Digital Technologies, Play and Learning

Christine Stephen and Lydia Plowman

Abstract

This paper gives an account of the findings of a series of qualitative research studies which explored the technologies with which children aged 3-5 years old play, the forms of learning related to these activities and the conditions which shaped their experiences with digital resources. Three forms of learning were observed in educational settings and an additional form identified when children engaged with technologies at home. However, the proactive support of adults was identified as crucial if children were to have the kind of positive encounters with technology which support learning. We found no evidence that playing with technologies dominated the everyday experience of young children but their individual preferences, the attitudes of their parents towards technologies and ways of learning and their family practices all make a difference to what is played and the opportunities for learning.

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Introduction

This paper is about young children's play and learning with digital toys and technologies at home and in their educational settings. Our account is based on a series of studies, funded by the UK Economic and Social Research Council, which we carried out in response to the developing expectations of parents, early childhood educators and policymakers that play with digital resources will support development and learning.

We have adopted a broad definition of digital technologies which encompasses, but is not limited to, screen-based technologies such as desk-top computers, lap-tops and tablets where the interface is through a keyboard and mouse or touch screen. Also included in our understanding of technologies are digital cameras, mobile phones and leisure technologies such as interactive television and DVDs and motion responsive games. Before they begin school children may encounter e-mail, shopping on-line, webcams, Skype conversations and internet searching as well as toys that simulate appliances such as mobile phones and cash registers and technological educational resources such as reading devices and responsive globes. Reflecting the ways in which parents and educators talk about engagement with technologies we have adopted a broad, activity-orientated understanding of play, focusing on what is 'played'. Our analysis is framed by a socio-cultural perspective. We have thought about digital technologies as a material and cultural feature of young children's lives, interacting with the physical, cognitive, social and emotional features of the environments in which they are growing up.

We begin with brief review of perspectives about young children's engagement with technologies before moving on to describe the methods used in our studies and our findings about play with technologies in preschool settings and at home.

Digital Technologies and the Early Years

Belief in the future value of preschool education and the benefits of policies which support early intervention in the lives of children and their families, coupled with the expectations held by parents and policymakers that competencies with ICT will be necessary to ensure future employability, has enhanced the status of play with technologies. Many parents have welcomed opportunities for children to play and learn with technological resources and in some jurisdictions policymakers and curriculum development bodies have been concerned to ensure that preschool settings are equipped to support children's learning about and through digital technologies and have produced curriculum and pedagogical guidance for the inclusion of a range of technologies in preschool settings (e.g. Learning and Teaching Scotland, 2003; NAEYC, 2012). Furthermore, the positive value placed on early education, coupled with the belief in the potential of digital technologies to enhance learning, has fuelled the market in educational technological toys for play at home.

At the same time a highly polarised and sometimes passionate debate rages around this topic, a situation characterised by Byron (2008: 1) as one 'in which panic and fear often drown out evidence'. On the one hand there are claims that being a competent user of digital media will be an essential pre-requisite for school and adult life in the 21st century while on the other there are

concerns about the dangers associated with the use of technologies, particularly screen-based resources. There are worries that screen-based technology is used as a form of unsupervised baby-sitting which denies children adult company, along with anxieties about 'addiction', physical inactivity, passivity and lack of verbal and social development. Others question the developmental appropriateness of computer-based learning experiences as opposed to traditional, 'hands-on' activities and the neurological impact on young children of spending time using digital toys and technologies. Those with more positive perspectives on technology argue for benefits for children's cognitive development and learning and for their social and cultural awareness and growth. These arguments tend to be forward-facing, concentrating on faster and better learning, the enhanced thinking skills needed in a knowledge economy and preparation for future work lives and citizenship

In the light of this intense debate it is surprising that there has not been more research on the role of digital technologies in early education: what does exist typically adopts a narrow focus, being concerned with the use of computers or new devices such as ipads or tablet computers and it is often targeted at use by school-aged children rather than preschoolers, for example, Banister (2010). There are large-scale studies which provide quantitative data about involvement with digital technologies, and with screen-time in particular, for children not yet attending primary school (e.g. Vanderwater et al, 2007; Marsh, 2005) but this evidence usually depends on parental report and is limited to exposure to a specified range of screen-based technologies. Verenikina et al (2010; 156), reflecting on the neglect of theorising about play and development in the design of computer games, point to the dearth of evidence-based understanding about the ways in which these activities can support what they describe as 'developmental play and higher order thinking in very young children'. Others have argued for more research about children's digital practices at home as well as in educational settings in order to better understand their meaning-making and the competencies they bring to school and preschool (Burnett, 2010; Zevenbergen, 2007).

Exploring what is played and what is learned: research methods

Our studies were designed to find out what technologies children were playing with and what evidence there was that learning was associated with this play. The research was carried out over sustained periods with children at home and in their educational settings and explored the actions and perspectives of the adults who cared for them in their everyday family and preschool lives. The children came from homes which mirrored the socio-economic profile of households in Scotland and therefore included both advantaged and disadvantaged families.

*Interplay, o*ur investigation of children's use of technologies in preschool, involved eight settings from the state and private sector (Stephen & Plowman, 2008). The purpose of *Interplay* was to discover what was needed to ensure that children's engagement with the technologies in their preschool setting was positive and likely to promote learning. Our earlier observations had suggested that children's encounters with computers and other digital resources in preschool playrooms were often brief and appeared to be unsatisfactory. Contrary to expectations, we had observed children abandoning playing with the computer because they could not understand or comply with the instructions for the game, got 'lost' in layers of choices or possibilities, were unable to cope with the cognitive demands of the tasks or lacked the necessary operational skills. In these circumstances playing with the computer appeared to be a less than playful activity and the attractiveness of other more traditional options in these richly resourced environments was evident.

Interplay was conducted through a cyclical process of guided enquiry involving researchers and practitioners. Practitioners decided on the particular kinds of technologies they wished to develop in the context of their nursery, gathered data through their everyday observations and profiling of children's learning and interrogated the data and its implications for their own practices. The research team posed questions, gathered data through systematic observation and video recording and interviews and supported practitioner reflection on the data and analysis.

We have conducted two studies of children's everyday experiences with digital technologies at home: *Entering e-Society: Young Children's development of e-literacy* (referred to here as *Entering e-Society*) and *Young Children Learning with Toys and Technology at Home* (referred to here as *Toys and Technology*) (Plowman et al, 2010). These studies offer evidence from 33 family case studies in total. Our methods were designed to explore children's everyday lives and the technological and social landscapes in which they lived; what Weisner (2002) refers to as the cultural pathways that characterise each family: their values and expectations, resources, routines and practices. Data collection in successive rounds over about 18 months included a range of interviews with parents, observations of children engaging with technologies, structured conversations with children, mobile phone diaries, 'toy tours' and parent- and researcher -recorded video.

Playing with digital technologies in preschool

In consultation with the research team the practitioners taking part in *Interplay* began to extend the range of technologies available in their playrooms while maintaining their focus on the potential for the resources to offer additional experiences or enhance children's learning across the curriculum. They added new software to desktop computers, introduced digital keyboards, cameras and microscopes and enhanced existing provision such as CD players. The children responded readily to these opportunities. They used digital cameras to take photographs, drew, coloured and printed out pictures using computer art packages and listen to audio-recordings of stories. Toys that simulated technologies were incorporated into imaginative play and the children completed computer games which focused on shape, comparing quantities, identifying rhymes and sequencing, though few of these games were open-ended.

On some occasions we observed children intensely engaged with digital technologies, exploring 'what if' or 'what next' options with an educator, competing enthusiastically to gain points or collect targets or viewing peer-produced photographs and videos with friends. However, we also found children vying for control of the mouse or passively waiting for a turn or observing others engaged in a game. Some children became frustrated and abandoned the technologies to move to another activity in the playroom or follow friends to play outside. The presence of digital technologies in the playroom enlarged the range of options available to the children but, when considered in terms of the cognitive nature of 'what is played', the scene appears little different from that of a learning environment without technologies where rehearsing and extending the application of newly acquired competencies is carried out through more traditional activities such as jigsaw puzzles, sorting and matching equipment and adult-led phonic activities.

To gather data about learning associated with play with digital technologies we drew on practitioner records. Their evidence suggested three kinds of learning associated with engaging with technologies:

- operational – learning how to use technological resources
- curricular knowledge and understanding – extending newly developed understandings and skills to varied circumstances and acquiring new knowledge
- developing positive dispositions to learn – affective, social and cognitive outcomes that sustain learning such as developing independence, confidence and willingness to persist in the face of initial challenge.

While the interests and choices of individual children influenced the resources with which they engaged our evidence suggests that it was the actions of their practitioners that made a crucial difference to the extent and level of children's satisfaction with their engagement with digital technologies in the playroom. It was clear that if they were to have positive encounters with digital technologies which were sustained and satisfying then access to the resources alone was not sufficient; positive engagement with technologies in the playroom depended on sensitive and responsive support from practitioners.

We have conceptualised this support as *guided interaction*. Guided interaction involves pedagogic activities which are indirect (distal guided interaction) and direct (proximal guided interaction). Distal guided interaction happens when practitioners make plans and develop their practice at a time when they are not directly interacting with children. It includes decisions about which resources to provide (e.g. purchasing a digital microscope to follow up interest in insect life in the nursery garden), the way in which practitioners are deployed in the playroom in order to facilitate interaction with children as they play with technologies, ensuring equitable access for all children and ensuring that resources are located in suitable physical locations in the playroom. Proximal guided interaction happens in direct interactions with the children. It is multi-modal, enacted through gesture, expression and touch as well as the spoken word. It happens when an adult is able to observe children as they encounter digital technologies and then act in a finely-tuned way to sustain the kind of interest and engagement that is associated with learning in action. These actions include modelling, explaining, sharing success and anxiety and prompting.

Playing with digital technologies at home

In neither of our home-based studies was there any evidence that play with digital technologies dominated the lives of 3- to 4-year olds. Our evidence is that variation and balance between play with digital technologies and technological toys and traditional toys is what children choose and their parents prefer (Plowman et al, 2010a). The children talked readily about favourites among their traditional and technological playthings and parents referred to the ways in which they ensured what they considered to be a suitable mix of physically active, imaginative and entertaining play activities indoors and outside.

Technologies and technological toys were only one part of a varied set of resources (including other people) that children had access to and used as they played at home. Televisions, computers with internet access and mobile phones were ubiquitous features of their homes. However, all of the homes in our studies, regardless of family income, also contained large numbers of traditional toys. Among the families taking part in *Toys and Technology* the proportion of children's playthings that could be categorised as technological ranged from 33% in one household to 10% in others. Among the traditional props for pretend play there were doctor's sets, dressing up clothes and toy kitchens.

Girls and boys had large numbers of soft toys, puzzles, jigsaws and board games and there were cars, train sets, construction kits like Lego, musical instruments and outdoor resources such as trampolines, bikes and balls. Each home offered books, resources for art and crafts and educational games such as dominoes or sound lotto.

What is played? Children's choices at home

Although each child played with a wide range of playthings we did find evidence of gender differences in the traditional and technological toys which children owned and in the branded characters which they favoured across traditional and technological formats. For instance, girls were more likely to play with Barbie dolls and visit the Barbie website while boys tended to prefer physical and virtual play with Lego. However, there was no clear difference between girls and boys in the proportion of their toys that were technological. Beyond these generalised gender differences, our evidence is that children's individual preferences and satisfaction with particular games and toys influence the ways in which they spend their time in play at home. In both of our studies children expressed distinct preferences for physical activities such as bike riding, swimming, going to a soft-play centre and playing in the garden. Inside their homes they favoured screen-orientated activities such as watching television, computer activities and games on websites such as CBeebies. Drawing and watching DVDs were also popular choices. The children's preferred activities indoors suggest that new technologies are a favoured source of entertainment. Television programmes and DVDs are designed to entertain and the children's responses suggest that games on the computer are experienced as engaging and fun, regardless of whether they are designed with learning or entertainment in mind.

Our evidence is that children are discriminating users of technological and traditional playthings and have particular preferences which drive their activities. In some instances children's enduring interests influenced the ways in which they engaged with technologies. For example Kenneth shared his father's interest in racing cars. He had a collection of toy cars and talked enthusiastically about watching television programmes about vehicles, playing with his remote control cars and taking digital photographs of cars at shows. Kelly on the other hand was disinclined to play with the ample supply of technologies and technological toys present in her home. She preferred traditional toys such as Polly Pocket miniature characters and accessories, traditional dolls and Barbie dolls and soft toys which afforded imaginative play. She chose to keep her technological pet switched off as its 'growth' and pre-recorded spoken phrases interfered with the ways in which she incorporated it into her pretend play. During the technology tours of their homes children sometimes explained that they had outgrown some technological playthings, occasionally referring with distain to items they now regarded as childish or boring. For example, Catryna told us how she no longer used the Barney dancemat and that although her sister's LeapPad was in the attic she did not think that she would want to use it. Their accounts presented digital technologies and technological toys in the home as resources to be grown into and out of: like traditional toys and clothes they were part of the material and social context in which they were growing up.

The children were ready to identify technology-mediated and traditional games and activities which they thought that they were good at and others which were challenging or which defeated them, often, referring to playthings associated with negative experiences as boring or too hard. The children often talked positively about their abilities at football, swimming and drawing and many

suggested that they were good at using games consoles, computers and televisions. We can make no judgement about the accuracy of the children's perspectives, nevertheless, their evaluations suggest that technologies and technological toys are not treated differently from other play resources. They enjoy some computer games and websites and can complete some games on a games console and not others. Some children have fun with technological pets while others prefer to rely only on traditional toys for their imaginative games and while some are motivated by improving their score at tennis on the Wii others would rather listen to a story on a DVD.

Family Context- Dimensions of difference

Our analysis of the parent-recorded video of their children beginning to use novel technologies made it clear that having a responsive adult able to engage in guided interaction at home is critical, just as it is in educational settings. At home we found examples of parents giving and children benefiting from the same forms of proximal guided interaction as exhibited by practitioners in preschool settings. There was a common repertoire of multimodal guided interaction across all the parents taking part in *Toys and Technologies,* including verbal and non-verbal responses and interventions, physical actions, cognitive activities such as reading and praise and shared pleasure. However, at home . . cognitive activities such as reading and socio-emotional behaviours. However, at home we noted more episodes where what was needed from parents was support to manage frustration or unhappiness with a score or lack of success at games on the computer, a games console or on the Wii. There was little evidence of children being unhappy or cross when they were engaged with technological games in the preschool playroom, perhaps because of the more homogeneous ability group there and the careful selection of activities to match children's competencies. In contrast, at home where resources were shared across the family 3- to 5-year olds became frustrated when failing to compete with other family members or when attempting a level of difficulty which was not appropriate for them.

Despite the common repertoire of supportive interactions offered by parents our video evidence, interviews and mobile phone diary records reveal the distinctive experience which each child has in the context of their family home. The children's individual interests and perspectives influenced their play with digital technologies but we found that these differences interacted with three other dimensions of difference which arise from the perspectives and behaviours of parents (Stephen et al, 2013):

- attitudes towards digital technologies and technological toys
- ideas about learning
- family practices.

The parents in our studies varied in their views on the value and specific benefits associated with digital technologies and technological toys and these perspectives influenced the encouragement that children receive to engage with technologies as play resources. In some homes certain technologies were reserved for adult use only and most families, aware of the media debate about the dangers for young children of too much screen-time, had instituted some time limits or rationing and rules which influenced each child's access to technologies at home. Some parents were convinced of the educational value of child-orientated technologies and technological toys so prioritised these when purchasing playthings while others were more sceptical about the benefits.

For instance, Jasmine's mother was doubtful about the potential for digital technologies to support learning and would not have purchased the FurReal puppy supplied by the research team. However, she was more open towards the educative potential of the Tag reading scheme. On the other hand, Arden's mother felt strongly that her son's learning was enhanced by the use of a child's computer marketed as an educational product and had purchased one for other children too.

Parents' understandings about how learning happens and the most effective way to support their child's learning made a difference too. In two families the main carer argued that children learn as they play and that they should be left to do this free from adult interference. In these households while children were welcome to make use of the ample digital technologies and technological toys available they were left to find out how to make use of them themselves and only when the child became very frustrated was any help offered. For instance, Robert's attempts at throwing a javelin for a game on the Wii became increasingly erratic and he became angry at his lack of success before he was offered some advice. In contrast, Ms Searl adopted a more directive approach in order to ensure that both technological and traditional playthings were used correctly and to ensure positive encounters with novel technologies. When introducing her daughter to the Tag Reading Scheme Ms Searl explained what happened when each icon was pressed and checked that Jasmine understood this before she was allowed to use the Tag independently.

The third dimension of difference arises from the particular practices which characterise each family context. The opportunities which children have to engage with digital technologies are shaped by shared practices and the circumstances of family life. The mobile phone diaries revealed that on Saturdays over one third of the activities recorded took place away from home. Families went shopping, visited relatives, took part in seasonal activities and went to the cinema. For example, the Fletcher family usually spent much of the weekend engaged in physical activities such as swimming and bike riding, limiting the time available for other forms of play. Ewan Sharp had few opportunities to play with digital technologies as he was encouraged to play outside as much as possible and technological playthings and special toys and books usually remained in the cupboards where they were stored to keep them safe from damage by his younger siblings in his busy and crowded home. Other families made use of digital technologies when they spent time together in the early evening. For instance, Rachel, her sister and parents often competed at bowling on the Wii. Some families valued watching DVDs together, communicated with distant relatives by Skype and shared photographs by email or their mobile phone while others exploring common interests through accessing the internet.

Just as in preschool, children learned how to use technological resources at home, extended their knowledge and understanding of the world and developed positive dispositions. However, at home we found evidence of an additional form of learning: learning about and changing the nature of their participation in the authentic cultural practices of their family or community. Children in our case study families learned to participate in sharing family narratives and visual records, to communicate by email and mobile phone, shop on-line and to relax together by playing games on the Wii and watching television.

Conclusions

Our studies suggest that play with digital technologies can be satisfying for 3- to 5- year olds and provide opportunities for entertainment, fun and learning but that this kind of play is just one part of

the complex and contingent socio-cultural environment in which children live and learn and does not dominate their lives. The children have a wide range of play preferences at home and in their preschool settings and extensive supplies of traditional playthings for use inside and out-of-doors as well as access to digital technologies and technological toys some shared with other family members and some designed specifically for preschool children. Digital technologies and technological toys are associated with learning operational skills, rehearsing and extending literacy and numeracy competencies and knowledge of the world and developing the kind of positive dispositions that facilitate further learning. The 3- to 5-year olds in our studies were discriminating users able to identify the technological and traditional playthings which they were good at and reject others.

As they play with digital technologies children are involved in many of the same kind of cognitive operations they encounter with traditional toys at home and in preschool, for instance, matching and managing quantity or practising literacy skills. Play with digital technologies may be less likely to extend children's physical capacities than traditional play activities but our evidence is that 3- to 5-year olds continue to seek out and enjoy gross motor play. Play with digital technologies can involve collaboration with others, competition and the sharing of resources and opportunities, all experiences which relate to children's social development. We have less evidence of digital resources stimulating imaginative play or being adopted by children as part of their pretend play, although some do blend traditional and technological playthings or engage with brand characters or games across digital and non-digital formats. It is perhaps in this area of imaginative play that there is the greatest scope for development in digital playthings so that the resources move away from the current reliance on defined and closed game designs to more open-ended and flexible resources that respond to children's changing interests and relate to authentic experiences which they want to reproduce in play.

The studies about children use of digital technologies at home and in preschool that we have drawn on in this paper were not designed to provide answers to the questions about potential harm or benefits that bedevil the media debate about young children's use of digital technologies. Nevertheless, our findings about the influence of children's preferences and family life and practices on their play with digital technologies throw doubt on claims that technological play has a universal impact for good or ill. Children's choices, the options provided and encouraged by their families and the presence or absence of a supportive adult at home or in an educational setting all make a difference to playing and learning with digital technologies. Children come to preschool and primary school with difference competencies with technologies, individual interests and varying expectations; conditions which will challenge their educational settings to recognise and build on these personal starting points.

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