

## **A Review Paper on Information and Communication Technologies: Means to Enrich the Learning Environment in Early Childhood Years**

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### **Abstract**

Information Communication Technology (ICT) value in Early Childhood Years appears to depend on the tools selected, and when and how they are used. The literature indicates ways that ICT can support children's learning, (such as language development and mathematical thinking), including supporting learning for children from diverse cultural or language backgrounds, or with special learning needs. It is better to be discerning and discriminating users of the ICT available to us, focusing on pedagogical best practice is a way forward. ICT has become an important part of the early childhood years. However, practitioners may experience challenges in integrating ICT successfully and there are challenges that educators, professionals, school authorities, staff and parents must resolve to ensure the fruitful use of ICT in early childhood years.

**KEYWORDS:** Early Childhood Years, Information Communication Technology

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### **Introduction**

The world that our baby's are growing up in is undoubtedly different from the world we experienced as children. We had no email; no world wide web, no mobile telephones and computers were a rarity. It's not unusual now to find computers ten times more powerful than the ones we first knew inside our children's toys! A good understanding of ICT is essential in order for our children to progress in the 21st century. The term ICT covers much more than IT; as well as computers it covers an understanding of ordered information, communication such as broadcast, telecoms and the internet, and input and output devices such as digital cameras, robots and music and video players.

ICT stands for "information and communication technologies". This term is now widely used in educational research, policy, and practice. It replaces the older term, "IT", or information technology, which was most often used in reference to computers and the Internet. In the past, the "information" dimension tended to predominate in the literature, and in people's thinking, about ICT. In recent years, the "communication" dimension of ICT has assumed an equal prominence. The term "ICT" encompasses much more than just computers. ICT can be defined as "anything which allows us to get information, to communicate with each other, or to have an effect on the environment using electronic or digital equipment"<sup>24</sup>. Some authors use the term *learning technologies*, while others simply describe it as *technology*. Children are introduced to ICT in their preschool settings. They might have 'magic boards', play phones, the internet and have access to computers with integrated

learning systems on them. They will be exposed to CD's and DVD's, 'QWERTY' keyboards and drawing tablets.

In early childhood education (ECE), the term ICT could include the following types of hardware and software:

- computers (including desktop, laptop, and handheld computers);
- digital cameras and digital video cameras;
- creativity and communication software and tools;
- the Internet;
- telephones, fax machines, mobile telephones, tape recorders;
- interactive stories, simulated environments, and computer games;
- programmable toys and “control” technologies;
- videoconferencing technologies and closed-circuit television;
- data projectors, electronic whiteboards, and more.

### **Value of ICT in Early Childhood Years**

The early childhood education sector encompasses young children, practitioners and parents or other people connected to the early childhood setting. There are three reasons why ICT matters in early childhood education. The first reason pertains to the pervasive quality of ICT by virtue of which it has an effect on the people (family members, caregivers and early childhood educators) and environments (physical and social) that surround young children’s learning. Second, ICT technologies present novel opportunities to strengthen many aspects of early childhood education practice such as children’s learning and play experiences, practitioners’ professional learning and development and relationships and communication between early childhood centers, parents, and other people. Third, there is global support and interest across the whole education sector for the development and integration of ICT into education policy, curriculum, and practice. Children today live in a communication-rich environment. The models of communication they encounter in their everyday lives include...a whole range of electronic and digital methods of communication<sup>24</sup>. Children’s early literacy and play experiences are shaped increasingly by electronic media<sup>17</sup>. So, in order to empower children and assist them in becoming competent and active participants in their environments, they must be given opportunities to develop “technological literacy”, a new form of literacy, which is increasingly considered to represent an essential curriculum entitlement in any broad and balanced curriculum for the 21<sup>st</sup> century. Today there is a significant amount of support and interest in the education sector for the development and integration of ICT into policy, curriculum, and practice. Some consider that just as it is every child’s right to become literate, he or she should enjoy the right to become a skilful user of ICT. Others believe that children should be given opportunities to experience ICT as a tool with vast possibilities for communication and information retrieval/sharing.

The literature suggests at least three reasons why ICT matters in early childhood education. First, ICT already has an effect on the people and environments that surround young children’s learning. Second, these technologies offer new opportunities to strengthen many aspects of early childhood education practice. Third, there is support and interest across the whole education sector for the development and integration of ICT into education policy, curriculum, and practice. These three themes are explored further below. ICT already affects the people and environments that surround young children’s learning ICT is becoming a ubiquitous component of the physical and social worlds occupied by young children. It is an important part of

the private and work lives of most people, including those who support young children's learning and development, whether as parents, family members, caregivers, or early childhood educators. It is often argued in the literature that children's early childhood education experiences should reflect and connect with their experiences in the wider world. Therefore, ICT matters in early childhood education, because it already has an effect on the people and the environments that surround young children's learning and well-being. There is strong consensus across the literature that it is timely for the role and potential of ICT for the early childhood education sector to be critically examined, to guide future development and decision-making in this area. ICT offers *new opportunities* to strengthen many aspects of early childhood education practice.

The second reason that ICT matters in early childhood education relates to the opportunities and potential that these technologies offer the sector. These include:

- opportunities to support and enhance children's learning and play experiences;
- opportunities to support and strengthen practitioners' professional learning and development; and
- opportunities to support and strengthen relationships and communication between early childhood centres, parents, and other people connected to the early childhood education setting.

Most of the literature about ICT in early childhood education strongly supports the view that technology on its own should never drive the process of ICT development in the sector<sup>7</sup>. Rather, all planning for the introduction and use of ICT by children and adults in early childhood education should be grounded in a clear understanding of the purposes, practices, and social context of early childhood education<sup>20, 21, 22</sup>. At least in the UK, early childhood education may actually be leading the way in developing best practice in the use of ICT to support positive learning experiences for children<sup>2</sup>.

There is support for the development and integration of ICT into education policy, curriculum, and practice across the whole education sector. There is now a strong focus on the development of ICT policy and integration of ICT in curriculum and practice across the whole education sector. ICT and "e-learning" have become important concepts in primary, secondary, and tertiary education. In most countries, policy and curriculum support for the development of ICT in the early childhood education sector have lagged behind that given to the school sector<sup>20, 22, 26</sup>. This situation is beginning to change. Some countries, like Scotland, have recently developed ICT strategies for the early childhood education sector<sup>15</sup>. Researchers, academics, and practitioners in early childhood education have also published books, articles, and guidelines which provide information and guidance about ICT in early childhood, and aim to support early childhood education practitioners to make well-informed decisions and choices about ICT<sup>8, 18, 20, 25</sup>.

### **Developmentally Appropriate Use of ICT in Early Childhood Years**

The term "developmental appropriateness" can be defined in a number of different ways, depending on what views or theories one holds about children's learning and development. Children's development is sometimes construed as a step-wise series of "stages"<sup>17</sup>. In this view, activities or ways of thinking that require a more advanced stage of development than a child has achieved are considered not to be developmentally appropriate<sup>13</sup>.

The use of ICT in the early years has the potential to enhance educational opportunities for young children. If applied in a developmentally appropriate manner, it can encourage purposeful and exploratory play, discussion, creativity, problem solving, risk taking and flexible thinking. Appropriate use of ICT tools depends on not just the skill and knowledge of the early childhood practitioner but also the “developmental appropriateness” of the technologies for the children in question. Developmental appropriateness forms a guiding principle in much of the literature on ICT in early childhood education. Two widely-cited sets of guidelines strongly emphasise developmental appropriateness: the DATEC (developmentally appropriate technology in early childhood) project in the UK<sup>24, 25</sup>; and the American National Association for the Education of Young Children’s position statement on the use of technology with children aged 3 to 8<sup>18</sup>.

Understandings of developmentally appropriate practice take a stronger Vygotskian perspective, encouraging educators to plan experiences that challenge children within their “zone of proximal development” – the area of difference in performance between what a learner can accomplish unassisted and what they could accomplish with the assistance of a more knowledgeable or capable other<sup>6</sup>. Theoretical understandings about children’s development continue to be redefined over time<sup>3, 17</sup>. In other words, Luke suggests that children’s early experiences with ICT and other media will impact on their development, and their experiences of childhood. Therefore, some of our ideas about development and what is developmentally appropriate for children will need to shift accordingly. To illustrate with one example: in the past, using a mouse to control a computer might have been considered incompatible with young children’s developmental abilities. However, children who have experienced using a computer at home might develop skill and expertise in controlling and manipulating the mouse at a younger age than children who have not. “Ecological” studies of young children’s experiences with ICT in early childhood education signal the need to view children’s development within a complex interplay of individual, biological, social, economic, and cultural factors, including attention to children’s experiences in their home and family lives.

DATEC’s eight general principles about what constitutes developmental appropriate use of ICT provide a useful general framework for practitioners. These principles are:

1. Ensure an educational purpose
2. Encourage collaboration
3. Integrate with other aspects of the curriculum: that is, if children are to understand ICT they need to see it used in a meaningful context, and for real purposes. This includes allowing for ICT to feature in children’s play.
4. The child should be in control: that is, the ICT application should not control the child’s interaction through programmed learning or any other behaviourist device.
5. Choose applications that are transparent and intuitive. The “drag and drop” facility on a computer screen is a good example.
6. Avoid applications that contain violence or stereotyping
7. Be aware of health and safety issues
8. Encourage the educational involvement of parents

### **Practitioners support Learning through ICT in Early Childhood Years**

Guided interaction as a means of creating opportunities for learning was at the core of this project. Direct guided interaction takes place in a face-to-face situation involving adults and children and may happen through gesture, touch, language or emotional support. It can include an adult placing their hand over a child's hand on the mouse, demonstrating enjoyment at using a digital camera, directing a child's attention with conversation and questions, or sequencing and breaking down activities. Indirect guided interaction refers to the ways in which practitioners prepare for and think about events in the playroom. It includes activities such as planning, making resources available and recording children's progress with ICT. Practitioners developed ways of actively guiding and extending children's learning through questioning, modelling, praising and acting as a supportive presence. In some cases the facilitating role of the adult was not only to demonstrate, explain or give physical guidance but also to plan a child's return to the activity and to continue monitoring their interactions. Thinking about guided interaction helped practitioners to question the purpose of ICT and to articulate, reflect on and legitimise changes in pedagogy. This prompted changes in the provision of resources, planning, assessment and nursery-wide policy. Practitioners became more innovative, expanding their definition of ICT as well as using existing resources differently, and began to plan for, observe and record children's engagement with ICT in new ways.

### **Types of Learning Promoted with ICT in Early Childhood Years**

Children's learning with ICT goes beyond developing skills such as using a mouse or developing hand-eye coordination. When their encounters with ICT are supported by guided interaction there is potential to promote three main areas of learning. ICT can help to develop children's dispositions to learn by increasing self esteem and confidence, or by supporting independence and persistence in the face of initial difficulties. It also has potential for promoting pleasure in learning by enhancing engagement, motivation and the desire to learn.

Knowledge of the world includes learning in areas such as mathematics, language, and knowledge of living things and places. In addition, exploring the role of ICT in leisure, work and play is an opportunity to recognise the competences and experiences children encounter at home and elsewhere, and to develop their ability to harness ICT for social and cultural purposes, such as communication, self-expression or entertainment. ICT also develops operational skills. This includes understanding the functions of items such as the keyboard and on/off switches as well as the ability to operate them. Using ICT also develops children's concepts of technological interactivity, by showing that taking an action can produce a response.

### **Perceived Benefits of ICT in Early Childhood Years**

Many early childhood educationists describe using ICT in the early years can foster development of communication skills among young children. There are many ways in which ICT can make rich contributions to children's literacy development, in the four interrelated areas of speaking, listening, reading, and writing<sup>28</sup>. For example they have discussed how "talking" word processors support young children's experimentation as they play with language. They highlight that these tools offer possibilities for children to compose and write without needing to have mastered the production of letters by hand. They also suggest using computers and printers to help children make signs, banners, and other props for pretend play, all of which will add interest and basic literacy skills to children's play and decisions involved in making

them will give children opportunities to use language. Moreover, this whole exercise of preparing and displaying printed products will create an atmosphere for children where print has direct relevance to their lives. Technology when used thoughtfully and innovatively can help children express themselves, verbally, visually, and emotionally. ICT provides a variety of ways for children to weave together words, pictures, and sounds, thereby providing a range of ways for children to communicate their ideas, thoughts, and feelings. ICT can support writing for young children as well as reading or pre-reading skills. ICT can hone children's storytelling skills such as even children who are not yet writing could dictate words to go with their pictures, or they could record their voices telling the story, or be videotaped as they tell the story and show the picture.

Some studies have shown that ICT use in the early years do have the potential of fostering development of social skills in young children by providing a forum for collaboration, cooperation, and positive learning experiences between children, or between children and adults. This however requires that the practitioners must be conscious of the kinds of learning interactions they would like to induce in the context of ICT use and adopt suitable teaching methods to support these. Other studies suggest that ICT use facilitates social development also by encouraging communication between children, turn taking and collaborative problem solving. However there are only a few good, recent studies available to substantiate this for pre-school children in particular. Nevertheless, sitting with others using a computer, talking and sometimes enjoying an animation together are positive social experiences for the children. Regarding effects of ICT on learning, children who had experience of computer use made developmental gains in non-verbal skills, structural knowledge, long term memory, manual dexterity, verbal skills, problem solving, abstraction and conceptual skills<sup>11</sup>. Also, some research using case studies have shown that ICT can be used to support aspects of learning including language development and mathematical thinking. The effects of talking books software in UK primary classrooms (focusing on 5- and 6-year-olds) and concluded that electronic books can complement teaching in infant classrooms, having a positive effect on cognitive and affective outcomes<sup>16</sup>.

## **ICT helps enrich the Early Childhood Years**

### ***Personal, Social and Emotional Development***

***Dispositions and Attitudes:*** Almost without exception, children using appropriate ICT are interested, excited and motivated. Unlike some adults, they are unafraid of technology and confident to try out new activities and because they find the work so interesting most children have longer attention spans when using ICT.

***Making relationships:*** Computers are very powerful facilitators of group work. Programs that present challenges stimulate children to discuss and to share. Creative programs that allow children to produce a polished product raise self-esteem. Children are eager to show and tell about their achievements.

### ***Communication, Language and Literacy***

***Communication:*** Role play activities with ICT elements are perfect environments for developing a wide range of communication skills

***Language for communication:*** Talking books on CD, on-screen Big Books, audio, cassettes and interactive websites are all ways in which ICT can be used to present

stories, music and rhymes. Usually these will be used with a teacher or other adult in the 'driving seat' with a group of children listening, watching and responding

**Language for thinking:** Role play may involve use of the telephone and other office equipment. The use of programmable toys can stimulate discussion and cooperative problem solving. For full specifications and operating instructions for Pixie and Pip robots and lots of ideas and supplementary resources for using them in the classroom

**Linking sounds and letters:** Word games including matching, rhyming and first letter recognition are available on websites and as part of CD collections. These allow children to practice skills in a very motivating environment

**Reading:** On-screen Big Books can be used to help focus children's attention on print and to explore a variety of stories. After using any ICT children can be encouraged to tell what happened. See 'Where do Hedgehogs Go?' in the Big Books section of the Classroom Activities

**Writing:** The use of the computer for the writing of labels and captions allows children to achieve a rewarding finished product. Word processors can also be used for 'play' writing in role play. This work also helps to develop simple word processing skills and keyboard familiarity. Clicker is a writing program which can be customised for early writers.

### **Mathematical Development**

**Numbers as labels and counting:** Simple on-screen counters are available which provide a superb stimulus for talking and thinking about numbers.

**Calculating:** Mathematical games and activities are available on websites and as part of CD collections. These allow children to practice skills in a very motivating environment.

**Shape, space and measures:** The use of programmable toys encourages children to think about space and position and make use of appropriate vocabulary for discussing these.

### **Knowledge and Understanding of the World**

**Exploration and Investigation:** The use of digital cameras can heighten children's attention to visual detail. ICT presents lots of opportunities for 'whatiffing' ... exploring and asking - What would happen if I did this?

**Information and Communication Technology:** Role play presents opportunities to find out about everyday uses.

**A sense of place:** Trails in and around the school grounds can be made using tape recorded instructions to direct children's attention to the world around them.

### **Physical Development**

**Health and bodily awareness:** Computer programs are available which can be used in the context of a topic on 'All About Me'.

**Using tools and materials:** The computer keyboard and mouse are tools that require practice for effective use.

### **Creative Development**

**Exploring media and materials:** Many programs allow children to create paint and print.

**Music:** Songs and music are available on-line and on CD. Musical keyboards are popular with young children.

**Responding to experiences, and expressing and communicating ideas:** Tape recorders and video or digital cameras may be used to record children's own music, songs and dance.

### **Health and Safety Issues during Early Years**

The health and safety issues must be an integral component of the early childhood practice and policy and “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”<sup>25</sup>. They recommend that children’s use of computers should occur in relatively short spells, usually no more than 10 to 20 minutes for 3-year-olds, extending to no more than 40 minutes by the age of 8. This can be ensured by paying attention to children’s physical and ergonomic safety; prevention from exposure to inappropriate content (e.g. games or Internet-based material of a violent or sexual nature, or containing undesirable gender or cultural stereotypes) and protection of children’s privacy (e.g. in online environments, or when information is published on the Internet). A cautious approach is necessary and the practitioners and children need to become well informed about safe and appropriate ways to work with computers.

### **Perceived Risks of ICT usage in Early Years**

The increasing pervasiveness of ICT has led some parents, teachers, and children’s advocates to question its relationship to the cognitive, emotional, social, and developmental needs of young children. More often than not, the argument is focused on young children’s use of computers and computer games and questions are raised on two accounts. Special concerns, potential harm and damaging effects of ICT tools on young children are:

- Harmful physical effects of prolonged computer use by children;
- Negative effects on children’s social development (such as promote anti-social behaviour like isolation or aggressive behaviour); and
- Developmental concerns (such as computer use can interfere with children’s cognitive development).
- Exposure to unsuitable content (such as material of a sexual or violent nature, or containing inappropriate gender, cultural, or social stereotypes); and
- Computer use may displace other important learning and play activities.

Some researchers condemn introduction of ICT in the early years on the premise that it is damaging to the development of children in all aspects – physical, cognitive, social, and emotional. Most research on ICT and its impact on young children have focused on the use of computers by them. An argument opposing early introduction of ICT is that as children learn through their bodies, computers are not developmentally appropriate<sup>12</sup>. As a screen-based medium, activities at the computer are not as effective as manipulatives in developing understanding and skills in the early years<sup>30</sup>.

Except for the coordination involved in using a mouse, computers do not support the development of motor activities or motor skills development. He goes on to assert that, although touch typing is a motor skill that can be learned with the help of a computer, it is inappropriate for most children to begin this before they are about 7 or 8<sup>14</sup>. Critical about computer-use in early childhood years, computer proficiency does not mean cognitive development, the latter requiring evidence of the

development of an underlying concept. He points to the difference between knowing how to use the internet and learning something from it<sup>9</sup>. Use of computers is damaging to young children's development as well as their learning. Stating that young children need human support and verbal interaction, she concluded that as computers fail to offer inter-sensory experiences to enhance learning, they are inappropriate as an educational resource for children below the age of about 7 years as using computers before the age of 7 'subtracts from important developmental tasks'<sup>13</sup>. Children in economically developed countries spend so many hours alone in front of the computer that a new non-nuclear family system of parents, children and computer has merged. They refer to the computer as 'intrusion' into the educational system, children's cognition and the family. Yet others believe that computer use might foster learning in a negative sense. For example, solitary game play on computers could lead to children's isolation from social interaction in learning and play, or that violence in computer games could encourage aggressive behaviour<sup>10</sup>.

A common concern expressed by most critics is that ICT might displace other important learning and play activities. In fact, an immediate moratorium on the further introduction of computers in early childhood, except for special cases of students with disabilities<sup>4</sup>. They take the view that children's use of computers should be sidelined in favour of other kinds of learning and play activities. They argue that computer use in early childhood education should be abandoned in favour of the essentials of a healthy childhood. Other concerns surround the health and safety issues of computer use for young children, research-based evidence about which is inadequate. For instance, there is not enough information on whether or not the radiation emitted by wireless ICT technologies could have harmful health effects for adults and children. There are also concerns about the physical effects of prolonged exposure to ICT, such as repetitive strain injuries, addiction and sedentary lifestyles. The information leaflet on keyboard skills in schools states that for children with years of typing ahead of them, using the keyboard with index fingers only is highly risky, especially when there may be added strain from playing games on home computers<sup>1</sup>. Moreover, little is known about the possible addictive nature of the internet and computer games on young children, as available information so far is limited to only older children.

### **Effective ICT Professional Development for Early Childhood Years**

Without good guidance, examples, and support for their own professional learning, staff will make their own decisions about the nature and extent of ICT use in children's learning. These decisions are influenced by such factors as teachers' own level of confidence with ICT, and their beliefs about learning and teaching in the early childhood years. Literature about ICT use in early childhood education settings, and studies of teachers and teachers-in-training learning to use ICT, highlight these key findings about effective professional development for early childhood educators:

- Effective professional development supports teachers to develop understandings of ICT that connect with their existing early childhood education philosophy and pedagogical views.
- Effective ICT professional development incorporates teachers' own aspirations, skills, knowledge, and understanding into the learning context. It provides opportunities for teachers to learn and explore new ways of working in their own early childhood education setting.

- Effective ICT professional development stimulates practitioners to reflect on their views and ideas about children's learning and development, and to analyse and question how things are done in early childhood education.
- Effective professional development emphasises collaborative knowledge-building, and practitioners sharing their situated learning experiences with ICT with one another. It provides support networks to help practitioners to be active researchers in their own early childhood education setting, and to access current research and expertise in ICT.

### **Conclusion**

The debate regarding ICT use in early years remains unresolved as indicated by review of literature of ICT in early childhood years that suggested a "scarcity of good quality research findings on using ICT in educational settings for early childhood years"<sup>26</sup>. In the end, it cannot be stated in absolute terms that early introduction of ICT is beneficial or harmful to young children for 'there are far more questions than there are answers about what computer and video games and internet use mean to the social, intellectual and physical development of children today'<sup>29</sup>. Nevertheless it can be stated safely that, with due safeguards in place and ensuring developmental appropriateness, ICT in early childhood education can effectively support and enhance children's learning and play experiences although all of this does demand that "practitioners are well trained and skilled in the appropriate uses of ICT with young children"<sup>23</sup>.

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