Effective Learning Environments for Young Children Using Digital Resources: An Australian Perspective

TONI DOWNES, LEONIE ARTHUR, AND BRONWYN BEECHER

School of Education and Early Childhood Studies
College of Arts, Education and Social Sciences
University of Western Sydney, Locked Bag 1797
Penrith South DC NSW 1797
t.downes@uws.edu.au

The use of digital resources in early childhood settings in Australia is a recent phenomenon. In 1999 Education.Au, a company funded by the various educational authorities in Australia, commissioned a study of the educational use of the Internet with children eight years and under. Data were collected through a literature review and discussions or interviews with all stakeholders in early childhood education: children, families, early childhood educators, school system representatives, academics, researchers, policy makers and advisers. This paper reports on the major outcome of the commissioned study: a pedagogical framework for the use of digital resources in early childhood settings. The framework includes a rationale and a description of the key elements of effective practice: quality resources, effective learning environments and appropriate teacher interactions.

The use of computers within early childhood educational settings in Australia is a relatively new phenomenon and there is a widespread lack of access to and use of computers and the Internet for educational purposes. The main reasons for the lack of access and use are two-fold: first, educator and community attitudes and beliefs that computer use is neither important nor appropriate in early childhood curriculum; second, the lack of funds and
low priority in most Australian educational settings for children from birth to five years of age means that there are no computers in the setting. Even in settings that provide education for children from three to twelve years of age, the limited computer hardware available is usually directed towards older children. This phenomenon also applies to the recent provision of access to the Internet and its use in programs.

The controversy surrounding the appropriateness of computer use with young children has been ongoing for almost two decades. One of the key arguments has been that young children do not have the fine motor, cognitive, or language and literacy development, to successfully engage in computer experiences. Another is that computers are a symbolic media which do not enable children to manipulate concrete objects and are therefore not developmentally appropriate. Also many early childhood educators do not see how computers can be included in a curriculum focusing on play and creativity. A fourth view questions the appropriateness of the pedagogy of drill and practice software, and the reflection of stereotyping and violence in content. These combine to generate a strong resistance to the use of computers in most early childhood settings in Australia (Dockett, Perry, & Nanlohy, 1999).

The complexity of resource provision and regulatory frameworks for early childhood education for the under fives in Australia also contributes significantly to lack of access to and use of computers in early childhood settings. For example, the provision of educational services for three to five-year-olds varies across states and territories and often involves community (non-profit), private (for profit) and government organisations. Regulatory frameworks are complex, focusing on the safety and welfare of young children rather than programs and resources. Funding mechanisms vary but all create significant problems for early childhood budgets, particularly in settings with small numbers of children.

In contrast, the education of five to eight-year-olds is within the school sector and sector-wide initiatives have combined to generate some expectations and minimum resources for the early years of schooling. Often, however these are implicit rather than explicit, as most explicit strategies are still aimed at older children. For example, where the use of the Internet is included as a requirement in curriculum documents, the requirements generally begin with children aged eight years and older. The NSW Human Society and Its Environment K-6 syllabus, requires teachers of Stage 2 students (ages 8-9 years) to provide students with first-hand experiences of communication networks. Similarly, where a recent government initiative in NSW required school principals to assess their current resources against their student population and curriculum needs, rarely if ever were the chil-
Given these conditions, then it is not surprising that too few children in early childhood settings have access to, or use computers and the Internet in educational settings. While there may be exceptions in particular settings or parts of Australia, there is little evidence that many early childhood educators in Australia are committed to the use of computers for learning or that the children regularly use computers or the Internet in these settings.

Nevertheless, exposure to the digital world is a “fact of life” for an increasing number of young children. A recent national study (Australian Bureau of Statistics, 1998) revealed that 48% of Australian homes where the oldest child is in the age range 0-4 years have computers. This proportion increases to 54% for homes where the oldest child is in the age range 5-9 years, and 71% where the oldest child is in the age range 10-14 years. Significantly, the number of households with Internet access increased fourfold over the period 1996 to 1998, with 1.1 million households now connected to the Internet. One third of these connected households are households with children. Despite the trend of increasing home use, it must be noted that half of the Australian children under 5 years old do not have access to computers in their homes. This situation is directly related to socio-economic status and geographic location. In rural and remote Australian communities access to home computers is significantly lower than in urban communities. The interaction of socio-economic and geographic variables particularly disadvantages indigenous Australian children who might otherwise be using computers as literacy tools.

THE STUDY

In 1999 Education.Au, a company funded by the various educational authorities in Australia to develop online resources and services for the education sectors in Australia, commissioned a study of the educational use of the Internet with children eight years and under. The study involved research and consultation regarding the identification of the key elements of good practice of early childhood educators. Among other things, the study explored the use of the Internet with children under 8 years and the availability of good Internet resources for children under 8 years. Within the study, information and empirical data were collected through:

1. A literature search of Australian and international research, policy and professional literature on the educational use of the Internet with under
A one-day workshop with invited system representatives and early childhood educators to explore theoretical, research, policy, and practical issues associated with young children’s use of the Internet.

3. Telephone discussions with selected early childhood educators to explore curriculum and pedagogical issues facing educators using the Internet with children under eight.

4. Two observation/discussion sessions with young children who regularly use computers/Internet at home and in educational settings to explore children’s own practices and views on appropriate, useful, and enjoyable Internet activities. The groups included three to five-year-olds from a day care centre and five to eight-year-olds children from a school.

5. A focus group of parents whose young children regularly use computers and/or the Internet in their home or communities exploring children’s current uses and parental views on children’s use in home and educational settings.

6. Telephone and/or e-mail discussions with system consultants and educators working in the area of early childhood curriculum and the use of new technologies in each state in Australia. The discussions centred on system-level curriculum issues facing early childhood educators using online resources, curriculum plans for integrating online activities across the curriculum, and requirements for EdNA Online services.

7. A search of the EdNA site and the wider Internet, to identify and evaluate appropriate educational, recreational and popular culture sites relevant and appropriate for young children, in the age groups 0-5, and 5-8 years, to identify trends in the nature and provision of sites.

The one-day workshop, parent focus group, and the two discussion sessions with children were recorded on audiotape and transcribed for analysis. Notes were taken during the individual telephone discussions. The data were then examined to identify issues related to the study’s purpose.

A FRAMEWORK FOR EARLY CHILDHOOD EDUCATION

This article presents the framework developed in the study. It has three inter-related components: (a) a rationale for use, (b) a description of effective learning environments, and (c) a description of appropriate teacher interactions. These components drew heavily on current literature and the
views of those stakeholders within the study who are already using these resources for teaching and learning in early childhood settings. In general the views of the stakeholders were consistent with the literature.

A Rationale for Use

In western cultures, communication and information are increasingly embedded within digital technologies as well as in the traditional print-based technologies. Digital artefacts and tools abound within these cultures. In their home and community, many young children, as well as older children and adults are learning through manipulating digital tools as well as print-based tools. From early on they are interested in and making sense of images and symbols in digital and print media, as well as manipulating language and mathematical symbols in both media (Makin, Holland, Arthur, Beecher, Jones-Diaz, Hayden, & McNaught., 1999).

All young children need to develop the capacity to express themselves and make sense of their world with digital media, artefacts, and tools just as they do with traditional media (paper and sand), artefacts (paintings and constructions), and tools (brushes and spades). Digital resources offer children a range of ways to play, to interact with other children and adults, to explore and represent their environments and solve problems, to be creative and to represent their ideas with symbols, words, sounds, and images.

The renewed understandings of developmentally appropriate practice (Bredekamp & Copple, 1997) which takes a stronger Vygotskian perspective leads early childhood educators to plan experiences that challenge children within what Vygotsky refers to as “their zone of proximal development.” Vygotsky viewed learning as socially constructed, where children learn what is necessary to participate within their society and culture through interactions with cultural tools that are mediated by peers and adults. In the 21st century these cultural tools include digital as well as paper-based communication and information tools, artefacts, and media.

Experiences that challenge children to develop new concepts and processes, especially when scaffolded by an adult or peers, are highly appropriate for young children’s learning whether they be with manipulatives or symbolic media based on print or digital technologies. When the dominant computer software environment was drill and practice, as it often was in the 1980s, it was appropriate for early childhood educators to reject the computer-based environment as an appropriate resource for early childhood curriculum. Today, open-ended and digital resources that promote communication,
interaction, discovery, and problem solving abound. In the study such re-
sources were categorised into four main types:

- **design and make resources**—where children can design, draw, paint,
create, make, build, or construct artefacts such as patterns, pictures,
scenes, written texts, galleries, cards, slide shows, and music;
- **work and play resources**—where children can play, explore, investi-
gate, look things up, solve problems, and do puzzles and other activi-
ties;
- **communicate and share resources**—where children can talk, send mes-
sages, join in a group discussion, and display products of their work
and play;
- **project resources**—where children work collaboratively on agreed
tasks on- and off-line with children in other locations.

Clements (1999) in a review of 20 years of research concerning young
children and digital technologies found that very young children have com-
fort and confidence in using such resources; they have little problem using
keyboards and other devices and they can follow pictorial directions and
use situational and visual cues to understand and think about their activity.
These capabilities, along with those associated with using paper-based re-
sources such as pens, crayons, paper and books, need to be developed
through opportunities to play and learn with the tools and artefacts in a vari-
ety of situations.

**Effective Learning Environments**

Digital media have unique potential as flexible and relevant resources
within early childhood learning environments. A number of issues connect-
ed with the development of high quality environments for the use of digital
media in early childhood educational settings were raised by the informants
in the study. These issues include:

- the pedagogical approaches needed to shape the use of digital resources;
- the learning goals and outcomes to be achieved;
- the embedding of digital resources within effective learning environ-
ments;
- digital media use as a social activity;
- using digital media in child-directed experiences;
using digital resources in ways that create open-ended learning experiences.

Each of these will now be discussed in turn.

**Pedagogical approaches to the use of digital resources.** Educators identified the central importance of continuity between philosophical and pedagogical approaches and digital resources in order to provide appropriate curriculum for young children. As one informant said: “good practice (with digital resources) comes out of a philosophical perspective of how kids work (learn).” These include the recognition that children mature at different ages; have different interests and different learning styles; and that there is a need to create a balance between familiar and new topics and processes for the child as well as a balance between novelty, predictability, and appropriate repetition. For this to occur, the design of the learning environment needs to be progressively layered so that an individual child or group of children can actively investigate further to satisfy their learning focus, strengths, interests and needs in appropriate and challenging ways. In designing learning environments, educators need to actively seek the integration of everyday manipulatives, print and digital resources.

**Learning goals shape the use of digital resources.** In the discussions educators expressed a belief that children’s use of digital technology needs to relate to specific learning goals or to have a particular focus. Current curriculum directions for young children focus on processes such as critical thinking, problem solving and learning to learn. One educator who participated in the study expressed this in terms of it being crucial that children get past the novelty and develop understandings and competence with processes: “Beyond ‘Isn’t this exciting?’ they are also understanding what they are doing.”

Current approaches to early childhood curriculum emphasise significant ideas across rapidly changing details and contexts. Critical understanding of these “big ideas,” which include change, cultural, and social systems, is more important than developing defined sets of knowledge. Digital resources primarily need to be used in the service of these broader curriculum processes and goals while at the same time meeting the needs and interests of the child. In many ways, this helps to shape the way digital resources are used, rather than what they are used for. As one educator said, using digital resources is: “about process and content... the interaction between the two is very important.”
Embedding digital resources within learning environments. Educators participating in this study were unanimous in their emphasis that digital media need to be integrated into the curriculum to be most useful to children. They saw the effective integration of digital resources in the learning environment being reflected in their timely, flexible and varied use within the total learning environment. As dictated by the degrees of engagement shown by the children and the defined curriculum goals, digital resources needed to be judiciously moved around and integrated within the play areas/learning centres of the environment.

Examples of integration include the computer being part of the art area for a couple of weeks, offering tools for drawing and designing as well as providing access to art works related to families for the children to investigate. When moved to become part of dramatic play area, an appropriate Internet site or piece of software with factual information or exploratory environments in relation to skeletons and broken bones can support children’s role playing in the hospital context. This could lead to further investigation through access to various Internet sites, or paper-based texts of what makes healthy bones. When moved to become part of the science area the Internet could provide the communication channels and information for children to participate in a whale watch project, in collaboration with children from other settings.

In some settings the computer and its related resources cannot be easily relocated to the various areas. In these settings it may be possible to bring the “area” to the computer. Changing the displays and props with the changing use of the computer helps shape children’s perceptions. They do not see it as a “computer corner” but rather as part of the “writing area” or “art area.” In these ways digital resources are utilised to extend and elaborate on the program in an integrated way along side other learning experiences and resources. The use is not a focus in itself, and children are not “doing computers.” The educators who participated in this study agreed, saying, for example, “Access (to digital media) is supported by teachers, but it’s not to say go away and use it as an isolated activity...it’s not just isolated from other experiences...having the Internet activities related to the other activities is part of the matrix and that goes to all sides—purposefulness, related use and supported by parents and educators when needed.”

Research suggests that this approach of combining digital and traditional resources within a learning environment is a powerful framework for learning and development. Haugland (1992) found that child’s play and active learning using a wide variety of learning media, artefacts and tools, including digital ones, improves learning and development.
**Using digital resources is a social activity.** Educators saw that the computer provided a major focus for much child interaction and learning prompted by peers and educators. Sometimes the educator provided the modelling, scaffolding, and challenge for further learning, and sometimes it was peers. As one educator noted: “children learn from peers and siblings more than from anyone else. So that modelling, the exposure to anticipation, is, for instance, to draw a friend into what you are doing.” The social interactions that children engage in scaffold and challenge each other’s learnings in literacy. The use of digital media as part of a literacy program also results in the further positioning of literacy as social activity, because children within the room and across the city, country and world can collaborate and communicate with each other (El-Hindi, 1998).

Since young children talk so much about what they are doing, social activity and interaction are important aspects of the collaborative learning that young children engage in when using digital resources. The nature of children’s social interactions is influenced by the characteristics of the digital resources they use for learning. Clements (1999) found that collaboration is encouraged through the use of resources that create open-ended experiences. A number of educators in this study particularly recognised the value of children having access to: “sites, which show how other children have solved problems…focus on what other children are doing.” One educator commented: “When kids ask questions of other kids who created their own pages then they became the resources and a wealth of material is generated.”

**Using digital resources in child-directed experiences.** Educators in this study indicated that digital resources need to support children’s self-directed learning experiences where they need to be able to investigate their own interests. These educators believe “that our role is not to ‘teach’ children, but to be conduits for children, enabling them to explore issues, to further develop ideas.”

When planning child-directed experiences with digital resources, the planning needs to start from careful observation of each child. The resources that young children use and explore need to be relevant to the child. As one educator expressed: “the child makes the decision where to go.” When the digital environment incorporates concepts, processes, attitudes, and values that are relevant, known, and understandable to the child, they are likely to be very interested and intrinsically motivated to respond, listen, read, and investigate further. Relevance to, and appropriateness for, the child often reflect environments or elements within environments that are known to the child and relate to their experiences and interests as well as their family, languages, cultures, and lifestyles.
The power of children’s interest in the use of the Internet was readily recognised by the educators who participated in this study, for example, one educator commented that: “…kids want to find European soccer results through sites on the Internet, it’s a passionate interest.” As Bredekamp and Rosegrant (1992, p.39) state, “considering children’s interests does not mean indulging children or abdicating responsibility,” it does mean harnessing the high levels of responsiveness and engagement shown by the child. Jones, Valdez, Nowakowski, and Rasmussen (1995) include this as one of the characteristics of engaged learners, namely children showing learning energises them. Importantly, one educator cautioned “That is not to say that a particular child (using the Internet) may say from time to time ‘Oh that’s boring’ compared to the faster pace of an electronic game that they’re used to playing, but reading a book or watching TV is different to playing a game and (the goal is) children who can move comfortably between those based on their own dispositions…."

**Digital resources provide open-ended learning experiences.** In this study, educators saw that it was important to provide open-ended learning experiences with digital resources. Children need depth in the resources; that is, many layers of meaning and complexity to explore rather than fixed or narrow resources.

Digital resources for child-directed experiences need to be open-ended, in order to cater for the multiple ways and directions in which young children learn. Young children can repeat and practice similar or same experiences many times as they develop greater understandings, and more refined development, from gross approximations towards more conventional ways of doing things. Young children need to be able to return to experiences again to focus on aspects of interest. The experiences need to be able to offer different responses to the child’s attempts, rather than the same as last time. For this reason, digital resources need to be sufficiently open-ended and challenging to encourage children to return time and time again. An educator reinforced the cyclic and dynamic nature of young children’s learning which is necessary to account for in digital resources: “They are picking up different things all the time, things can be developed in that way, then there’s this freshness but repetition and they’re learning new things all the time and relating the elements.”

The nature of the open-endedness of experiences created by digital resources is complex. The experience needs to respond to the individual child or small group of children utilising the experience. In this situation, individual children are likely to need different experiences, with various kinds and
levels of response and further experiences, as well as being different on other occasions for repeated practice. This feature of appropriate experiences has been identified as “sorting the chaff from the wheat” in relation to particular digital resources (Dublin, Pressman, Barnett, & Woldman, 1994). The experiences need to be able to:

- encourage children to respond in “thoughtful ways,”
- offer responses to children’s answers,
- offer variations that are child-controlled, and
- cater for individual children’s abilities, cognitive development and computer skills as well as the child’s culture, language/s and experiences.

The challenge of providing appropriate digital resources reflecting the complexity of learning was clearly defined by the participants in the current study: “Kids work very well with the exploratory mode”; “Lots of interaction and lots of colour and feedback… should also not be anything too complex (or) you lose the children.”

Another important point arises from the research literature on the power of open-ended learning experiences. Well-designed, open-ended group projects result in better learning for children than when children explore in random ways (Lemerise, 1993). More recently Clements (1999) argued that when designing learning experiences using digital resources educators need to enable children to spend more time looking for ways to collaboratively solve problems whilst working on a specifically designed group project. Once the environment is effectively set up, the educator is then free to observe and to interact with children in appropriate ways as explored in the following section.

**Appropriate Educator Interactions**

The informants in this study identified a number of key elements of effective interactions between educators and young children. Of primary importance was the role of the educator in scaffolding children’s use of digital media, thereby encouraging risk taking and persistence, and asking questions that challenge children’s thinking.

The adult’s role in scaffolding children’s thinking and learning is complex and crucial. Since young children need different types of scaffolding at different times, the educator firstly needs to be a consistent and close observer of children’s actions and interactions (Arthur, Beecher, Dockett, Farmer, & Death, 1996). At times, observations may need to be prolonged
in order to see the learnings with digital resources (Cochran-Smith, Kahn, & Paris, 1988). In addition, the public nature of children’s interactions with screens and keyboards and their prolonged engagement with open-ended experiences enable educators to observe children’s diverse learning and thinking styles and social interactions (Emihovich & Miller, 1988; Wright, 1994).

Appropriate interactions may range from acknowledgment to co-construction to directive interactions with children as explored in the continuum of teaching strategies (Bredekamp & Rosegrant, 1992). The following aspects need to be considered:

**Warmly encourage both risk taking and persistence.** The emotional and social environment implemented by the educator will strongly impact on children’s responses to using digital resources. Children need to feel comfortable and that their efforts with digital resources, as with all experiences, are valued and accepted. They need to feel that it is acceptable to have a go, and to understand that mistakes are part of the learning process. This can be promoted as educators demonstrate, model, and co-construct risk taking with children using digital resources. As one educator explained: “When children see educators have a go, get it wrong and the sky doesn’t fall in, they believe it’s safe for them to take risks as well.” Indeed, educators and parents believed that “kids who have experiences on the Internet…are more confident and take a risk to get something out of it, they are pretty cluey at that age, it’s more than child development, the processes will be more aligned.”

Persistence is an attitude as well as a behaviour. This positive problem solving means attempts to achieve a goal are repeated. This begins with random attempts at the goal, but from evaluation of attempts, trial and error becomes more strategic in reaching the goal. Educators need to model this attitude and behaviour when solving problems using digital resources, as well as when using traditional resources. Representation and celebration of children’s risk taking behaviours and persistence in problem solving through further discussions, questions, photos, drawings, dictated sentences, children’s meetings (Watson, 1997) are important dimensions of the adult’s role in promoting these learnings. It is important that these representations and celebrations are extended to problem solving environments using digital resources as well as traditional resources.

**Ask questions that challenge children’s thinking.** Educators are able to ask a range of questions to promote children’s learning while using digital resources. Young children’s oral language learning and associated cognitive learning is usually reflected in the functions of language (Tough, 1981) that
they utilise. Such functions include self-maintaining, directing, reporting, logical reasoning, predicting, anticipating, projecting, and imagining. Higher order functions such as reasoning, predicting, projecting, and imagining reflect higher order thinking.

The informants felt that using digital resources for challenging children’s thinking was achievable from as young as three years old: “Probably a lot of the older children (3-5 years old onwards) are starting to question a lot more. So with the programs that are on there, they are starting to ask why, what is happening, there is a lot more language associated and they’re interested in refining their research and gaining that extra knowledge.”

Indeed, there was a general recognition amongst educators and parents that, in the case of digital media, the children were the ones with the greater expertise, and their use of such media formed a challenge to adult’s thinking. As one educator suggested;

Student’s Internet projects are good for getting educators involved, activity can take off with kids, but teacher initiated. If kids are at an age to process the project they can take the teacher along with them, instead of the other way round.

Thus, in addition to encouraging and supporting children’s use of digital media, the need for educators to be confident modellers of appropriate use of digital media was also identified as an important component of effective educator interactions.

**FINAL COMMENTS**

Establishing a sound pedagogical framework for the use of digital resources within the early childhood sector in Australia is a necessary part in the overall process of ensuring the effective use of these resources with young children. The commissioned study took the process a step further by identifying the key elements of appropriate use of digital resources and arguing for the development of an appropriate online pathway into those resources. The recommended pathway addressed the issues of integrating curriculum and professional development resources and strategies for early childhood educators. To compliment these strategies any further national agenda must also address the regulatory frameworks and funding in the early childhood sector in Australia which combine to maintain the growing gap in provision of appropriate hardware and network access to this sector of
education in Australia. Only when these issues are addressed will the main barriers to access and effective use in early childhood education be removed.

**References**


**Acknowledgements**

Education.Au, a company funded by the various educational authorities in Australia to develop online resources and services for the education sectors in Australia, commissioned a study of the educational use of the Internet with children eight years and under. A full report of the study has been published: *Online Appropriate EdNA services for children eight years and younger* (1999) and is available at www.edna.edu.au