Technologies and Learning in Pre-school Education

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Abstract
The paper reports a study based in eight pre-school settings that used a process of guided enquiry with practitioners to identify ways of enhancing children’s encounters with information and communication technologies. Researchers used the concept of guided interaction to describe the ways in which learning could be supported and practitioners explored this concept in a range of technology-based interventions of their own design. Findings were produced in three main areas: (i) practitioners’ developing pedagogy for supporting children’s use of ICT, (ii) children’s learning with and through technologies, and (iii) an elaborated understanding of the nature of guided interaction within a context of learning through play and child-initiated activities.

1 Objectives
This paper presents the findings of a two-year research project (Interplay: Play, Learning and ICT in Pre-school Settings) which was funded by the UK Economic and Social Research Council’s Teaching and Learning Research Programme. The contribution to the programme’s goal of enhancing outcomes for learners was to identify ways in which practitioners can provide more support for three- and four-year-old children’s learning with ICT in nurseries.

Interplay has two interrelated aims:

i) to investigate the role of adults and peers in enhancing children’s encounters with ICT in pre-school settings

ii) to develop an iterative, practitioner-generated process of planning, action and review to enhance and enrich children’s early encounters with ICT.

This paper relates primarily to the first aim by illustrating and discussing the characteristics of guided interaction, a concept which describes how children’s interactions with computers and other forms of ICT are actively supported by practitioners and peers, for example through physical or verbal directing or prompting. Guided interaction operates in two dimensions: distal and proximal. Distal refers to guided interaction that takes place at a distance from the specific learning interaction and so has an indirect influence on learning. Proximal refers to the face-to-face interactions between adults and children that have a direct influence on learning. We discuss the development of a range of strategies to support learning with ICT that are rooted in the dynamics and constraints of authentic pre-school settings and have been identified through a process of guided enquiry, a collaborative and iterative approach in which the research team provides the stimulus for practitioners’ identification of the issues that are important to them in their practice.

Pre-school education is a particularly interesting area for investigating the use of ICT as it offers opportunities to observe the relationship between formal and informal learning and the balance between learner-centred and adult-directed activities. The study described here took place in Scotland, where almost all three- and four-year-olds are in part-time pre-school education, funded by the government and provided by the public, private or voluntary sectors.

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Children start formal school education at the age of five so ‘pre-school education’ is defined as provision across these three sectors for children aged between three and five in the two years before they begin school.

2 Context
This study took place (2003-2005) during a period of widespread (though not unequivocal) support for the value of ICT in educational settings and a political commitment to its introduction. There continues to be a desire to prepare children of all ages for what is seen as an increasingly complex and technological world and, in the UK, the government and others see ICT as having the potential to drive up the standards of children’s education. Governments across Europe are introducing ICT at progressively earlier stages of education but the culture of pre-school provision in Scotland, as in many countries, is distinct from formal school education and policies that have been developed for schools are not necessarily transferable. Compared to schools, in pre-school settings:

- practitioners have a diverse range of qualifications and experience and limited access to ICT training
- there is limited provision of ICT resources
- the curriculum and assessment are less prescriptive
- there are different norms of professional practice, with more emphasis on learning through play and less reference to formal, adult-directed teaching.

Practitioners do not view themselves as teachers but see their role as monitoring and responding to children’s progress and facilitating development through both the activities they provide and the conversations that prompt and extend children’s thinking. Earlier research (Plowman & Stephen, 2003, 2005) showed that practitioners found the introduction of ICT into the playroom to be challenging. Practitioners were familiar with providing highly contingent responses to children in other contexts but this did not extend to children’s play with ICT, partly because they tended to define ICT in terms of computers. We found that children ‘playing’ with the computer frequently experienced operational difficulties, were hampered by their inability to read instructions or respond to dialogue boxes and failed to complete tasks when the games or activities with which they were interacting were too conceptually demanding. Children did not find their time at the computer rewarding in terms of pleasure or achievement when it was chosen as a free play activity if they did not have adult support. They seldom asked for help, preferring to leave the computer and turn to one of the many other activities on offer in the playroom, so their time at the computer was very brief.

There were few examples either of direct or proximal interactions between practitioners and children at the computer, other than as a reaction to problems such as turn-taking disputes, or of less direct or distal interactions such as observing, recording and assessing children’s progress with ICT. Based on interviews and observations we identified their inhibition as being due to a combination of the following factors:

- a desire for children to find out for themselves
- a resistance to approaches that could be perceived as too instructional
- being unaware of children’s need for help, particularly when the computer is located out of peripheral vision
- limited confidence with ICT
- prioritising assistance required elsewhere in the playroom.

These tensions between shifts in education policy, practitioners’ own experiences and the culture of practice in pre-school settings prompted Interplay’s aims of identifying ways in
which pedagogical actions by adults can support children’s encounters with ICT. (Our original aim was to identify ways in which both peers and adults could support children’s encounters with ICT in the playroom but as we found very few examples of peer support the study was refocused on the role of adults.) The concept of guided interaction was used as a tool for thinking about how children’s encounters with ICT can be enhanced and actively supported in a setting that values the role of play and was conducted with the active participation of pre-school practitioners.

A starting point was to encourage a broader view of ICT. There was at least one desktop computer available in each of the playrooms but access to other ICT resources, and whether practitioners recognised these technologies as ICT, varied across settings. Our earlier research showed that desktop computers are not suitable for lone play activities by children aged three and four because computers:

- were originally designed for adults to use individually in the workplace
- are not ergonomically suited to very young children because of their size, position and fixed location
- generally rely on text as a means of input and output and require fine motor control for operation
- tend to inhibit dialogue as children or adults focus on the screen and do not make eye contact.

Extending the definition of ICT to include digital still and video cameras, mobile phones, electronic keyboards and toys that simulate technologies such as laptops and barcode readers has a number of advantages. These technologies can provide better support for mobility and collaborative use, are easier to integrate into play activities, are more fun to use and can support a range of activities. 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.

3 Theoretical framework
Guided interaction is located within a Vygotskian tradition of understanding supported learning and relates to other concepts including scaffolding (Wood, Bruner & Ross, 1976), assisted performance (Tharp & Gallimore, 1989), dialogic inquiry (Wells, 1999) and guided participation (Rogoff et al., 1993). All of these approaches can be applied to the support of technology-mediated learning although they have not been developed specifically for this purpose. There has been a body of research exploring scaffolding in relation to technology-supported learning (Lajoie, 2005; Wood & Wood, 1996; Yelland, 2005), but the emphasis of that work has been directed at the desktop computer, whether concerned with intelligent tutoring systems, promoting peer collaboration or exploring how learners seek help. The study reported here differs inasmuch as guided interaction focuses on ways of supporting learning with diverse technologies and so can be used to identify a broader range of opportunities for learning.

We used the concept of guided interaction to extend these theoretical perspectives to technology-mediated learning in the context of pre-school education. In attending to modes of communication and the role of artefacts there are important areas of overlap with these frameworks, but there are also some key differences.

- The concept of task performance underlies some of these theoretical perspectives but this is inappropriate in the free play context of pre-school settings. Guided interaction focuses more on the process of learning than the successful achievement of a task.
The main mode of scaffolding and other forms of assisted learning is generally *spoken language*. Guided interaction is enacted multimodally and language was not necessarily the main mediator of learning in a pre-school context.

Although conceptualized within a sociocultural framework, many studies tend to have a close focus on the *site of engagement* and the immediate learning environment. Guided interaction attends to the broader context of learning, encompassing planning, the provision of resources and concepts of role as critical elements in the distal dimension.

Nevertheless, whether child-to-child, child-to-adult or between people and artefacts interaction is central to understanding learning in a sociocultural framework and all of these approaches describe a dynamic, reciprocal process which is multi-causal and highly contingent. Our interest was in looking in more detail at how one realm of interaction can be better understood by researchers and practitioners.

4 Design of the study and sources of data
The study was based in eight pre-school settings which represented a range of types of provision and served 400 families with a broad range of socioeconomic status. The pre-school settings were formed into two cluster groups based on location and the research was undertaken in collaboration with two practitioners from each setting, at least one of whom had little or no previous experience with technologies in the playroom.

Researchers visited each of the pre-school settings on seven occasions and produced baseline information, a technology audit, field notes, focused observations and video recordings. Over the course of the 2003-2004 school year, each cluster group met with researchers four times to share observations based on video recordings and to identify ways in which practitioners could provide guided interaction and support to children using ICT within the playroom setting. During this period, each site identified two small-scale projects for implementation and evaluation that would either address recognised problems with technology-based activities or allow them to explore new activities or pedagogical actions. One project was designed to include computers and one involved an alternative form of ICT.

During the practitioners’ first project to explore guided interaction, we collected more video data on an opportunistic basis and practitioners produced records of observations, typically on sticky notes or written in progress files, but occasionally using photographs or video. This new data was discussed in further cluster group sessions and the cycle was repeated as part of a practitioner-generated cycle of planning, action and review that was familiar to practitioners as a way of structuring learning activities and their own work. This process of guided enquiry was collaborative, with the research team providing the stimulus for practitioners’ identification of the issues that were important to them and ensuring that the range of strategies to support learning with ICT was rooted in the dynamics and constraints of authentic pre-school settings.

The definition of guided interaction developed iteratively as a result of our own analysis combined with the practitioners’ experiences and observations and there was thus a circular relationship between our development of the concept and its application which reflected the culture of practice in the playroom. The individual and collective testimony of practitioners regarding the changes in their practice was a key source of evidence. We gathered this evidence through reflections on the interventions at the cluster meetings, individual interviews on how they conceptualised their practice before and after the interventions, practitioner-generated data and a questionnaire on competence and attitudes distributed to all 40 practitioners in these settings.
This data has been cross-referenced with about sixteen hours of video recordings which were coded to capture episodes in which children interacted with technologies and to provide examples of guided interaction. A preliminary understanding of guided interaction, based on our earlier research, informed this initial analysis and was used to identify episodes where it was demonstrated, as well as situations where its absence led to less productive experiences. These sequences were presented to the two cluster groups as a means of stimulating reflection on practice and to enable us jointly to identify the characteristics of guided interaction and how this might support children’s learning.

5 Results
We produced findings in three main areas: (i) practitioners’ developing pedagogy for supporting children’s use of ICT in the playroom, (ii) children’s learning with and through technologies, and (iii) an elaborated understanding of the nature of guided interaction. In our analysis of outcomes for learners it became apparent that the domains of learning were similar across both practitioners and children and we therefore analysed changes in learning for both groups in terms of skills, confidence and knowledge. As practitioners’ skills, confidence and knowledge increased so did the skills, confidence and knowledge of the children. This, in turn, led to greater learning for practitioners as they became emboldened to try new approaches, creating a virtuous spiral. The focus here is on the concept of guided interaction as that was a key tool in promoting changes in learning.

For practitioners’ learning, the main source of data was a comparison of the initial and final interviews supplemented by comments during cluster group sessions, their own records of the interventions and the practitioner survey. The research team provided no training for practitioners but confidence in using ICT in the playroom grew as the cluster group sessions enabled them to share experiences and the two interventions enabled them to observe children’s use of ICT more closely than hitherto. They also developed pedagogical knowledge about the value of particular resources and ways of recording, assessing and integrating ICT activities into nursery planning. Changes were also evident in identifying areas where they had previously both over- and under-estimated children’s capabilities, questioning the role of ICT in the playroom and recognising that ICT can be used to access and support learning throughout the curriculum.

Our evidence about children’s learning comes from practitioners’ observation notes, interviews, discussions at the cluster meetings and extracts from their written accounts of the interventions. Practitioners in Scotland do not routinely refer to learning outcomes (Stephen, Brown & Cope, 2001) but we identified three areas of learning that can be supported by play with ICT: developing dispositions to learn, extending knowledge of the world and acquiring operational skills. These three categories are not intended to be exhaustive (physical development is missing, for instance) but they enable us to identify more clearly the broad areas of learning that can be supported by ICT. Both distal and proximal interactions have associated learning outcomes, even if these are not explicitly articulated.

Children’s learning across these categories depends 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 and family members. Guided interaction can support all three areas of learning described here although some areas are currently more readily supported than others.

Exploring the concept of guided interaction in the context of playroom use of ICT is at the core of this project and so more systematic analysis of the video data was conducted after the interventions were completed. This gave us more detailed information on the characteristics of guided interaction in the proximal dimension; other sources of data, such as interviews and
practitioner records, had provided information on guided interaction in the distal dimension. The sociocultural perspective that informs the design of the study requires a focus on the context in which learning takes place rather than measuring individuals’ internalised learning associated with a more cognitive approach. This focus on activity led to interaction between the adult, child and technological artefact as a unit of analysis with the learner’s cognitive development seen as the product of the activities and cultural practices that they engage in with others.

Our focus on interaction 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 access this evidence on video and so reflect on the process of interaction after the event, whereas practitioners have to make interpretive decisions in the moment without the opportunity for review. 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.

Analysis across all sources of data enabled us to devise a taxonomy of guided interaction showing examples of different types of support, the different modes in which that support is enacted, and the learning outcome with which the support is associated (tables 1 and 2). All examples in the tables are taken from data collected during this study. Some are drawn from children’s use of computers; others are drawn from children’s use of alternative types of ICT.

### 6 What is guided interaction?

The analysis indicated two main dimensions of the framework for understanding guided interaction: distal and proximal. Distal refers to guided interaction that takes place at a distance from the specific learning interaction and so has an indirect influence on learning. Proximal refers to the face-to-face interactions between adults and children that have a direct influence on learning.

The tables are not designed to provide information on the frequencies of different types of interaction. A more controlled study would be required to produce such findings but it is possible to identify particular types of pedagogical action and interpret them within this framework. Representing guided interaction like this is a means of both analysing what was happening in these learning interactions and documenting the range of practitioner activity that supports learning, helping us to identify responses to two questions we posed at the outset of this study: i) how does guided interaction fit into a pre-school culture of child-initiated learning through play and ii) how can practitioners find a space for guided interaction amongst their many other responsibilities in the playroom?

#### 6.1 Distal

Although our original focus had been on closely coupled interactions we became aware through dialogue with the practitioners that the activities that are more remote in terms of time and space were also guiding interaction, albeit indirectly. This orchestration of learning includes making provision for learning in terms of access to and monitoring time spent on ICT equipment, creating an environment to facilitate learning, planning the curriculum, and identifying next steps (see table 1). These pedagogical actions are therefore guiding interaction at one remove from the face-to-face interactions described as proximal. As such, they are not as easily observable, or as susceptible to categorisation, as proximal interactions and it is partly for this reason that these less visible aspects of support for learning do not receive as much research attention.
The distal nature of the support is demonstrated by the lack of learning outcomes categorised as operational (which generally requires face-to-face interaction) and an emphasis on dispositions for learning and knowledge of the world, principally through planning and provision. Practitioners tend to prioritise the planning and providing role of the adult (Stephen et al., op. cit., 2001) because direct interactions between practitioner and child are not privileged in pre-schools, where the usual pedagogical approach derives from a concern with children’s progress through developmental stages or sees child-initiated free play as the medium for learning. In such circumstances, a focus on direct adult-child interactions can be interpreted as suggesting a move to ‘teacherly’ intervention which is considered inappropriate in pre-school settings. Moyles et al. (2002, p.3) interpret this as ‘the difficulty experienced by practitioners in focusing upon their own impact upon children’s learning as opposed to making practical provision, e.g. laying out materials from which children can make choices’.

Table 1: Characteristics of guided interaction (distal)

<table>
<thead>
<tr>
<th>Form of guided interaction</th>
<th>Example</th>
<th>Mode</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>arranging access to ICT</td>
<td>using sand timer to structure turn-taking</td>
<td>practice</td>
<td>learning dispositions</td>
</tr>
<tr>
<td>ensuring access to help</td>
<td>checking on levels of engagement</td>
<td>practice</td>
<td>learning dispositions</td>
</tr>
<tr>
<td>modelling</td>
<td>using technology for a purpose, eg making video to show parent’s evening</td>
<td>practice</td>
<td>knowledge of the world</td>
</tr>
<tr>
<td>monitoring</td>
<td>planning child’s return to activity</td>
<td>policy; practice</td>
<td>knowledge of the world, learning</td>
</tr>
<tr>
<td></td>
<td>ensuring balance across the curriculum</td>
<td>policy</td>
<td>dispositions or operational</td>
</tr>
<tr>
<td>planning</td>
<td>ensuring range of activities for each child</td>
<td>policy</td>
<td>knowledge of the world, learning</td>
</tr>
<tr>
<td></td>
<td>identifying learning needs</td>
<td>policy, practice</td>
<td>dispositions</td>
</tr>
<tr>
<td>providing resources</td>
<td>making broader range of ICT available</td>
<td>policy</td>
<td>knowledge of the world, learning</td>
</tr>
<tr>
<td></td>
<td>including disposable camera in story sacks for taking home</td>
<td>practice</td>
<td>dispositions, operational</td>
</tr>
<tr>
<td>setting up activities</td>
<td>changing location and presentation of listening centre</td>
<td>practice</td>
<td>knowledge of the world, learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>dispositions</td>
</tr>
</tbody>
</table>

6.2 Proximal

The proximal dimension of guided interaction can be resource intensive because establishing joint attention on a one-to-one or small group basis is a prerequisite. Table 2 shows a prevalence of physical interactions and so they have been sub-divided into categories such as touch and movement. The physical modality is mainly related to operational outcomes as practitioners typically show a child how to do something rather than use a verbal explanation. However, it is also related to dispositions for learning through physical manifestations of pleasure in learning or the simple act of physical presence providing reassurance to a child making an action for the first time.

Dispositions to learn encompasses a range of affective, social and cognitive features of learning to learn which are particularly important because supporting children’s development as confident and self-directed learners is given high priority in pre-school settings. ICT has a role to play in developing children’s dispositions to learn by increasing self-esteem and the
confidence gained from accomplishment as well as supporting independence and persistence in the face of initial difficulties.

Table 2: Characteristics of guided interaction (proximal)

<table>
<thead>
<tr>
<th>Proximal (Direct interaction)</th>
<th>Form of guided interaction</th>
<th>Example</th>
<th>Mode</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>demonstrating</td>
<td>how to use a tool such as the paintbrush or eraser</td>
<td>physical action; oral</td>
<td>operational</td>
<td></td>
</tr>
<tr>
<td></td>
<td>placing a hand over child’s hand as they move the cursor or click on icon</td>
<td>touch; oral</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>how to frame a picture in viewfinder</td>
<td>physical action; oral</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>how to plug in electronic keyboard</td>
<td>physical action</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>turning over pages of story as children listen on audio tape</td>
<td>physical action</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>waving hand in front of EyeToy</td>
<td>physical action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enjoying</td>
<td>sharing pleasure in features such as animation</td>
<td>oral; laughter</td>
<td>learning dispositions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>moving to the music on a CD player</td>
<td>physical action</td>
<td>knowledge of the world, learning dispositions</td>
<td></td>
</tr>
<tr>
<td>explaining</td>
<td>what is on slides for the computer microscope</td>
<td>oral</td>
<td>knowledge of the world</td>
<td></td>
</tr>
<tr>
<td>instructing</td>
<td>reading dialogue box on screen</td>
<td>oral</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>tell child how to use digital camera</td>
<td>oral, gesture</td>
<td>operational</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tell child to push button on tape player</td>
<td>oral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>managing</td>
<td>intervening in turn-taking</td>
<td>oral; facial expression</td>
<td>learning dispositions</td>
<td></td>
</tr>
<tr>
<td>modelling</td>
<td>putting on headphones to check sound level</td>
<td>physical action; oral</td>
<td>operational</td>
<td></td>
</tr>
<tr>
<td></td>
<td>using a play phone to order a taxi</td>
<td>physical action; oral</td>
<td>knowledge of the world</td>
<td></td>
</tr>
<tr>
<td>monitoring</td>
<td>moving child to appropriate level of difficulty</td>
<td>gesture; oral</td>
<td>learning dispositions; operational</td>
<td></td>
</tr>
<tr>
<td>prompting</td>
<td>suggesting a child tries something new</td>
<td>oral</td>
<td>learning dispositions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>helping with typing in names (typically to start a new game)</td>
<td>oral; typing</td>
<td>operational</td>
<td></td>
</tr>
<tr>
<td>providing feedback</td>
<td>giving encouragement for efforts</td>
<td>oral</td>
<td>learning dispositions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>smiling as child types name on keyboard</td>
<td>facial expression</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>says ‘That’s beautiful’ when child shows picture on camera</td>
<td>oral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supporting</td>
<td>stays close to child using video camera for safety and emotional support</td>
<td>physical presence</td>
<td>learning dispositions; operational</td>
<td></td>
</tr>
</tbody>
</table>
It also has potential for supporting curiosity and promoting pleasure in learning by enhancing engagement and motivation. There are few examples here of intended outcomes that could be classified as knowledge of the world, which is more likely to be enacted in the distal dimension through the provision of resources aimed at specific areas of the curriculum. Interventions were rarely explicitly cognitive in orientation, such as developing learning in terms of the subject content, and most interactions were operational. We observed very few examples of children’s overt help-seeking behaviour and noted that support for operational outcomes cannot easily be provided at a distance: it requires close supervision to identify and meet needs that are not explicit. A fuller description of these tables is provided in Plowman & Stephen (under review).

7 Educational importance
The focus here is not on what children can learn about ICT (which would be a straightforward matter to assess) but on how interactions with adults can enhance learning in activities mediated by technologies. The research demonstrates that enhancing learning includes providing support not just for operational skills but also for less measurable positive dispositions towards learning such as persistence, engagement and pleasure.

Interactions that enhance children’s engagement with ICT in the playroom are multimodal, including gesture, touch, language and, on some occasions, the emotional support of a known adult. But our observations and the evidence from practitioners suggests that enhancing children’s encounters with ICT requires pedagogical activity beyond the immediate interpersonal interactions. Guided interaction encompasses planning for both the whole setting and for individuals, the selection and provision of appropriate resources and the physical environment of the playroom.

The research led to an outline of a range of strategies to support learning with ICT that maintain a balance between child-initiated and adult-led activities and are rooted in the dynamics and constraints of authentic settings. The study challenges the widespread belief that free play is a sufficient condition for learning and emphasises the practitioner’s role vis à vis the place of guided interaction in a pedagogy that promotes social and cognitive development in the early years. Whilst our starting point was to avoid disturbing the distinctive qualities of pre-school provision, such as the emphasis on learning through play and child-led activities, we were keen to avoid the deficit approach to educational change (imposing a ‘solution’ or ‘improvement’ on practitioners) and clear that our findings had to be derived from authentic settings if they were to have any credibility with practitioners or any claim to relate to the complexity of playroom experiences.

This framework enabled practitioners to see how their current practice can constitute guided interaction and raised awareness of existing, if isolated, practices. Although it was new to them, guided interaction was a term with which practitioners felt comfortable, so they were able to use this concept to reflect on practice and explore how they could enhance children’s learning with ICT. Guided interaction is not prescriptive – it is about practitioners using their own experience to identify opportunities for learning that may otherwise have been missed. It is consistent with the approach to ICT embedded in the Scottish policy document, Early Learning, Forward Thinking (Learning and Teaching Scotland, 2003), which is underpinned by principles that relate to understanding the different ways in which children learn and seeing relationships and interactions as lying at the heart of all learning experiences as well as a need for pedagogy to evolve, rather than allowing technology to drive change.

This lack of prescription contrasts with the equivalent guidance from England issued by the Qualifications and Curriculum Authority (2005). This presents a number of scenarios involving a range of different types of ICT and for each one provides a section headed ‘What does the practitioner need to do?’ Our approach was to start from existing practice, observing
the ways in which practitioners support learning in other contexts and identifying the strategies that could be adapted for ICT. For instance, an observation of a practitioner showing two children how to make cookies revealed that in a situation which does not involve ICT and in which the practitioner feels comfortable, they will guide children’s interactions with a range of artefacts, including cookie cutters, baking trays, a rolling pin, ingredients and a recipe book, use explicitly instructional language, engage children in learning conversations and model behaviour. Examples such as this were used as the basis for thinking about the forms of support that could be adapted for situations in which ICT was a focal activity. The table showing guided interaction in the proximal dimension is drawn solely from observed behaviours during the practitioner-generated interventions; the table showing guided interaction in the distal dimension is based on their accounts of practice. We are not therefore imposing change or directing practice but supporting practitioners to identify appropriate pedagogical actions.

Supporting learning in the ways that we have outlined here may seem commonsensical. Suggesting that young children need adult support for interacting with complex artefacts is not a particularly striking finding. If this is the case, the question is why it is not a part of usual playroom practice. The lack of direct, extending interactions through talk and other modalities is not only a characteristic of practice in the settings included in *Interplay*. A recent report on Scottish pre-school provision based on 1600 inspections pointed to many positive features of the playrooms visited but called for enhancements in the nature of the interactions between adults and children to support learning (HMIE, 2006). Similarly, an analysis of pedagogical practices in settings involved in the Effective Provision of Pre-school Education study (a large-scale, longitudinal study of the cognitive and social impact of attending pre-school provision) concluded that

> [O]ur research has also shown that adult-child interactions that involve some element of ‘sustained shared thinking’ or what Bruner has termed ‘joint involvement episodes’ may be especially valuable in terms of children’s learning. We found that the most effective settings encourage ‘sustained shared thinking’ but we also found that this does not happen very frequently. (Siraj-Blatchford et al, 2002)

A probable explanation is that it is an outcome of the tension between the child-led, holistic construction of pre-school education that dominates western culture and the more interventionist guidance suggested by guided interaction (discussed at more length in Stephen & Plowman 2005). Reservations about the interventionist nature of guided interaction in the proximal dimension are understandable if the interactions are conceptualised as unidirectional teaching but interaction is, by definition, a two-way process. Guided interaction places the onus for guidance on the practitioner (or peers) but the focus is on a common activity, the pursuit of shared goals, and the maintenance of mutual understanding. Wood & Wood (1999 p.152) point out that, if practitioners are fully responsive, ‘it follows that it is the learners who drive them to act as they do’. In other words, it could be claimed that it is the children who guide the interaction. Rogoff (1991 p.351) also emphasises the learner’s agency in this two-way interaction by stating that ‘[b]oth participation and guidance are mutual efforts of children and their caregivers or companions: neither can be attributed to an individual alone’.

Guided interaction is therefore consistent with child-centred pedagogy if practitioners are sensitive to the ways in which children initiate communication (which may be gaze, gesture or physical contact rather than verbal) and respond to their needs. An integral part of guided interaction in the proximal dimension requires being alert to the ways in which children actively direct the focus of learning and using pedagogical judgement to identify the optimal point for intervention. This also applies where there appears to be an absence of activity: in the many cases where children seem to respond to the computer in a desultory manner the responsive practitioner will be able to interpret this as a request for intervention. Practitioners
also became aware of times when a child’s self-directed exploration is more appropriate and, in these circumstances, the intentional absence of direct action may be a source of guidance.

Although this is a small-scale study, confidence in our conclusions can be based on the process of testing and refining our findings through user validation and endorsement involving practitioners, managers of provision and policy-makers. Our findings can be summarised as:

**Finding 1**

- Children’s encounters with ICT are enhanced when practitioners use guided interaction.

**Implication**

- Professional development can help practitioners to find ways of enhancing the value of encounters with ICT whilst balancing child-initiated and adult-led activities.

**Finding 2**

- Encounters with ICT accompanied by guided interaction can enhance three key areas of learning: dispositions to learn, knowledge of the world and operational skills.

**Implication**

- Maximising the learning benefits of ICT requires a responsive, reflective pedagogy which values pleasure and engagement as well as operational skills.

**Finding 3**

- Providing a broad range of ICTs promotes diverse opportunities for learning.

**Implication**

- Nurseries should broaden their focus from computers to other forms of ICT, including digital still and video cameras, mobile phones, and electronic keyboards and toys.

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**References**


Technologies and learning in pre-school education


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1 ‘Information and communication technologies’ (ICT) is the term used in educational contexts in the UK to describe a broad range of technologies. Information technologies (IT) was the term previously used across the industry, business and education sectors but it was generally restricted to computers, peripherals and computer software. The ‘C’ was added by education policymakers to emphasise the use of technology for communicative purposes.

2 The term ‘practitioners’ is used throughout this paper to refer to the professionals who work in an educational capacity in pre-school settings. They are not referred to as ‘teachers’ in Scotland as they see themselves as having a distinct, and less didactic, role. The practitioners also tend to have a wide range of qualifications, from vocational certificates and diplomas to degrees and postgraduate qualifications. Pre-school education is available to all three- and four-year-old children and can be offered in nursery classes attached to primary schools, in stand-alone nurseries provided by the private or public sector, and in voluntary sector playgroups as long as quality criteria are met. The term ‘playroom’ here refers to the area in which children in engage in indoor activities.