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Children using ICT: the seven principles for good practice

From their earliest years, children should be finding out about and identifying the uses of technology in their everyday lives. They should also be using computers and programmed toys to support their learning. Children need the opportunity to explore and play with computers just as they do with other forms of ICT, such as cassette recorders. This kind of play acts as the foundation for more structured use of applications later on. It means that ICT must be integrated across the curriculum.

The key is to ensure that children have access to ICT which offers them opportunities to develop general skills and also extends their specific knowledge of that technology. Given the range of computer hardware and software now available on the educational and toy market it has become increasingly difficult to make informed choices between them. DATEC's publication of guidance material for parents and practitioners is therefore calculated to provide for a pressing community need. It is based on research with practitioners and researchers in the field.

A growing consensus has emerged regarding the most appropriate forms that ICT education should take in early childhood. Seven general principles have been identified for determining the effectiveness of ICT applications – or uses of ICT – in the early years, to help practitioners provide the best possible experiences. They are:

1   ensure an educational purpose
2   encourage collaboration
3   integrate with other aspects of curriculum
4   ensure the child is in control
5   choose applications that are transparent
6   avoid applications containing violence or stereotyping
7   be aware of health and safety issues.

Parental involvement should also go hand-in-hand with these.

Practitioners can use these points to engage in a discussion about each area and how it might fit into the general philosophy and practice of their setting. The guidance might also inform the setting's ICT policy, as it does in the sample policy on pages 00–00. The principles can also be used as a useful tool to evaluate software programs or other ICT applications, and also help with working with parents..

1. Ensure an educational purpose

Typical educational uses of ICT might be something as simple as the introduction of a pretend mobile telephone to encourage imaginative role play, which children from a very early age will do quite naturally. The educational benefits of imaginative role play are well documented.

A favourite computer application with many children, is 'Make a bug' from the CD-Rom *Millie's Math House.* This can be integrated as part of a more general class project, for example about insects and minibeasts. But any application introduced to children in order to develop understanding and experience of ICT should not just be enjoyable, although this is

important. It should be educationally effective too. However entertaining most arcade-type games might seem, they provide little encouragement of creativity or, indeed, any other worthwhile learning outcome and should therefore be rejected. This is not to suggest that applications should not be fun or used for leisure, only that they should be carefully chosen to have some educational value as well.

Many settings and some homes use language and number drill-and-practice programs, but these have very narrow educational aims, such as practising addition or learning colours. Such programs should be used with caution, as they promote a very directive form of teaching, normally with the use of an external reward (a smiling face, a tick or a funny sound). Over-reliance on this kind of program risks reducing children's intrinsic motivation to learn. In any event there are usually much more interesting ways of learning about these things (see 'Ensure the child is in control', below).

Children need a variety of applications which encourage a range of development, including creativity, self-expression and language. Applications should be employed after a thorough discussion with staff and parents, wherever this is possible, about the educational benefits and constraints of the particular application.

In common with many other Edmark programs, Millie's 'Make a bug' operates in two play modes: free play and programmed learning. In both cases, the names of the numbers and the body parts chosen are 'spoken', and one of these modes allows the child to play freely – encouraging a creative response in a play environment that enhances their awareness of number. The application is therefore to be recommended for this facility alone. Unfortunately, the other mode provides a more problematic series of programmed learning exercises which are less desirable and should constantly be looked out for in programs

In this more complicated mode, the rabbit in the picture frame gives the children specific instructions for making a bug. The child then has to follow the instructions to make a bug with, for example, two feet and nine tails. If the child gets the answer wrong they have to select them correctly to continue with the game.

There are two major problems with the program. First, it has some worrying limitations (for example, a child who has been instructed to make four tails, and who does so by adding two tails with another two tails, will be told that she is wrong). So, children who approach tasks in less conventional ways will be given negative responses to their sometimes-ingenious solutions. Such limitations in ICT programs need to be looked out for and may cause practitioners to reject them.

Second, the exclusive use of external authoritative praise does little to encourage self-motivation or perseverance on the part of the child. (The bunny simply says 'Good job' or 'You're really good at this' when the child gets something right, and 'whoops' when things go wrong.)

2. Encourage collaboration

While it is important for children to play alone (and they do this very well), an indicator of quality play, according to Bruce (2001), is also playing collaboratively. There are parallels in the world of computer use. Children can access programs individually, but the best applications provide a valuable means of encouraging collaboration. According to Light and Butterworth (1992), activities requiring 'joint attention' and which involve 'children learning to share' provide a better cognitive challenge for young children than activities where they work alone. Collaboration is also important in providing opportunities for cognitive conflict as children make efforts to reach consensus (Doise and Mugny 1984), and for finding potential solutions together in the creative course of problem-solving (Forman 1989). Children may

collaborate simply by taking turns or else the program themes may require further investigation in other mediums – the world of book exploration or the world of play.

Imaginative role-play provides a natural context for children to share play ideas and use resources in imaginative ways. Hats are made from saucepans, cars from wooden blocks, princesses' cloaks from any material at hand. Such resources are important because they provide symbols for the children to play with. Children can articulate their thinking, enabling them to express ideas which they are still only beginning to grasp intuitively (Hoyles 1985). Many screen-based applications offer the same possibilities in terms of symbolic manipulation. Instead of physically playing at roles and characters, perhaps by changing familiar resources into ordinary or special and magical objects, children move things around on the screen. It should be noted that adult intervention is usually needed to gain the most from software designed for collaborative problem-solving, drawing or construction.

At Gamesley, an inexpensive closed circuit television (CCTV) system provides children with a play environment that enhances their communication, language and literacy. The CCTV system has been improvised using a pair of donated portable television receivers and video security cameras bought from a DIY store. The novelty of being on television encourages communication and collaborative play. Children use it to communicate with each other from different rooms in the building. This can be achieved using telephones, or walkie talkies and even email – but CCTV offers the chance of visual links as well as sound. Web cams also offer this potential. Children happily follow each other's instructions or imitated actions seen on the screen. They exchange ideas and develop conversation skills.

Research suggests that the apparatus encourages social interaction, with children sharing more visual attention and making increased eye contact (Siraj-Blatchford, I. & J. 2002) – although the greatest potential of CCTV in the nursery may only be achieved through the encouragement of more structured and scaffolded play, which needs adult involvement at the level of planning, interaction and observation as well as interaction in the play.

3. Integrate with other aspects of curriculum

ICT applications should be integrated as far as possible with other play and project work, and all should work together to help make the curriculum relevant to children.

There is a significant problem regarding this issue in much of the current ICT provision in schools. A lot of primary schools are opting for computer suites, which are sited away from the usual play and work areas for children, and thus actively discourage the integration of ICT with the rest of the curriculum for the children. Children need to see ICT used in a meaningful context and for real purposes.

Thankfully, there are also excellent examples of good ICT integration. For example, when the real world of ICT (telephones, photocopiers, washing machines) is reflected in children's play. Sometimes this means that real technological artefacts are actually used in the playing. Metal detectors prove very popular, for example.. The computer can also bring integration. Children in one setting used a drawing program to make part of a birthday card, and then completed it using other materials. Adults in another setting have taken children with them to the laundry room and explained the program cycles for hot and cold washes. On the computer, the 'Make a bug' application (see above) can be used by children to design a bug which they go on to make with play dough or some other modelling medium. In all of these cases, the children are given an understanding of the purposes and uses of ICT as a tool to solve real problems.

Computer applications provide a means by which children may engage and interact with a much wider range of virtual and audio artefacts and environments than would otherwise be

possible. For example, Internet access in one nursery enabled a child to find out about owls. He found a site that showed a live link to an owl's nest and then spent the morning watching owl babies being fed and cared for by parent owls. He astounded nursery staff by managing the whole process himself, not least because he was not yet able to read conventional print. But, in this case, he had made sense of the symbols he encountered because he was engaged in a purposeful activity using a medium he enjoyed working with.

A child's world is rich with symbols of many kinds: traffic signs which may be computerised on motorways; exit and entry directions in shops and public buildings; no-smoking instructions; and disabled-access signals, to name but a few. Developing an awareness of symbols and an ability to manipulate them is clearly important for emergent literacy and numeracy. In the usual course of helping children to develop these skills, practitioners specifically encourage children to recognise the value of using symbols, which can also include spoken or written words and numbers to represent things, quantify them and manage the information. A great deal can be done to promote these processes in the wider play context and also in children's play with technological toys. Many settings use computer programs which manage information as part of their project work so that, for instance, children might collect information on a topic about the body (eye or hair colour, perhaps) and make simple graphs on the computer using these data.

Another very important reason for employing an integrated approach to ICT is the recognition that this is more consistent with the notion of ICT products as tools. Tools are designed to be applied for particular purposes when required, they are not usually designed for continuous use for their own sake. The common practice of operating a rota for children to gain access to computers is entirely contrary to this approach. Equally inappropriate is the common practice of providing access to computer use as a reward (or punishment). Computers should be used as a means to fulfil a function which cannot be achieved better through other means. Questions to ask relating to this are:

What does this program enable the children to do that they couldn't do otherwise?
Is it helping towards particular skills and understanding?

4. Ensure the child is in control

Generally, ICT applications should be controlled by the child, they should not control the child's interaction through programmed learning or any other behaviourist device. Such an approach promotes directive teaching and is contrary to popular conceptions of good educational practice. There is consensus among informed early childhood educators across Europe about the importance of developing children's early awareness and positive disposition towards literacy and numeracy. And it may very well be the case that programmed learning can operate against these principles. Negative responses can do much to add to sense of failure and low self-esteem, especially among children who offer non-conventional but imaginative responses.

A similar case can be made against applications which incorporate 'closed' problem-solving, that is problems with only one solution. One of the best strategies for solving this sort of problem is simply to try every possible option until you find the right one, and this tends to be strategy that most children adopt. A child who reaches a correct answer by routine elimination of wrong responses is unlikely to be well motivated or to develop any sense of real achievement. The irony is that this is precisely the strategy which computers are usually designed to adopt, and given the speed at which they can test the outcomes it is a strategy they excel in.

A whole range of labour-saving technologies may be applied to save us from repetitive or time-consuming tasks of this kind. But when it comes to more complex real-life dilemmas,

like deciding who to support when your friends fall out with each other or making decisions when we don't have enough money to buy everything we want or need, technology is unable to provide the answer. The kinds of problems computers struggle with are the sort with multiple solutions where the real intellectual challenge is to clarify the problem sufficiently well to recognise when the best solution has been found. Arguably, it is just this sort of creative problem solving that children should be given practice in.

Babyz, by Mindscape, is an example of a really open-ended program which children can access with adult support.[1] The program offers children the opportunity to care for a baby aged between 9 and 15 months old. look after. Children have to solve 'problems' which they have themselves developed, along with the adults who support them. They can't go quite so far as deciding to throw the baby out of a window, but they choose pretty much any other solution. This is much better than the software creating the problems to solve.

5. Choose applications that are transparent

As far as possible, ICT applications should provide 'transparency': their functions should be clearly defined and intuitive. In practice, this means that the application can complete each clearly defined task in a single operation. A good example of this is the 'drag and drop' facility on the computer, which literally allows the user to pick an item up with a click, drag it to somewhere else and then drop it in that place with another click. It is a perfect simulation of what happens in real life when something is moved.

When taking a picture using the Sony Mavica digital camera, the image on the large screen at the back of the camera freezes and a simulated 'shutter' sound is heard. The photograph is saved on to a floppy disk. So, when a child has taken a photo, she can remove the disk put it into the computer and double-click to bring the picture directly on to the screen. The process is simple and easy to understand and achieve.

6. Avoid applications containing violence or stereotyping

Computers can empower all young children to be more independent, but research shows that issues of equality are key. A number of studies have shown that:

- girls often use computers less often than boys
- the presence of a computers in a setting does not ensure access
- teachers, while concerned about equity, often hold attitudes which hinder access, for example use of the computer may be granted as a reward, or its use may be restricted to drill-and-practice tasks for less able children
- children from low-income families often have less access and/or lower-quality access to computers in the home (see, for example, Thouvenelle *et al.* 1994).

Unfortunately it cannot be assumed that all of the software finding its way into early years contexts and homes is appropriate or even tasteful, but in selecting applications it is important to be alert for stereotypical of patronising images or actions related to social class, ethnicity and gender. Applications should also satisfy the principles laid out in the advertising standards authority code of practice, with regard to violence. The code states that:

Particular diligence must be exercised in matters of violence and sexual violence … materials must not condone nor encourage anti-social behaviour of this kind. Nor should they play on the fears of the vulnerable. Depictions of and references to weaponry, especially those weapons which are easily obtainable in the UK and are potentially attractive

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[1] *Babyz* is available from Mindscape Entertainment, Elm Park Court, Tilgate Forest Business Centre, Brighton Road, Crawley, RH11 9BP; www.babyz.net

to violent minds, should be avoided or presented with great care (ASA 2002; see also Siraj-Blatchford, J. & Whitebread 2003).

Where applications fail to meet any of these criteria, it would be difficult to justify their use in any educational context.

7. Be aware of health and safety issues

Serious concerns have been voiced about the consequences of encouraging extended use of desktop computers by young children. ***It is therefore advisable that a typical use of any desktop computer application by a child should be comparatively short, usually no more than 10 to 20 minutes for three year olds, extending to no more than 40 minutes by the age of eight.*** Clearly, if a child or group of children is totally engaged in an activity and the completion of this requires a longer period at the computer this should be allowed, but it would not be desirable to encourage children to do this regularly.

Apart from the very significant difficulties of providing ergonomic, yet communal 'work stations', these concerns relate to the hazards of repetitive strain injury, carpal tunnel damage, effects upon sight, obesity and the possible risks of radiation exposure from monitors. All of these hazards are well documented as they relate to adult computer use, but little research has been conducted to identify the implications for the youngest children at this early stage of their physical development.

So, evidence regarding the degree of risk associated with these hazards remains unclear, but limiting the time children spend at computers will avoid any potential dangers. It is important that, while learning about ICT in their world, children also learn how to manage their own space and select the right tools to use when sitting at a computer. This can be matched to computer use in the world of work. Office workers, for example, are given clear guidance about posture, eye-level, foot rests, arm supports and time to spend on computers. In the same way, children need to become responsible for ensuring that they have a chair of the right height. Cushions can help. Adults of course need to promote this too. They can, for example, ensure that small mice are available for the small hands of children. These can be bought at most reputable computer stores. General health awareness relating to ICT and computer use should form part of children's learning about ICT, and should certainly form part of any setting's health and safety policy.

Where the computer use is integrated with other activities and the computer is used effectively as a tool, for instance in imaginative role play, modelling or painting, children will benefit from greater movement and exercise away from the computer. Use of the computer should not be at the expense of outdoor opportunities and experiences which promote developing essential gross motor skills through running, climbing, jumping, swinging and using wheeled toys. Daily and frequent access to outdoor experiences is essential for all children and their development. Some ICT applications can encourage playing and being outdoors. Metal detectors have already been mentioned. Identifying ICT in the outdoor environment when out walking or using programmable toys outside can help but is no substitute for the running and climbing that practitioners should ensure goes on throughout childhood (though it's always possible for some young children to be taking digital pictures of their friends as they run and climb).

What practitioners can do

Adhering to the principles outlined above, and promoting these with parents, is the responsibility of practitioners – and should be much easier to do than it once was. In the past, early years practitioners have suffered from lack of resources and poor training opportunities in ICT. Recently, there has been a growth in the resources for ICT, though it is

still fragmented and unevenly distributed across providers. Selection and introduction of the kind of ICT applications suggested above demands that practitioners are well-trained and skilled in the appropriate uses of ICT with young children. Staff should therefore seek help and support from their local authorities to develop their skills, and will also need to use appropriate literature and research.

There are simpler ways of introducing ICT to the children in an early years setting. Encourage children to observe and talk about the uses of ICT in their environment. On local walks, for example, practitioners can talk with children about traffic lights, telephones, street lights or the bar-code scanners which identify prices in shops. As emphasised throughout this booklet, the children might play with improvised pretend or real technological artefacts to support their imaginative role play. There are many opportunities in which children can integrate ICT into their play, but to do this they first need to know about ICT in their worlds. Practitioners play an important role in extending children's awareness of ICT and in supporting their exploration of these experiences and their new knowledge within their play. Sometimes this will involve providing resources; it may mean joining in the play as a co-player or observing children at play in order to identify more clearly how they are making sense of ICT in their worlds and their learning needs. ICT is about *much* more than desktop computers.

Involving parents

Research suggests that home–school communication leads to better understanding and more positive attitudes for teachers and parents about each other's roles. Many studies have shown that children achieve more academically when parents, teachers and children all collaborate towards the same goals (Siraj-Blatchford, I. *et al.* 2002). Schools also report that children show a more positive attitude towards learning under these circumstances, and are better behaved.

Parent involvement is therefore a component of effective schools which merits special consideration. When participation is well planned it can promote higher success in pupils and lead to more successful family environments. Communication between professional educators and parents is crucial in the early years and a more articulated set of aims between the home and early years setting can lead to better outcomes for children. But many staff are ill-equipped to know what strategies to adopt to foster better home–school relationships. Research shows that there is currently very little knowledge in settings about the children's ICT experiences at home and that this not an area on which parents are normally asked for information.

In the United States large-scale and longitudinal studies have been conducted by Epstein (1996). According to Epstein, five main types of home–school improvement can be identified:
- parenting skills, child development, and home environment for learning
- communications from school to home
- parents as volunteers in school
- involvement in learning activities at home
- decision making, leadership and governance.

While a great deal is often achieved in terms of points 1 to 3, most early childhood educational settings find points 4 and 5 particularly challenging (Siraj-Blatchford, I. *et al.* 2002).

At Gamesley parental involvement is encouraged through many aspects of children's learning which take into account Epstein's points. They suggest that, to involve parents, they should:

- use digital, still and video pictures on a TV or computer in the classroom or entrance, recording trips, the day's activities, curriculum presentations, and any special events
- use digital pictures in the records
- ask parents to trial new software
- use closed circuit televisions to enable parents to watch children at play and learning
- loan cassette recorders to take home
- make CDs of children singing
- make use of the standing touch screen as an information resource
- develop a website.

Useful websites
The following sites are well worth a browse, to see if they offer the right kind of experiences for the children in your setting. But any programs applied, downloaded or purchased should be evaluated in light of the principles outlined above.

- BBC CBeebies: http://www.bbc.co.uk/cbeebies/
- BBC Games: http://www.bbc.co.uk/cbbc/games/index.shtml
- Berit's Best Sites: http://www.beritsbest.com/
- Enchanted Learning Online: http://www.enchantedlearning.com/categories/preschool.shtml
- Kids @ National Geographic: http://www.nationalgeographic.com/kids/
- Kids Domain: www.kidsdomain.com
- Kid's Wave: http://www.safesurf.com/safesurfing/
- Microsoft Kids Website: http://www.kids.msn.com/
- Peter Rabbit: http://www.peterrabbit.com/
- PBS Kids: http://pbskids.org/
- Thomas the tank Engine: http://www.hitentertainment.com/thomasandfriends/uk/
- Winnie the Pooh: http://www.worldkids.net/pooh/welcome.html
- Yahooligans: The Web Guide For Kids: http://yahooligans.yahoo.com/

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