	3	4	0	18	110 1:67:13
Family D	Sophia, girl, 11 (Coloured)	3	4	1 Creative and Talented Prog.	33	91 videos (3:43:55)
Family E	Linton, boy, 6 & Della, girl, 6 (Black)	4	4	0	8 1:30:57	9 0:58:31
Family F	Karabo, boy, 10 (Black)	4	4	2 Judo class and music teacher	20	4 3:25:00
Family G	Lulama, girl, 5 (Black)	5	3	0	30	0
Family H	Kamden, boy, 4 (Coloured)	5	2	0	37	4 0:03:47
Family J	Gemma, girl, 8 (Indian)	5	3	2- Robotics Club	11	20 0:53:40
Family K	Fahiemah, girl, 10 (Coloured)	0	3	0	4	1 0:00:10

Focus Groups Data

Number of transcripts	288
Number of images (including of LEGO models)	2945
Number of concept maps/drawings	102

No. of videos recorded by parents, and total time of videos in H:M:S	No. of GoPro videos recorded by children, and total time of videos in H:M:S	No. of images taken by the research team	No. of images taken by the families (parents and children)	No. of fieldnotes/ observations (including school/ home visits)	No. of WhatsApp messages sent by parents	No. of questionnaires completed
14 videos (1:37:42)	17 videos (1:04:55)	459	5	1 (4 parts)	8	0
4 videos (0:11:29)	28 videos (4:05:48)	760	47	1 (4 parts)	35	0
0	4 0:05:30 (taken by researchers)	694	2	1 (4 parts)	29	0
0	22 (42m:38s Taken by children)	905	2	1 (4 parts)	7	1
0	3 0:15:09	65	0	8	0	0
0	3 0:41:00	31	Not itemised in dataset	8	?	0
2 0:34:00	9 0:54:24	31	0	3 (in parts)	?	0
15 0:04:55	5 0:08:04	17	10	0	0	0
0	17 3:43:32	74	0	6		0
0	0	71	0	2		0

Approaches to data analysis

The qualitative data were analysed in the same way in both South Africa and the UK. A deductive coding framework was developed, drawing on the tools developed by the LEGO Foundation (Zosh et al., 2017; Jensen et al., 2019), in addition to previous research on play and technology and on adult questioning undertaken by members of the team (Chaudron et al., 2017; Rollins Gregory, Haynes & Murris, 2017).

This project used the LEGO Foundation *Learning Through Play Experience Tool* (LTPET) to analyse the data. The tool begins with an analysis of how far a playful experience is agentic. When children have agency, they are active in making choices about their play and have a sense of self-efficacy in relation to their play experiences. The psychological scaffolding of the LTPET consists of the six stages of agency: **Non-Play, Passive, Responding, Exploring, Owning, Transferring**.

Non-play is when a child shows no interest in an activity. If a child has a minimum sense of agency, she or he will simply follow the instructions and be in the Passive stage. The next stage, Responding, is when the child responds to the design elements, a welcoming parent, peer, or facilitator and begins to form intentions. If the child's interest is piqued, she enters the Exploring stage and begins to explore different elements and set her own goals. Then, if the play experience reaches a high level of quality, the child enters the Owning stage where the experience and learnings are internalised. Finally, with play experiences of the highest quality, the child becomes able to transfer the learning to other situations; this is what is meant by playful experiences of the highest quality. The Transferring stage can only happen after the playful experience in question. The quality of a play experience is based on five play characteristics, defined by the LEGO Foundation⁵⁰ as 'meaningful', 'actively engaged', 'iterative', 'socially interactive' and 'joyful'.

For the purposes of this study we adopted a taxonomy of digital play devised by Marsh et al. (2016) and based on an earlier version proposed by Hughes (1996). Although play is a highly contested term, these criteria enable us to discern the many different forms that play takes and to see how the opportunities for play afforded by digital technologies map onto more established forms, in ways that provide insights about creativity in particular. In addition, we adopted Lucas's (2016) five-dimensional model of creativity which has taken key concepts associated with creativity from the existing research literature and formulated them as 'creative habits of mind' which can be both taught and learnt. The model has been implemented widely internationally. The five habits are identified as being: (i) Inquisitive; (ii) Imaginative; (iii) Persistent; (iv) Collaborative; (v) Disciplined. The data analysis involved coding using the five creative habits of mind in relation to the digital play taxonomy.

The role of adults in the mediation of children's play was undertaken through the use of a range of theoretical tools which included the LEGO Foundation's framework (Jensen et al., 2019) and Scott's work (2018a) on parental mediation of young children's digital play.

These various frameworks were merged to provide a set of agreed deductive codes to be used by both countries. Researchers also developed inductive codes that informed their analyses, in alignment with normal procedures for thematic analysis (Braun & Clark, 2006).

The survey data were processed and analysed using the IBM SPSS 22 statistical package. Descriptive statistics summarising the demographic features of the UK dataset were developed, in addition to a full set of statistical analyses. These can be found on the UK open data repository site.⁵¹

Responses from each question in the survey were cross-tabulated against the following variables: age of child, socio-economic class, ethnicity/race and gender. All variables in the survey data, both demographic and question-response, are either nominal or ordinal in nature so these results were then analysed using the chi-square test of association (Connolly, 2007; Muijs, 2011) to indicate statistically significant relationships (e.g. between a child's gender and their reported tablet usage). Statistically significant results were highlighted at the 1% and 0.1% level of significance to account for the large size of the dataset and repeated statistical testing (following Marsh et al., 2015). Additionally, post-test Cramer's V effect sizes have been calculated (Muijs, 2011) in cases where statistically significant results at the 1% level were found, and are reported in the table.

Ethical issues were addressed throughout the study, in line with the BERA *Ethical Guidelines for Educational Research*, fourth edition (2018) and the research ethics regulations of the School of Education at the University of Cape Town. Parents of children in the case studies and focus group interviews signed consent forms, and all adult participants signed consent forms. The notion of informed consent underpinned the approach to the research, with an understanding that for young children, assent must be judged through ongoing assessments of the child's body language in addition to other potential markers of discomfort (Dockett & Perry, 2011). If children appeared to be tired, the interviews/video recording schedules were adjusted accordingly.

Endnotes

- ¹ Dubit is a global children's research agency and digital development studio with offices in Leeds, Washington DC and Melbourne. Dubit's team of 70 works closely with young people to understand their behaviours and play patterns in order to create strategies and products that connect safely and effectively with young audiences.
- ² https://www.legofoundation.com/media/1063/learning-through-play_web.pdf
- ³ https://figshare.shef.ac.uk/collections/Children_Technology_and_Play/4876659
- ⁴ Minecraft is a sandbox videogame that enables users to build worlds and interact with other users.
- ⁵ Roblox is a massively multiplayer online videogame in which users can play and create multiple games.
- ⁶ <https://www.crimestatssa.com/toptenbyprovince.php?ShowProvince=Western%20Cape>
- ⁷ UK Video F7r_20191028_v004
- ⁸ <https://minecraft.gamepedia.com/Herobrine>
- ⁹ <https://www.amazon.co.uk/Quest-Justice-Elementia-Chronicles-Book/dp/0008152861>
- ¹⁰ UK video F4r_20191021_v007
- ¹¹ UK Video F1r_20190907_v009
- ¹² UK Video F1c_20190928_v004
- ¹³ UK Video F3r_20190920_v013
- ¹⁴ <https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework>
- ¹⁵ UK video F4r_20191128_v003
- ¹⁶ UK video F4r_20191128_v002
- ¹⁷ UK video F4r_20191128_v006
- ¹⁸ UK video F4r_20191128_v005
- ¹⁹ UK video F2r_20190930_v019
- ²⁰ UK Video F2r_20190916_v017
- ²¹ <https://unesdoc.unesco.org/ark:/48223/pf0000368479>
- ²² https://figshare.shef.ac.uk/collections/Children_Technology_and_Play/
- ²³ UK Video F8r_191028_v001.
- ²⁴ <https://www.youtube.com/watch?v=ILNZvjetnho>
- ²⁵ UK Video F1r_20190928_v009.
- ²⁶ UK Video F9p_20191003_v037.
- ²⁷ UK Video F7r_20190912_v006
- ²⁸ UK Video F4r_20191021_v007
- ²⁹ UK Video F7r_20190812_v002
- ³⁰ UK Video F2c_20191030_v001
- ³¹ UK Video F7r_20190827_v013
- ³² UK Video F9r_20191121_v002
- ³³ UK Video F4r_20191128_v003
- ³⁴ UK Video F2c_20191031_v018
- ³⁵ UK Video F1c_20190928_v004

³⁶ UK Video F2r_20190930_v021

³⁷ UK Video F1r_20191012_v003

³⁸ UK Video F7r_20190827_v017

³⁹ UK Video F7r_20190827_v020

⁴⁰ UK Video F7r_20190827_v013

⁴¹ UK Video F4r_20191128_v005 and UK Video F4r_20191128_v006

⁴² <https://playingthearchive.net/about/>

⁴³ <https://www.businessinsider.co.za/sa-fibre-data-costs-the-most-expensive-in-the-world-2019-12>

⁴⁴ See Blum-Ross, Kumpulainen and Marsh (2019)

⁴⁵ Socio-economic status was defined using the National Readership Survey (NRS) grades. A summary of these can be found here: <http://www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade/>

⁴⁶ See, for example, <https://www.dailymaverick.co.za/article/2019-06-04-transgender-learners-make-inroads-in-reshaping-rigid-binaries-in-schools/>.

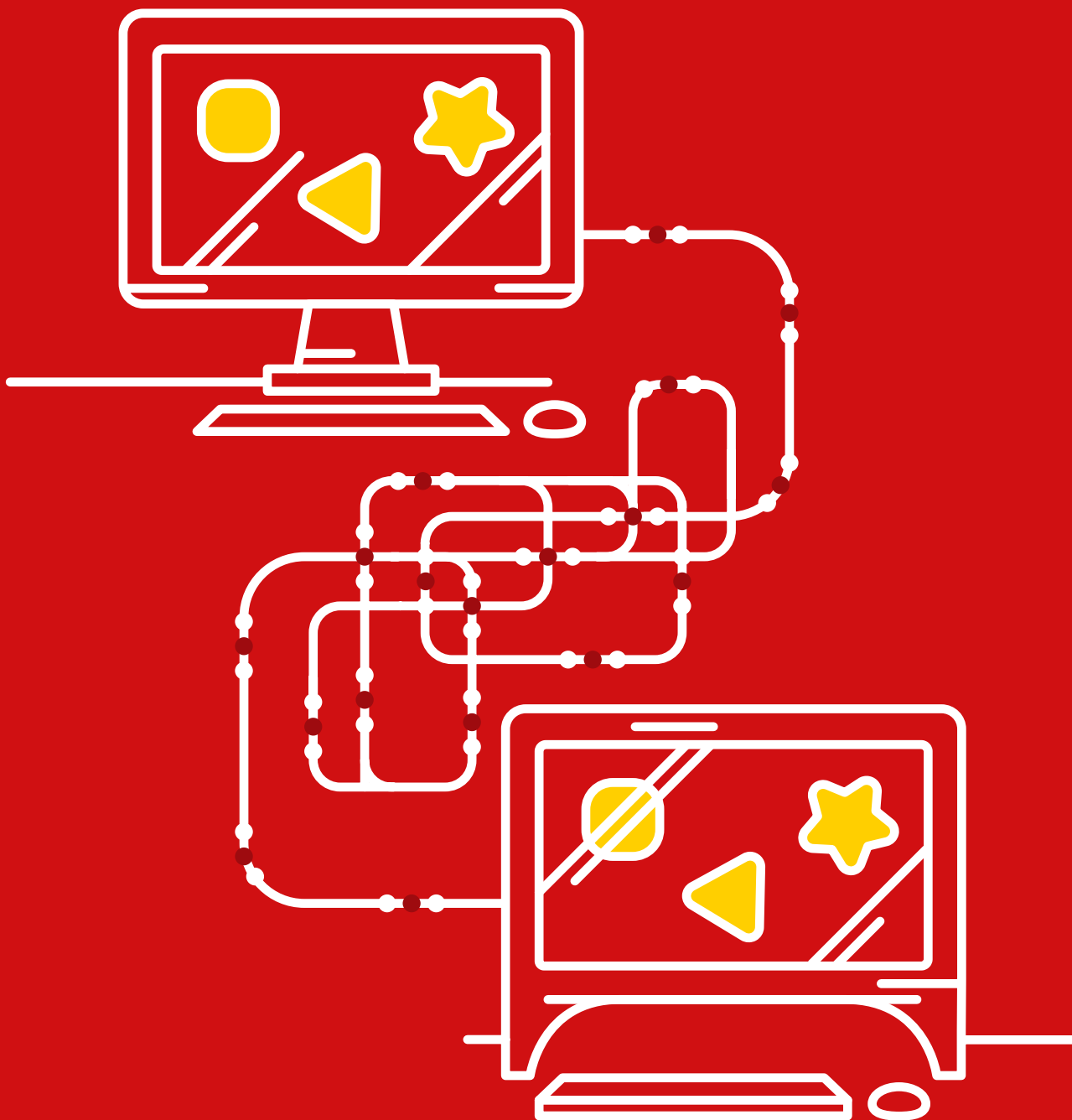
⁴⁷ <http://www.statssa.gov.za/publications/P0318/P03182018.pdf>

⁴⁸ <http://tinyurl.com/2019legosurvey>

⁴⁹ <http://etilab.uct.ac.za/lego/>

⁵⁰ https://www.legofoundation.com/media/1063/learning-through-play_web.pdf

⁵¹ DOI 10.15131/shef.data.c.4876659



Get to know us better at LEGOFoundation.com

Follow us on Twitter @LEGOFoundation

Like us on Facebook

www.facebook.com/LEGOfoundation

Email us at LEGOFoundation@LEGO.com

LEGO Fonden

Højmarksvej 8

7190 Billund, Denmark

CVR number: 12 45 83 39

LEGO is a trademark of the LEGO Group.

©2020 The LEGO Group