Supporting young children's learning with technology at home and in preschool

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Abstract
We describe two empirical investigations of three- and four-year-old children's uses of technology, one conducted in family homes and the other in preschool settings, with the aim of comparing the ways in which children's learning with technology is supported in these different settings. The studies conceptualise learning within a sociocultural framework and use the concept of guided interaction to focus the discussion. Three areas of learning that can be supported by the use of technologies are outlined (extending knowledge of the world, acquiring operational skills, and developing dispositions to learn), with the addition of learning about the cultural roles of technology in the home context.

Both studies took place in Scotland and families were selected according to socioeconomic factors. The first study, of eight preschool settings, involved practitioners in implementing two interventions involving learning with technology. Findings were based on video analysis, interviews with practitioners and a process of guided enquiry. The second study, of children's homes, involved survey responses from 346 parents and five visits over about fifteen months to an initial 24 case-study families. The article also draws on a discussion with educational experts to discuss the policy and practice implications for transition to school.

There were differences in terms of the human and technological resources available, the motivation and opportunities for providing guided interaction and the types of learning that were supported. Children encountered a more diverse range of technologies at home, were more likely to request help and could benefit from observing family practices. The limitations on the technologies available in most preschool settings and their lack of use for authentic activities meant that there were fewer opportunities to develop children's awareness of the different cultural and work-related uses of technology. Preschool and primary school staff have limited knowledge of children's home experiences with technology.

Keywords: preschool, children, learning, technology, home, guided interaction

Introduction

This paper considers the ways in which young children's learning with technology is supported in the two main arenas of their lives: home and preschool. We focus on three- and four-year-old children, drawing on findings from two projects which examine children's learning with technology in preschool playrooms (*Interplay*) and at home (*Entering e-Society)*. Research suggests that patterns of learning interactions differ across these settings in areas such as numeracy (Aubrey et al, 2003) and, particularly, literacy (Feiler, 2005; Heath, 1983; Marsh, 2003; Tizard & Hughes, 1984). We also know that older children's uses of technology differ across home and school (Holloway & Valentine, 2001; Kent & Facer, 2004; Kerawalla & Crook, 2002; Snyder et al., 2002). However, there has been little research to date which combines a comparison of learning at home and in preschool with an examination of children's developing competences with technology, one exception being Marsh et al's (2005) study of young children's use of popular culture, media and new technologies.

We use data from *Interplay* and *Entering e-Society* to consider how factors such as the cultural practices of different environments, the material resources available, and the role of adults shape the ways in which young children's encounters with technology are supported. As we use guided interaction to focus the discussion, we start by providing a brief introduction to this concept and how it fits within a sociocultural framework. We then take each context of preschool and home in turn and summarise the associated research study, describe the technologies available to young children, and outline who provides guided interaction, its practice, and the areas of learning that are supported. We have discussed guided interaction in home and preschool settings separately and in more detail elsewhere (Plowman et al, under review; Plowman & Stephen, 2007) but our aim here is to discuss the commonalities and differences across these domains and to describe some of the implications for practice and policy.

The studies took place in Scotland, where children start school education at the age of five and almost all three- and four-year-olds are in part-time preschool education funded by the government. Although we use 'ICT' to describe the information and communication technologies available in preschool, this is a term deriving from policy and is not used by parents, so we usually refer to 'technologies' in the home environment. We use the terminology in this way as it highlights the different types of technology, and associated practices, available in the two settings. The paper challenges some assumptions about home learning and shifts the focus of interest from desktop computers to other forms of technology, providing findings of interest to policy makers and practitioners concerned with children's learning with technology in the early years.

Supporting learning: a sociocultural approach

The two studies were informed by a sociocultural approach that recognises that both teachers and learners draw on cultural and material resources and that children's competences with technologies extend beyond the operational aspects to include understanding the role of technology in work and play. Technology-mediated learning is particularly appropriate for sociocultural analysis because of the centrality of tool-mediated action and the ways in which this can reveal learning. The 'tools' can be technological artefacts, in which case analysis focuses on human-technology interaction, or dialogue and social practices, in which case the interactions are interpersonal. Introducing technology into the teacher-learner relationship inevitably alters the mediation of learning and the studies examined the conduct of face-to-face interaction, along with the less visible, more distal interactions.

This shift in focus, from the proximal to the distal, was originally prompted by our realisation that dialogue did not have the important role in technology-mediated learning for young children that a sociocultural approach led us to expect. A focus on talk as a means to enhance pedagogy and learning through the co-construction of meaning is a central concern of much research in this tradition, whether it involves technology or not (e.g. Hennessy, 2005; Hughes & Westgate, 1998; Skidmore, 2006). This perspective is summarised by Alexander's (2006, p.5) statement that 'it is through language, especially

spoken language, that teachers teach and children learn'; but rather than the preponderance of over-directive use of classroom talk that he reports, it was its *absence* that was noteworthy in our study of learning with technology in preschool.

We share with these researchers, and others who draw on sociocultural frameworks, the theoretical assumptions which lead to a focus on activity rather than the focus on individuals' internalised learning associated with a more cognitive approach (Wertsch, 1991). We therefore see interaction as central to a view of learning as a co-constructed outcome of the activities and cultural practices that individuals engage in with others. The 'interactional turn' in educational research (Erickson, 2006, p.177) means that research in this tradition focuses on the observable. Ideally, this would mean a combination of ethnographic approaches for revealing the cultures of these settings and fine-grained video analysis for revealing interaction. Video enabled us to document some of these complex interactions in preschool settings (Plowman & Stephen, 2008) although it cannot equip us to identify learning directly and its use inevitably focuses on proximal interactions. For supplementary data that enabled us to make judgements about children's learning and accounts of unobserved activities and experiences in preschools we have relied on the records routinely kept by practitioners. With some exceptions, our home visits did not coincide with children's spontaneous use of technology and so we used other approaches to elicit examples how they used technology combined with parents' accounts of their children's activities. This variability in the forms of data that we collected during the two research projects means that we cannot present findings in such a way that a direct comparison is possible, especially as our observations in *Interplay* were made both before and after the practitioners' own interventions to enhance learning. However, the sociocultural orientation and the concept of guided interaction serve as a framework for considering differences in support for learning across the two settings.

Although there are obvious differences between domestic and preschool settings there are also a number of characteristics which suggest that a sociocultural approach to the analysis of support for learning could be fruitful. The shared features which are pertinent to the following discussion are:

- the presence of adults and child(ren)
- the presence of digital technologies
- the co-location of children, adults and technologies in time and place, and
- technology being used whilst other activities were going on in close proximity.

Guided interaction

The account of guided interaction presented here is an abbreviated version of that developed during *Interplay* to describe the ways in which children's interactions with technology can be actively supported in preschool settings. The concept of guided interaction i) provided a tool for thinking about the different modes by which learning can be supported in preschool settings and ii) helped practitioners to articulate, reflect on and legitimise changes in pedagogy. As it was elaborated in partnership with practitioners, it seemed likely that the term might be restricted to formal learning environments, but during the fieldwork for *Entering e-Society* it became apparent that the concept could also be used as a tool for examining the ways in which learning with technology is supported in the home. In this paper it provides a framework for describing the ways in which children's learning with technology is supported in these different domains.

Our analysis of preschool learning indicated two main dimensions of guided interaction. In the *proximal*, or face-to-face, dimension guided interaction was most apparent in the interactions between adults and children that have a direct influence on learning and are usually visible. However, we became aware through dialogue with the practitioners that the activities that were more distant in terms of time and space were also guiding interaction and that support was more usually provided in the

distal, or less direct, dimension. The practitioners orchestrated learning through the provision of resources and planning the curriculum and so these pedagogical actions were guiding interaction at one remove from the closely coupled interactions described as proximal.

The *mode* described the means by which guided interaction was enacted. In the *proximal* dimension the interactions associated with guided interaction were multimodal in nature, encompassing language, gesture, touch, gaze, and physical action. These interactions were highly contingent on the activity, the site of learning, the learner's level of competence and the individual practitioner. In the *distal* dimension support was enacted through policy and accepted norms of professional practice, including providing resources, ensuring access to them and setting up activities. Distal guided interaction was not, therefore, as easily observable as proximal interactions and this may account for why these less visible aspects of support for learning have hitherto received less research attention than interaction which is readily identified in the here and now.

There are many ways to conceptualise supported learning within the Vygotskyan tradition, including scaffolding (Wood, Bruner & Ross, 1976), assisted performance (Tharp & Gallimore, 1989), dialogic inquiry (Wells, 1999) and guided participation (Rogoff *et al*., 1993). Guided interaction shares with them an emphasis on the mediation of learning and the role of artefacts, but differs in its focus on technology-mediated learning and its attention to both the proximal and distal dimensions of providing support. It also differs in its attention to the ways in which that support is enacted multimodally, often through non-verbal communication. The analysis of practice in preschool playrooms enabled us to devise a taxonomy of guided interaction showing examples of different types of support, the different modes in which that support was enacted, and the three main areas of learning with which the support was associated: (i) extending knowledge of the world, (ii) acquiring operational skills, and (iii) developing dispositions to learn (Plowman & Stephen, 2007). For the following comparison, we use the three areas of learning and the two dimensions of distal and proximal as a framework to examine support for learning with technologies in preschool settings, followed by a summary of our research into learning with technology at home.

Learning with technology in preschool: *Interplay*

Interplay (2003-2005) set out to explore how practitioners can enhance three- and four-year-old children's encounters with ICT in a preschool culture of child-initiated learning through play. It was prompted by our previous observations of children walking away from learning opportunities with ICT because the content of the activity was inappropriate or the technology's interface imposed too great a barrier. To achieve this aim we first needed to identify the areas of learning that could be supported by ICT and by working with practitioners in a process of guided enquiry (Stephen & Plowman, in press) we established which practices constituted guided interaction and could make a difference to children's learning in the playroom context.

The practitioners from eight preschool settings, serving about 400 children, met with the researchers in two geographically determined cluster groups four times over a period of a year or so. On these occasions the researchers used video-recorded examples of children's encounters with technology as a stimulus for discussion. Following an introductory meeting of each cluster, the research team observed and video recorded playroom activity over a period of a few months and this was discussed in the second meeting. Each site also planned a small-scale project for implementation and evaluation that would either address recognised problems integrating ICT into teaching and learning or enable the exploration of new activities or pedagogical actions. The practitioners' projects were discussed in the third cluster group meeting and another project identified, repeating this cycle. A final review was held in the fourth meeting. As they put their interventions into action practitioners collected evidence such as notes of playroom observations, photographs and extracts from children's profiles to bring to the next cluster meeting. The discussions between practitioners at the cluster meeting were recorded and were a

further source of evidence about the nature of guided interaction. Practitioners' discussions in the cluster meetings were recorded and they were also interviewed individually about how they conceptualised their practice in the playroom both before and after data collection. A questionnaire on competence and attitudes was distributed to all forty practitioners in these settings.

A total of sixteen hours of video data was recorded in the eight nurseries. Video recordings made during the first phase of the research were analysed in terms of interaction episodes and coded using broad categories (type of technology or other artefact, absence or presence of adult, the activity, the nature of the child's response). These interaction episodes were used as a way of managing the data by interpreting the start and finish of specific periods of activity with a particular artefact. They could be as little as thirty seconds, although five to ten minutes was typical, and could involve a child alone, a fluctuating group of children, some adult-child interaction or a combination of these. This process led to the identification of episodes in which practitioners provided support as well as examples where an absence of support led to less productive experiences for children, such as being bored or giving up an activity easily. These sequences were edited and presented to the two cluster groups as a series of video vignettes designed to stimulate reflection on their naturally occurring practice. We had identified 'guided interaction' as a potentially useful term in an earlier study in preschools (Plowman & Stephen, 2005) and introduced it to practitioners in this study as a way of conceptualising different forms of support, although we had not described its characteristics in detail at that stage. The definition of guided interaction thus developed iteratively as a result of our own analysis combined with the practitioners' experiences and observations and meant that findings were rooted in the culture of the playroom.

Using interaction as the unit of analysis also meant that we were using the same evidence as practitioners to interpret children's learning and behaviour. The key difference is that, as researchers, we were able to reflect on the process of interaction after the event, whereas practitioners have to make interpretive decisions in the moment. The use of video clips in the process of guided enquiry empowered practitioners to engage in this process of analysis and reflection and share their insights. Our analysis, in turn, enabled practitioners to see their role in mediating children's interactions with ICT in a new light and to think about ways in which practice could be developed to enhance children's learning.

Technologies in preschool

There was at least one desktop computer available in each of the playrooms. Access to other ICT resources varied but interactive whiteboards were beginning to be used in some settings and there was fairly widespread use of digital cameras by both adults and children to make a record of various activities. Practitioners tended to think of ICT only in terms of desktop computers but they were encouraged by us to think about extending its range to encompass digital still and video cameras, electronic keyboards and some of the toys that can be found in preschool settings. Because some of these technologies are more familiar to practitioners they promote confidence, they can be more affordable and they can give children the opportunity to build on competences and knowledge that they may develop in the home.

Who provides guided interaction in preschool?

The main source of guided interaction in preschool was the practitioners. We found that they had an extensive repertoire of pedagogical actions to support learning but needed help to reflect on how they could apply this expertise to enhance children's encounters with ICT. Their focus on child-centred practice meant that preschool staff felt uncomfortable with behaviours that they perceived to be teacherly. However, practitioners' interventions developed as part of *Interplay* showed that it was possible to combine child-centredness with the targeted support needed when young children use ICT in preschool settings.

Peer support for learning was more limited than practitioners believed to be the case. Although practitioners cited collaborative use of the computer as evidence of peer support we found that children actively helped each other infrequently. Whilst it was fairly common for children to use a computer in pairs or groups it was unusual for them to provide mutual support and peer tutoring. Their communication with each other tended to be nonverbal and interaction was aimed at individuals gaining access to, or prolonging, a sought after activity. This was usually achieved by taking control of the mouse, moving closer to the screen, or upending the sand timer used to time sessions when they wanted to prolong their turn.

The practice of guided interaction in preschool

Video analysis and observation demonstrated that language was not dominant as a mode of communication as there were few examples of extended adult-child dialogue (Plowman & Stephen, 2007). Talk is a key medium for interaction in school classrooms but in preschool settings affective responses were central to the practitioners' role, so touch, gesture and eye contact were also important forms of communication. The absence of talk was particularly striking when children used computers. When on their own, they rarely initiated talk with other children or adults, either to convey enjoyment or to seek help. When sitting alongside an adult, the focus on the screen inhibited communication as it made eye contact difficult.

During the period in which practitioners implemented their chosen interventions we used guided enquiry to support our analysis of pedagogical interactions, supplemented by our subsequent analysis of video recordings (Plowman & Stephen, 2008) of children engaged in activities with ICT. Proximal guided interaction could be manifested as an adult placing their hand over a child's hand on the mouse, providing emotional support by sharing successes and problems, directing a child's attention by pointing, or sequencing and breaking down activities.

What types of learning were supported in preschool?

Our analysis of practitioners' accounts of children's learning suggested that ICT was used to promote the three main areas of learning indicated earlier (extending knowledge of the world, acquiring operational skills, and developing dispositions to learn). These categories were not intended to be exhaustive but to function as a framework to enable us to identify more clearly the broad areas of learning that can be supported by ICT. Interviews with practitioners and observation in the field suggested that the degree of competence children acquired across these categories depended on a number of factors including developmental stage, their own interests and preferences, access to ICT, the quality of guided interaction, and the particular interests and aptitudes of practitioners as well as experiences at home. Guided interaction could support all three areas of learning described here although some areas were more readily supported than others.

Extending knowledge of the world included what is referred to as subject knowledge in schools. It encompassed learning in areas such as mathematics, language, and knowledge about living things and places typically gained through software, websites and talking books. The category also included children's understanding of the role of ICT in leisure, work and play. *Acquiring operational skills* referred to understanding the functions of items such as the mouse and on/off switches as well as the ability to operate them, which often relies on motor skills. Operational competence also develops children's concepts of technological interactivity and demonstrates their understanding that taking an action can produce a response. Children usually needed adults to help them acquire specific operational skills, after which they could move on alone to become independent users. *Developing dispositions to learn* encompassed a range of affective, social and cognitive features of learning to learn which were given high priority in preschool settings. Our interviews suggested that the practitioners mainly conceptualised learning as supporting children's development as confident and self-directed learners and that this was a fundamental part of practice. ICT was perceived to have a role to play in this by

increasing self-esteem and the confidence gained from success, as well as supporting independence and persistence in the face of initial difficulties. A more detailed description of these forms of learning is provided in Plowman and Stephen (2007).

Learning with technology at home: *Entering e-Society*

The aim of *Entering e-Society* (2005-2007) was to investigate the development of digital literacies among three- and four-year-olds in their home environment. Guided interaction was not therefore a specific focus, although it was used as a way of analysing the support for learning provided by members of the family and others. The extent to which digital literacies develop in tandem with traditional literacies and whether socioeconomic disadvantage makes a difference to this development were features of the study which we discuss elsewhere (McPake et al., under review).

Data collection involved survey responses from 346 parents of children across central Scotland and five visits over about fifteen months to an initial 24 case-study families. The principal aim of the survey was to contextualise the case study data collected in the second stage. Survey data were analysed using SPSS to generate frequencies and cross-tabulations of the data, focusing in particular on differences between 'disadvantaged' and 'more advantaged' families.

The survey and home-based case studies were conducted in four local authorities in Scotland: two with a high level of urban deprivation, and two with a more mixed distribution of urban and rural, affluent and disadvantaged families. In order to ensure that the survey reached a broad spectrum of families, we selected different types of provider, including public and private nurseries, and children's centres catering for young children in need of more sustained support. Families were invited to take part in the case studies on the basis of their survey responses and selection of the 24 families was designed to ensure a balanced distribution of gender of child, family socioeconomic status and location as well as high and low use of technology in the household. Nineteen of these families remained involved until the end of the case-study phase.

We chose case studies as the main form of data collection, as have other studies of young children in the home, whether focusing on pretend play (Haight & Miller, 1993), language development (Tizard & Hughes, 1984) or health care and health-related behaviours (Mayall, 1994), because this enables researchers to collect data from and about children in authentic settings. in situations like this, where children are not very vocal with visiting researchers, reliance on observational methods can privilege the researcher's interpretation of events rather than the child's. In an attempt to counteract this bias we used a variety of methods which foregrounded children's perspectives and enabled us to consider aspects of their experience that may have been overlooked. Our approach was designed to reflect our understanding that children have valuable perspectives on their experiences and we devised activities which were intended to appeal to them, had face validity for the children and their parents, and were within the children's existing behavioural repertoires. (See Stephen et al, forthcoming, for a more detailed account of the methods used for involving children in this study.) Investigating children's operational competences, for instance, drew on children's self-report as well as observations and parental accounts (which, we found, did not always match the children's own perceptions). Investigating parents' understandings, aspirations and expectations drew on responses to attitudinal questions in the survey as well as interviews spread over multiple visits and providing opportunities for parents to share their reminiscences of their own uses of technology since childhood.

The study therefore drew on the audit provided by the survey, observations and interviews with families in their own homes, and conversations with children. Our case studies enabled us to probe the survey data and identify both important variations and similarities across the sample. We focused on the reasons why families chose to purchase particular technologies and how they were used, the extent to which parents believed their children's use of such technologies had educational or other benefits and

the ways in which parents' own experiences of technology for work and leisure influenced the opportunities they provided for their own children.

Although the key focus was on the kinds of competences which children were developing with technology at home, and the role which disadvantage might play in creating a digital divide at this early stage in children's lives, we were also concerned with the potential impact of this on their formal educational development, both at preschool and as they entered primary education. Towards the end of the study, we therefore drew on preliminary findings to discuss the implications of our work on children's experiences with technology at home for future policy and practice in preschool and primary school with experts from across the UK.

Technologies in the home

By the time they were ready to start school, most of our case-study children had experience of using a broad range of technologies in their own homes and those of friends and relatives. They were likely to have access to toys that simulate appliances such as mobile phones, laptops and cash registers as well as encountering a range of leisure technologies, such as interactive television and DVD players, electronic musical instruments, iPods and CD players. Digital and mobile phone cameras had an important role in many families for communicating with other family members, and children enjoyed use of the increasing range of games on computers, websites, games consoles, hand-held devices and mobile phones.

Our survey data focused on three key technologies: mobile phones, interactive TV and access to the internet. We found that almost all (98%) of our respondents owned at least one mobile phone, while three quarters (75%) possessed televisions with interactive features. There were no significant differences for children in 'disadvantaged' and 'more advantaged' families in relation to these kinds of technologies. Income was a factor in determining internet access however, with over four fifths (82%) of the 'more advantaged' families having an internet connection, compared with just over half (56%) of the 'disadvantaged' families.

Whilst it might be expected that children in households that had been categorised as high technology would have a wider range of competences than children in low technology households we found no clear correlation. A high level of presence in the home did not necessarily mean technologies were made available to the children and, where they were, it did not always mean that children were drawn to use these resources, even when encouraged by their families. Ownership did not therefore correlate with access, indicating that income is not the only factor to take into consideration when investigating the digital divide. Although almost every family owned at least one mobile phone, fewer than one in seven of the children (14%) were allowed to use them. Two thirds (66%) of the children whose parents had internet access were allowed to use it, but in almost all cases (90%) this was reported as with adult supervision. However, these data provided only a limited amount of information about how children use these technologies or why children may be prohibited or discouraged from using them. The case studies allowed us to explore young children's experiences with technologies in greater detail and to consider what factors may lead to some children having more extensive opportunities to learn with technologies than others.

Thus our survey data showed that in all families of preschool children, regardless of socio-economic status, a wide range of technological items was available for use, with only internet access being restricted in 'disadvantaged' families. Internet access is widely regarded as the key marker of the digital divide for adults but, in the context of this research, it is less important than some other factors because a relatively small proportion of the children's activities is associated with internet access. Watching television or DVDs, game playing on computers and consoles, and play with other types of electronic toys were much more prevalent.

Who provides guided interaction at home?
Our interviews and observations suggested that the main source of guided interaction at home included parents and other adult relatives, family friends, and older siblings and cousins. One of the activities designed to elicit information from the children confirmed this: parents were the most frequently mentioned source of support and none of the children cited preschool or teachers. Children could see adults going online to order shopping or book a holiday, recording family occasions with a digital video camera or using a wide range of domestic technologies. Siblings were making calls, texting or taking photos with their mobile phones, chatting on MSN, using games consoles, and downloading music. Sometimes children were explicitly shown how to use these technologies but more frequently these were activities that formed a backdrop to children's lives.

Family members bought children LeapPads, VTech Smile games consoles or portable DVD players as Christmas and birthday presents and showed the child how to use them. Providers of gifts, such as grandparents, neighbours, aunts or uncles, were motivated to provide guided interaction for the recipient's benefit but they were not necessarily a high user of technology: having time available to tutor children was more important than expertise. Other facilitators, such as older siblings, could be high users of the computer and games consoles but, for this reason, they could also act as inhibitors of learning as they could prevent their younger brothers and sisters from gaining access to the technology and dominate its use. For some children, however, cousins and siblings were an important source of hand-me-down games consoles and software as well as expertise.

The practice of guided interaction at home
Parents were not necessarily explicitly concerned with learning outcomes but they had an interest in developing their child's operational skills to use a remote control, find specific websites or operate a DVD player. This investment of proximal guided interaction meant that children could become independent users and occupy themselves without disturbing parents from domestic tasks and leisure activities or interrupting older siblings' play. Parents felt less guilty about using the computer to serve this function because it was perceived to be educational, although the television was considered to be safer in terms of unsupervised viewing. Like the preschool practitioners, distal guided interaction in the form of peripheral vision was often used for overseeing safety and ensuring that children were not getting stuck. However, help-seeking behaviours were more overt in the home as children would call for help when it was needed or go and find somebody to assist, and family members had an incentive to be responsive if it prolonged the time that children could be engaged in an activity.

Adult or child helpers felt few inhibitions about being teacherly and children's operational skills were therefore developed as a result of direct instruction. As in the preschool settings, this form of guided interaction took place in the proximal dimension as explaining and demonstrating technical skills and interpreting rules and instructions required face-to-face interaction at the site of engagement. Explicit tutoring tended to be targeted towards different operational skills such as manipulating remote control devices and recognising icons for websites such as *CBeebies* or *Nick Jr*. Otherwise, children were believed to 'just pick it up' or to teach themselves and about three-quarters of the parents commented that they did not know how children had developed various competences (Plowman et al., accepted subject to revisions). Spoken language may therefore have a limited role in supporting learning with technologies in the home compared to the more visual modes of modelling and demonstrating. However this assertion requires further research as we did not have the extensive video recordings of interactions that we had for preschool settings on which to base such an analysis.

What types of learning were supported at home?
Parents were asked whether their child had done anything with technology since our last visit that they had not realised they could do. They responded with examples including children rewinding a video in

slow motion, locating cable television channels, changing channels with a remote control, resizing a window on a website, and using digital cameras or a laptop's trackpad in a controlled manner. Some parents commented on their children's use of terminology rather than operational skills and reported children using words such as 'pause' and 'load', demonstrating awareness of web addresses on television programmes and asking for a site to be saved in 'Favourites'.

Over the lifetime of the project families acquired different technologies for different purposes. The children were thus being inducted into various cultural practices ranging from talking to relatives on mobile phones, to taking and printing digital photos of the family pets, sharing memories by watching family video recordings of special events, or using old computers and non-functioning mobile phones as props for play in imaginary offices, shops and schools. Whether children were directly involved in these activities or observers of them, they could lead to the development of an understanding of the cultural role of technologies as well as operational competences. However, parents tended to under-estimate their children's learning because much of what they were picking up (using the telephone, putting on a DVD) was, in their eyes, unremarkable.

Discussion: comparing learning with technology at home and in preschool

We conceptualise the two sites of use examined here as both sociocultural and technological landscapes. Both home and preschool provide settings in which the social relationships existed that constitute potential sources of support and in which cultural practices were modelled and transmitted. The two settings were also spatial environments populated by technological and other artefacts. This section therefore moves on from the separate descriptions of the two studies to discuss some of the similarities and differences in the ways in which young children's encounters with technologies are guided in the different environments of the home and preschool settings. The following discussion draws on Table 1, which summarises our findings as they relate to five key questions applicable to both settings:

- Which technologies are available?
- Who provides support for children's learning with technology?
- What is the motivation for providing this support?
- How is the support provided?
- What types of learning are supported?

The table shows that, whilst there are a number of commonalities across the two sites, there are key differences in terms of the technology that is available, who owns and uses it, the motivation for providing support and the types of learning that are supported. In the distal dimension there are similarities in terms of provision of resources and setting up activities, although modelling is more prevalent in the home and is provided by both adults and other children. In the proximal dimension there is more explicit and contingent instruction and demonstration at home because the adult-child ratio is favourable for these activities and proximal interactions are more readily supported when it is easy to identify if a child needs help.

Table 1 about here

Learning and technology

The children in our studies had typically acquired basic levels of competence in all three areas of learning identified in our preschool study (extending knowledge of the world, acquiring operational skills, and developing dispositions to learn) by the time they were ready to start school. Young children acquired *operational* competence at home and in the playroom, although the emphasis in preschool settings was generally on computers, whilst in the home this was supplemented by televisions, DVD players and, occasionally, mobile phones and games consoles. Children's learning at home meant that

they could switch items off and on, rewind and fast-forward, and they understood that digital technologies can be used to communicate with friends and relatives, by phone (voice, texting and picture messaging), by email and, in some cases, by webcam. Preschool practitioners' evidence about children's learning was heavily weighted towards developing *dispositions to learn* but parents were more likely to focus on children's operational skills and were less aware of the ways in which they were supporting the emergence of learning dispositions. Nevertheless, family settings afforded opportunities to develop dispositions that promote learning including sustained attention, learning to follow instructions, problem-solving skills, and exploration. Children added to their *knowledge of the world* at home as they did in the playroom, as many children were using technologies to support the development of early literacy and numeracy or, occasionally, to find information on the web, although neither parents nor practitioners paid particular attention to the learning that might be described as subject content.

In an earlier home-based study *Already at a Disadvantage?* (McPake et al, 2005) we identified an area of learning which we referred to as *learning about the cultural roles of technology* and defined as children's understanding of the roles which technology plays for a range of social and cultural purposes, such as communication, work, self-expression or entertainment. The description of guided interaction provided earlier in this paper was based on fieldwork in preschools but we did not find sufficient examples of learning about the cultural roles of technology to warrant this category and so it was subsumed into knowledge of the world, along with knowledge about living things and places. Now that we have completed the more detailed study in homes reported here we find that we need to return to this category as the domestic context offered more opportunities to develop an awareness of the cultural significance of technologies than preschool settings.

This paper does not focus on issues relating to digital divides (for which see McPake et al, forthcoming) but it is worth noting that although the surveys showed few significant differences in terms of ownership of technological items between 'disadvantaged' and 'more advantaged' families, the case studies showed that there were differences in terms of the functionality of the equipment, and of potential restrictions on choice depending on what was available. Our findings indicated that there were variations amongst these families, but that the reasons for variation were more complex than the traditional discussions of the digital divide would suggest. Children in 'disadvantaged' families may be granted more access to technological items precisely because they have been acquired cheaply and are easily replaced, while children in 'more advantaged' families may be restricted to occasional and highly supervised use of expensive equipment, sometimes needed for work purposes. Children's opportunities for using technology at home were not primarily related to household income and appeared to be more influenced by parents' prior experiences with technology and their views on the role of parents in supporting their child's learning generally. However, the study did not focus on the impact of socioeconomic status on support for learning. This, and the influence of marketing on both children and parents, will be investigated in the follow-on project (*Young children learning with toys and technology at home*).

The practice of guided interaction at home and preschool

The prevalence of guided interaction and the forms it took varied from one context to another. In the home, both adult and child helpers felt fewer inhibitions than practitioners about being teacherly and family members were able to invest time in explicit tutoring in the expectation of the child's subsequent independent play providing a pay-off. The adult-child ratio for practitioners meant that they were not generally able to provide one-to-one support but we found limited evidence of direct instruction in either setting. Rather, parents appeared to leave children to 'pick up' their learning with technologies. This approach was fairly effective in the home inasmuch as children developed a wide range of competences, partly as a result of their legitimate peripheral participation (Lave & Wenger, 1991). In the preschool, children's encounters with ICT were usually described as 'playing' with the computer

and we characterised the support for learning that was often provided as reactive supervision (Plowman & Stephen, 2005). This approach operated by default rather than constituting a pedagogical strategy, although free play was an intentional aspect of playroom practice. This reactive supervision was associated with children choosing for themselves when or if they would use the computer and what they would do. In these circumstances supervision was most commonly manifested as keeping a check on turn-taking and length of time at the computer or was a reaction to requests for help when children got stuck. However, children rarely requested help and would either just give up when they encountered difficulties or were oblivious to a problem and would continue random clicking.

Our research suggests that greater awareness of the potential for learning through legitimate peripheral participation could lead to changes in practice in nurseries so that practitioners think about ways in which they can engage in authentic activities of the kind found in the home. This approach would be sympathetic to practitioners' concerns about being teacherly but would necessitate placing technologies used for day-to-day tasks in a more visible location in the playroom. Rogoff et al. (1998, 240) draw attention to the ways in which children in various cultural contexts can be 'skilled and active in attending to what they watch' and it was clear that parents and practitioners overlooked the potential of children's observation as a way of learning. Although Moll et al. (2004, p.74) point out that 'children are not passive bystanders... but active participants in a broad range of activities' the activities and the technologies need to be visible and genuine for children to benefit in this way. The technological landscape of the home meant that children were constantly aware of what we have referred to as environmental technology (Plowman et al., under review) and so there were many opportunities for children to interact with or observe family members, creating a link between family culture and children's learning.

The parents' belief that children were able to teach themselves seems to contradict reports of children learning from direct instruction at home. But whilst parents were aware of their role on occasions when specific operational skills were imparted, they did not seem to be aware of the extent to which they demonstrated operational skills or the extent to which they modelled behaviour. There were few examples of using technology for real life activities in preschool settings as practitioners used the computer sited in the office for activities such as producing letters to go home or printing photographs and posters. As this was out of sight of the children, occasions for modelling uses of ICT and providing opportunities for children to learn the cultural and social value of technology were restricted. Interactive whiteboards were found in some preschool settings but these are explicitly an educational resource not found in homes or used for other purposes. In the home, authentic activities were commonplace and a richer range of technologies for both work and leisure was available, typically with higher specifications than would be usual in the playroom. In these cases, guided interaction was incidental rather than explicit.

Although the findings may suggest that technologically-mediated interactions in preschool settings were impoverished by comparison with what was available in many domestic settings, we observed practitioners making sensitive and contingent responses when children were engaged in playroom activities such as baking or completing jigsaw puzzles. If the interactions necessary to support children's learning with ICT in the playroom were already present in the practitioner's repertoire the question arises as to why these aspects of practice were not more frequently observed when children played with technology. As described at greater length in Stephen and Plowman (in press) there were several possible answers to this question. Making time for one-to-one interactions was not always achievable and the recourse to reactive supervision was an understandable response as practitioners typically had oversight of more than one activity. The process of casting an eye over the room to monitor play and levels of engagement does not reveal problems at the computer screen and a child walking away from an unproductive encounter with ICT may not be noticed if they settle readily in a

different activity. These problems could be compounded by practitioners' lack of confidence with some technologies.

Another explanation was found in the practitioners' understanding of their role. Exploration is the favoured mode for learning in nurseries, unlike school classrooms, and the element of guidance in guided interaction can be interpreted as too teacherly. Practitioners' implicit theory of practice rests on a Piagetian concept of learning that fits with their desire for child-led playroom experiences. This emphasises their role as providers and facilitators of playroom learning opportunities (Stephen et al., 2001) but tends to underplay the value of their direct interactions with children. However, our evidence argues not for a shift to didacticism but for mindful interactions that are sensitive to the context and to individual needs. This is in line with findings from a large-scale study (Sylva et al., 2007, p.53) which defined effective pedagogy in the playroom as focusing 'on planned interactions and extending child-initiated activities in a purposefully designed learning context rather than merely reacting to spontaneous activities in an unthought-of or ad hoc manner'. This interpretation of effective pedagogy, like our analysis of guided interaction, complements rather than replaces free play and does not privilege formal instruction.

Sites of learning: home and preschool

To what extent does the site in which learning takes place determine learning activities? Kent and Facer (2004) suggest that the boundaries between young people's home and school use are not distinct and they describe a continuum of learning practices in which the location does not determine the practices adopted by young people. However, the participants in their study were in formal schooling and aged between nine and seventeen; the comparison of home and preschool presented here suggests that this continuum of learning practices does not currently exist for children who are three or four. The contrast is not as simplistic as a distinction between formal and informal learning because preschool education is predicated on learning through play, which is seen as a natural activity for children of this age and does not need to be site-specific. Furthermore, instruction is usually associated with formal educational settings but, as we have seen, it was more likely to take place in the informal setting of the home than the preschool.

Different metaphors for the gap or difference between out-of-school and school as sites of learning have been used by researchers examining the integration of knowledge developed in these different settings, particularly in terms of literacy practices. Gregory (2005), for instance, refers to 'interspace' to describe the ways in which school discourse may be taken home and transformed into home talk through play but also stresses the importance of teachers recognising children's different linguistic and cultural resources in their classroom practices and provision. Others (Cook, 2005; Gutierrez et al., 2000; Moje et al., 2004) have enrolled the metaphor of 'third space' to describe the integration of knowledge from the different spaces of home and school.

In her discussion of home and school literacy practices Marsh (2003) suggests that there was more evidence of the nursery infiltrating the home than vice versa. Whilst her observation that 'literacy practices are inextricably linked to geographical space' (p. 373) refers to what we might call traditional literacies of reading and writing, it is clear that opportunities to support and develop children's emerging digital literacies (discussed in more detail in McPake et al., 2008) also differ across home and preschool, depending on the human and technological resources available and the cultural embeddedness of existing practices. Given that nursery staff are aware of the policy imperative to develop out-of-school links as a way of encouraging the development of traditional literacies, it is possible that the dissonance is even greater for learning with technology. Marsh's (ibid.) metaphor of 'one-way traffic' refers to the ways in which the dominant conceptualisation of literacy is derived from the school and nursery and permeates parents' perceptions of the value of their family practices. In our case, this was seen in parents' disregard for the learning that could develop through their children's

observation of the ways in which family members used technologies and their focus instead on the operational skills, such as using a mouse, with which nurseries were more concerned.

At a time when there are pressures for preschool education to become more like formal schooling it is worth considering the ways in which Hannon (2003, p.103) itemises the ways in which home learning can be more powerful than school learning:

> in being shaped by immediate interest and need, in often seeming to be effortless, in spontaneity, in being a response to real rather than contrived problems, in being of flexible duration, in having a high adult-child ratio, in being influenced by adult models, and in allowing a 'teaching' role for younger family members.

Although this statement relates to traditional literacies, our comparison of home and preschool indicates that it could equally apply to learning with technologies. We found few links between children's developing competences at home and at preschool: preschool practitioners had ways of informing parents about their children's activities and development at the nursery but the preschool was not seen by parents or children as a source of learning about or with technology. Other than some examples of children taking home digital photographs of the day's activities to show their parents we found no examples of technology being used to engineer cross-domain learning in the way that story sacks or shoeboxes (Greenhough et al., 2005) are used to develop literacy. Practitioners had a restricted view of what children could do, and therefore of how they could develop this learning, because children did not have opportunities to demonstrate the competences developed at home on the more limited range of technologies in the nursery. However, parents were not necessarily aware of what their children could do either: some were surprised by their knowledge or competences and used 'just picking it up' as a way of making sense of this learning.

In *Already at a Disadvantage?*, the study linked to *Interplay*, we followed up sixteen of the children with home visits as well as targeted interviews with key workers in the nursery to establish the extent to which social disadvantage might impact on preparation for primary school (McPake et al., 2005). When asked if they knew anything about the children's use of ICT at home, three-quarters said that they did not. Some staff expressed negative views about the amount of television children watched, or about the kinds of electronic games they played, a finding also reported by Marsh (2003, p.374) who comments that the literacy practices which are closest to the child are 'the ones least likely to be included in the curriculum'. This belief that home practices are not necessarily conducive to what is seen as valued learning by the nursery or school has some parallels with a period when it was believed that education needed to compensate for what were seen as deficiencies arising from a lack of cognitively demanding language in the homes of young children (Clark, 2005, p.6).

Implications for policy

As the countries that make up the United Kingdom are at different stages of developing the early years curriculum with reference to the role of ICT we held an experts' forum with participants from the UK inspectorates, preschool settings, local authorities and curriculum agencies in 2007 to discuss current perspectives on the use of ICT in preschool playrooms and the early years of primary school and to discuss the implications of the research reported here for future policy and practice. The experts confirmed the emphasis on operational skills in the first year primary school classroom and believed that both children and parents could be disappointed at the impoverished range of technologies available there. They considered that few schools are currently in a position to build on the well-developed competences which many children have already acquired by the time they start formal schooling.

There is not yet consensus on what could be expected of children's competences with ICT on transfer to primary school, although the view was expressed that the emphasis should be on confidence rather than the skills which can be taught at the point of need. The current transfer of information forms do not generally refer to ICT. Interviews with practitioners have suggested that, on transition to the first year of formal schooling at age five, teachers expect only operational competence with computers from their new pupils and they tend to underestimate the outcomes of learning from both home and preschool (McPake et al., 2005). The participants at the forum acknowledged that staff in primary schools may be judgemental about children's practices at home, and know little about them, and parallels were drawn with a time when teachers believed that parents should not teach their children to read and write because that was the job of the school. Now that policy has begun to take more account of prior learning and moved on from the concept of a new start on transition to primary school this should extend to the development of children's competences with ICT at home.

Our case-study findings support the experts' views. None of the parents with a child moving to school during our studies reported being asked about their child's use of technologies at home and the nursery was cited as the key source of learning about technology in just one case. The report of one parent that she had been told by a teacher that children would be shown how to use the keyboard and mouse 'properly' at school is an indication of the disregard for competences and dispositions acquired at home and suggests that it may be more meaningful to think in terms of whether schools are ready for children than whether children are ready for school (Ackerman & Barnett, 2005).

A leaflet (Scottish Executive, 2006) on new technology in learning distributed to every household in Scotland with children states that 'parents, carers and family members are by far the most important influences on children's lives'. It enjoins parents to build on children's natural curiosity and enthusiasm for new technology, encouraging them to become comfortable and confident with it from an early age, as it can 'really help their learning'. Some of our case study families resisted explicit learning activities, voicing the opinion that children would be exposed to them soon enough, on entry to school. Although all the 24 families in our case studies had some characteristics in common – a three- or four-year-old child attending nursery and living in central Scotland - there was wide variety in attitudes to preparation for school and the role of technology. Some families, across income levels, were enthusiastic users of technology and parents in these homes encouraged their children's engagement with computer games and children's web sites. In these families, children's developing competences with technology were noted with pride and seen as necessary for a successful future. In some homes, more traditional activities were highly valued and parents encouraged imaginative games with dolls or outdoor play. Some of these parents expressed the view that they were not hostile to digital technologies but they would leave introducing them until their child was ready or interested. Across these case-study families, there was no clear-cut divide in attitudes between those who were economically advantaged or disadvantaged or even, in many cases, between those families who were categorised as high technology and those who were not.

Conclusions

Practitioners are encouraged to value home learning (Learning and Teaching Scotland, 2003; QCA, 2005) but the lack of research in this area has meant that it has not been possible so far to be more specific about the nature of children's experiences with technology at home or the ways in which they might inform practice. This study has identified a number of areas for consideration in the development of policy in this area or in planning for initial teacher education, vocational training for nursery staff and professional development courses. These include acknowledging the range and diversity of children's early experiences and developing a broader vision of the nature of children's existing technological competences. The limitations on the technologies available in most preschool settings and the lack of use by staff meant that children's awareness of the different cultural and work-related uses of technology was restricted. Children may not have been able to operate some of the technologies they

saw in use at home, but they had an awareness of their function because the activities were culturally embedded in family members' day-to-day lives. In addition to this learning about the cultural role of technology, children developed diverse operational competences and learning dispositions at home. Even in low technology households, the home provided a much richer mix of technologies than many preschool settings as well as providing opportunities for children to both observe and participate in authentic activities. Our findings suggest that currently preschool and primary staff have limited knowledge of children's home experiences with technology and that they are therefore not in a position to optimise this learning. Moreover, the kinds of ICT-related skills which primary school teachers choose to develop in their pupils have little in common with the competences that children develop at home.

We need to be cautious about creating a deficit model by privileging certain types of early experiences of technologies as children's learning develops in many different contexts and in no fixed order of acquisition. However, understanding children's experiences across the different contexts of home and preschool enables us to identify ways in which their prior learning can be supported. If schools are able to recognise and build on the wide range of competences and dispositions children bring from home and from preschool education they will be better able to support children's learning in ways that have implications for their future, increasingly technologised, education.

9579 words

References

Ackerman, D. & Barnett W. S. 2005. *Prepared for Kindergarten: What does 'Readiness' Mean?* New Brunswick, NJ: National Institute for Early Education Research.

Alexander, R. 2006. *Towards Dialogic Teaching* (3rd ed.) Thirsk, UK: Dialogos.

Aubrey, C., Bottle, G. & Godfrey, R. 2003. Early mathematics in the home and out-of-home contexts. *International Journal of Early Years Education* 11, 2: 91-103.

Clark, M. 2005 (2nd edition). *Understanding Research in Early Education: The relevance for the future of lessons from the past*. Abingdon, Oxon: Routledge.

Erickson, F. 2006. Definition and analysis of data from videotape: some research procedures and their rationales. In *Handbook of Complementary Methods in Education Research,* 3rd edition, eds. J. Green, G. Camilli & P. Elmore. Mahwah, NJ: Lawrence Erlbaum.

Feiler, A. 2005. Linking home and school literacy in an inner city reception class. *Journal of Early Childhood Literacy* 5, 2: 131-149.

Greenhough P., Scanlan M., Feiler A., Johnson D., Yee W., Andrews J., Price A., Smithson M., Hughes M. 2005. Boxing clever: using shoeboxes to support home-school knowledge exchange. *Literacy* 39, 2: 97–103.

Gregory, E. 2005. Playful talk: the interspace between home and school discourse. *Early Years* 25, 3: 223-236.

Gutiérrez, K., Baquedano-Lopez, P., Tejeda, C. 2000. Rethinking diversity: Hybridity and hybrid language in the third space. *Mind, Culture and Activity* 6, 4: 286-303.

Haight, W. & Miller, P. 1993. *Pretending at Home: Early development in a sociocultural context*. NY: State University of New York Press.

Hannon, P. 2003. Family literacy programmes. In *Handbook of early childhood literacy*, eds. N. Hall, J. Larson, J. Marsh, 99-111. London: Sage.

Heath, S. 1983. *Ways with words. Language, life and work in communities and classrooms*. Cambridge: Cambridge University Press.

Hennessy, S., Deaney, R., & Ruthven, K. 2005. Emerging teacher strategies for mediating 'Technology-integrated Instructional Conversations': a socio-cultural perspective. *Curriculum Journal* 16, 3: 265-292.

Holloway, S. & Valentine, G. 2001. 'It's only as stupid as you are': children's and adults' negotiation of ICT competence at home and at school. *Social and Cultural Geography* 2, 1: 25-42.

Hughes, M. & Westgate, D. (1998). Teachers and other adults as talk partners for pupils in nursery and reception classes. In *Cultural worlds of early childhood,* eds. M. Woodhead, D. Faulkner, K. Littleton. 214-222. Abingdon: Routledge.

Kent, N. & Facer, K. 2004. Different worlds? A comparison of young people's home and school ICT use. *Journal of Computer Assisted Learning* 20, 6: 440-455.

Kerawalla, L. & Crook, C. 2002. Children's computer use at home and at school: context and continuity. *British Educational Research Journal* 28, 6: 751-771.

Lave, J. & Wenger, E. 1991. *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Learning & Teaching Scotland. 2003. *Early Learning, Forward Thinking: The Policy Framework for ICT in Early Years*. Dundee: Learning & Teaching Scotland.

Marsh, J., Brooks, G., Hughes, J., Ritchie, L., Roberts, S., Wright, K. 2005. *Digital beginnings: Young people's use of popular culture, media and new technologies*. Sheffield: University of Sheffield.

Marsh, J. 2003. One-way traffic? Connections between literacy practices at home and in the nursery. *British Educational Research Journal* 29 3: 369-382.

Mayall, B. 1994. Children in action at home and school. In *Children's childhoods: Observed and experienced*, ed. B. Mayall. 114-127. London: Falmer Press.

McPake, J., Plowman, L., Stephen, C. (under review). Digitally divided? An ecological investigation of young children learning to use ICT. Submitted to *Early Childhood Development and Care*.

McPake, J., Plowman, L., Stephen, C. (forthcoming). Developing digital literacies at home. Presented at AERA 2008 conference, New York, March 2008.

McPake, J., Plowman, L., Stephen, C., Sime, D.. Downey, S. 2005. *Already at a disadvantage? ICT in the home and children's preparation for primary school*. Coventry: British Educational Communications and Technology Agency.

Moje, E., Ciechanowski, K., Kramer, K., Ellis, L., Carrillo, R. & Collazo, T. 2004. Working toward thrid space in content area literacy: an examination of everyday funds of knowledge and Discourse. *Reading Research Quarterly* 39 1: 39-70.

Moll, L., Amanti, C., Neff, D., Gonzalez, N. 2004. Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. In *Funds of Knowledge: theorizing practices in households, communities and classrooms,* eds. Gonzalez, N, Moll, L, Amanti C., 71 – 88. Mahwah NJ: Erlbaum.

Plowman, L., McPake, J., Stephen, C. (under review). The technologisation of childhood? Young children and technologies at home. Submitted to *Children and Society*.

Plowman, L., Stephen, C., McPake, J. (under review). Just picking it up? Young children learning with technology at home. Submitted to *Cambridge Journal of Education*.

Plowman, L. & C. Stephen. 2008. The big picture? Video and the representation of guided interaction. *British Educational Research Journal*.

Plowman, L. & C. Stephen. 2007. Guided interaction in pre-school settings. *Journal of Computer Assisted Learning* 23 1: 14-26.

Plowman, L. & C. Stephen. 2005. Children, play and computers in pre-school education. *British Journal of Educational Technology* 36 2: 145-158.

Qualifications and Curriculum Authority (QCA) (2005). *ICT in the foundation stage*. London: QCA.

Rogoff, B., Mosier, C., Mistry, J. & Göncü A. 1998. Toddlers' guided participation with their caregivers in cultural activity. In *Cultural Worlds of Early Childhood*, eds. M Woodhead, D Faulkner, K Littleton, 225-249. Abingdon: Routledge.

Rogoff, B., Mistry, J., Goncu, A. & Mosier, C. 1993. Guided participation in cultural activity by toddlers and caregivers. *Monographs of the Society for Research in Child Development* 58 8: Serial No. 236.

Scottish Executive. 2006. *Making the difference: New technology in learning*. Leaflet.

Skidmore, D. 2006. Pedagogy and dialogue. *Cambridge Journal of Education* 36 4: 503-514.
Snyder, I., Angus, L., & Sutherland-Smith, W. 2002. Building equitable literate futures: home and school computer-mediated literacy practices and disadvantage. *Cambridge Journal of Education* 32 3: 367-383.
Stephen, C. & Plowman, L. (in press). Enhancing learning with ICT in pre-school. *Early Child Development and Care*.
Stephen, C., McPake, J., Plowman, L. & Berch-Heyman, S. (in press) Learning from the children: Exploring preschool children's encounters with ICT at home. *Journal of Early Childhood Research*.
Stephen, C. Brown, S. and Cope, P. 2001. Alternative perspectives on playroom practice. *International Journal of Early Education* 9 3: 193–205.
Sylva K, Taggart B, Siraj-Blatchford I, Totsika V, Ereky-Stevens K, Gilden R & Bell D. 2007. Curricular quality and day-today learning activities in pre-school. *International Journal of Early Years Education* 15 1: 49-65.
Tharp, R. & Gallimore, R. 1989. *Rousing minds to life: teaching, learning and schooling in social context*. Cambridge: University of Cambridge.
Tizard, B. & Hughes, M. 1984. *Young Children Learning: Talking and thinking at home and at schoo*l. London: Fontana.
Wells, G. 1999. *Dialogic inquiry: Toward a sociocultural practice and theory of education*. Cambridge: Cambridge University Press.
Wertsch, J. 1991. *Voices of the mind: A sociocultural approach to mediated action*. Cambridge MA: Harvard University Press.
Wood, D. J., Bruner, J. S., & Ross, G. 1976. The role of tutoring in problem solving, *Journal of Child Psychology and Psychiatry,* 17 2: 89-100.

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www.ioe.stir.ac.uk/research/projects/interplay/
www.ioe.stir.ac.uk/research/projects/esociety/

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Table 1: Supporting young children's learning with technology at home and in preschool

	HOME	PRESCHOOL
WHICH TECHNOLOGIES?	o diverse range of leisure, domestic and work technologies o some ownership of items by children o technologies used by both adults and children o higher specification o easily accessible o technology as cultural and educational resource	o limited range of technologies, with focus on computers o no ownership of items by children o technologies used by children, but rarely by adults o lower specification o time-limited access o technology as educational resource
WHO PROVIDES SUPPORT?	o inter-generational & intra-generational support o family members o adult-child and child-child o adults as learners	o inter-generational support o preschool staff o adult-child, little peer support o adults as learners
WHY IS SUPPORT PROVIDED?	o as play activity o prepare children for school and work but not always explicitly oriented to learning o allow adults time for their own activities	o as play activity o prepare children for school and work o meet demands of curriculum
HOW IS SUPPORT PROVIDED?	o support as social activity o help-seeking is uninhibited o spontaneous o guided interaction (distal): modelling, monitoring, providing resources, setting up activities o guided interaction (proximal): demonstrating, enjoying, explaining, instructing, managing, modelling, monitoring, prompting, providing feedback	o support as individual activity o help-seeking is limited o planned o guided interaction (distal): monitoring, planning, providing resources, setting up activities o guided interaction (proximal): some demonstrating, instructing, managing, but limited modelling, monitoring, prompting, providing feedback
WHAT TYPES OF LEARNING ARE SUPPORTED?	o children determine own goals within available resources o encompasses operational, dispositions to learn, and knowledge of the world o understanding the cultural role of technologies o communication and maintenance of family relationships	o children determine own goals within available resources o mainly dispositions to learn and operational; some knowledge of the world but limited awareness of the cultural role of technologies