

Computer-based Learning in a Primary School: Differences between the early and later years of primary schooling

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There have been increasing expectations that all primary school students and teachers actively use information and communications technologies (ICT) in their learning. In order to achieve this it is important that appropriate environments are set up to support the varying needs and potential of the different groups within the school context. However, in case studies of primary schools undertaken as part of the study Enhancing Learning Using New Technologies, also known as the E.effects Project, our research indicated that the ICT learning environments established within schools often favoured the later primary year levels over the early primary school years. This paper will present illustrative evidence of this inequity using data extracted from the E.effects Project case studies. It also discusses observed differences in approaches between early primary school years and later primary programs from the perspective of early childhood philosophies that underpin the first years of school.

Introduction

There is an expectation that young students aged between 5- and 8-years-old are now making substantial use of information and communication technologies (ICT) as a learning tool in the first years of primary school (Learning and Teaching Scotland, 2003; DET, 2001; Sheridan & Pramling Samuelsson, 2003; Siraj-Blatchford & Siraj-Blatchford, 2003). This expectation draws attention not only to the learning that is taking place using ICT but the environments established to facilitate this learning. Recent years have seen a great deal of attention focused on older students and their learning with ICT (O'Hara, 2004; Plowman & Stephen, 2003), however research (Clements, 2002; Downes, 2002; McDonald & Hannafin, 2003) is increasingly indicating that young students are also capable users of ICT in their learning. Furthermore, the use of ICT by young students in the early primary school years has its own unique potential for learning (Bolstard, 2004; Clements, 2002; Goodison, 2002; Kankaanrantra & Kangassalo, 2003; Kilderry, Yelland,

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Lazaridis, & Dragicevic, 2003; Sanger, Wilson, Davis, & Whittaker, 1997) which impacts on the child's immediate school learning as well as potentially their learning into adult life (Learning and Teaching Scotland, 2003).

In the early primary school years, working with ICT enables young students greater opportunity for working with ideas creatively and to engage in higher order thinking (Clements, 2002; McDonald & Hannafin, 2003). The nature of ICT is that ideas are linked together in terms of associations, reflective of natural thought patterns, rather than as linear ideas as is the case in print-based resources. For a young child, therefore, working with ICT allows for a more natural approach to thinking and working with information and knowledge, with less restriction on adaptations to prescribed linear approaches to thinking (Sheridan & Pramling Samuelsson, 2003). ICT enables young students to work with, communicate, and represent these ideas in ways that are less reliant on physical coordination since the mechanistic nature and inherent difficulties of recording with pencil and paper are removed (Goodison, 2002; Kilderry *et al.*, 2003). Moreover, compared with older students, younger students demonstrate higher gains in learning outcomes with ICT and have a more positive attitude to using it in their learning (Volman & van Eck, 2001).

In the early primary school years, therefore, ICT has the potential to liberate young students and allow them to experience, work with, and build on ideas that were previously inaccessible due to their abstract and complex nature (Kilderry *et al.*, 2003). A learning environment supportive of ICT use can help young students make the transition to abstract thinking (Clements, 1999). Learning experiences of this kind at an early age can potentially positively change students' later learning experiences.

Effective use of computers in classrooms can not only impact on learning, but also can shape students' social processes (Clements, 2002; Yelland, 2001). Contrary to previous perceptions (Cordes & Miller, 2000) young students learning in contexts which support ICT use are more socially interactive, and communicate and collaborate more (Clements, 2002; Kankaanrantra & Kangassalo, 2003; Kilderry *et al.*, 2003). ICT promotes a motivating student-centred learning environment for young students, increasing their desire to take part in and experiment in their own learning (Goodison, 2002; Tanock & Segedy, 2004) as well as supporting their peers in their learning (Clements, 2002). The enhanced achievement, increased self-esteem, and positive attitude to school this potentially promotes in young learners can enhance both their current and future learning (Clements, 2000; Yelland, 2001).

Additionally, results of several studies focusing on students' computer game use show that boys and girls use computers in different ways and have different preferences when it comes to using computers (Linderoth, Lantz-Anderson, & Lindstrom, 2002; Facer, Furlong, Furlong, & Sutherland, 2003). These studies suggest that gender patterns of ICT use previously reported may be addressed by introducing computer games to students at an early age. Therefore, an early start with computers might create a new approach towards ICT on both a general and a

gender level, which, over time, will influence traditional and cultural patterns of ICT use (Sanger *et al.*, 1997; Sheridan & Pramling Samuelsson, 2003; Volman & van Eck, 2001).

Furthermore, with increased home use of ICT, young students are now entering school with developed computer skills (Rideout, Vandewater, & Wartella, 2003). Students in the early years of school are often comfortable enough with their own computer skills to be able to focus on the learning content they are working with, rather than the technology (Kilderry *et al.*, 2003; Clements, 2002).

ICT has the potential to enhance the skills, knowledge and learning dispositions of young students, which impacts on both their current and future learning (Learning and Teaching Scotland, 2003). This enhanced potential for learning however is not an automatic result of use. If young students are to gain from the learning possibilities ICT offers, then the environments in which they are using them must support them in their use. Some aspects of the environment which have been identified as contributing to the way a young child uses ICT and therefore the impact it may have on their learning include: the availability and location of computers, content used with ICT and teacher support for ICT-based learning (Turbill, 2001; Sheridan & Pramling Samuelson, 2003). Understanding of the ways ICT environments are being established in the early primary school years is necessary if we are to capitalise on the potential learning benefits of ICT for young students.

The Study

The study *Enhancing Learning Using New Technologies*, otherwise known as the *E.effects* Project was an Australian Research Council Strategic Partnerships with Industry—Research and Training (SPIRT) Scheme between the Faculty of Education, University of Technology, Sydney and the Curriculum Support Directorate, NSW Department of Education and Training. The *E.effects* Project was a longitudinal, qualitative study designed to examine the use of ICT in schools and its impact on learning and teaching. The study specifically investigated how teachers are integrating ICT into the classroom, the impact ICT is having on teachers' pedagogical, curriculum and assessment practices, how ICT is mediating students learning, how different groups of students were being addressed with ICT and the ICT-related resources schools had available to them and how they were located and allocated.

Seven case study schools, which included four high schools and three primary schools, were selected to participate in the study. All seven schools were commonly working within the normal and general context of the New South Wales (NSW) curriculum; they were not "lighthouse" schools or classes working with special conditions, support and opportunities. The seven schools were located across regional and city NSW. Analysis of each case study school included focusing on the particular conjunctions of student and staff demographics, school culture and agendas that comprise each school.

The seven schools cumulatively joined the study and were visited over the three-year period. Two high schools and two primary schools were visited in late 2001. The following year, these four schools were revisited twice and an additional high school was included. Finally, in 2003, the five schools already participating and an additional primary school and high school were visited once.

Over the three year period 287 teacher interviews were conducted and 71 classroom observations were undertaken. Of these 123 interviews and 30 classroom observations took place with the primary schools. In 2004 one of the primary schools was revisited for the purposes of a smaller related study. During this time interviews and classroom observations were conducted with two teachers teaching in the early primary school years as well as an interview with the principal.

This paper draws on all the data collected from the three primary schools from 2001 to 2004. It examines the types of ICT-based learning environments being established in these three primary schools and the impact of these on young students' learning. What is being argued here is that the practices and attitudes, captured by these themes, are not confined solely to ICT-based learning nor to the primary school context, but rather also reflect broader ideologies of the young child as a learner in the primary school.

Comparison of approaches to ICT across the year levels in the primary schools was not an aspect initially to be focused on in the study. However, it became clear relatively early on in the field visits that learning with ICT was being developed more solidly in the later primary years compared with the early school year levels. This paper outlines aspects of the differences, namely in uses of ICT and the value curriculum gives to ICT in the early primary school years.

The Case Studies

The Pastures Public School

The Pastures Public School is a kindergarten to Year 6 (K-6) government school in an "affordable housing estate" in outer suburban Sydney. At the outset of the study the principal, a computer enthusiast, viewed technology as a "learning tool" and his focus was to develop the ICT skills of students, staff and parents. The principal volunteered to trial the Year 6 computer skills assessment (CSA), which is a standardised computer skills exam implemented by the Department of Education (DET) for students in the final year of primary school.

The school had a computer lab that each class visited once a fortnight for a lesson taught by the computer coordinator. This arrangement served the dual purpose of providing computer skills development for the students as well as providing release time for the regular classroom teachers, referred to as "relief from face to face teaching" (RFF). The computer coordinator stated that she modified the lessons for the younger ones, for example they spent time using cardboard cut-outs of keyboards to practice keying. This was one of a number of "non-computer" practice strategies

the computer coordinator had used with the students in the first years of primary school during her years as computer coordinator. There was an expectation by the principal and computer coordinator that students would build on the skills learnt in computer lab in their regular class work. Only two classrooms teachers however, both from upper primary, took explicit action and worked with the computer coordinator in this respect. The kindergarten teacher stated that she was not aware of what her students were doing in the computer lab, but she suspected that with kindergarten it could not be very advanced.

Comparatively more teachers in the early school year levels than teachers in the upper primary years positioned themselves as novices in comparison to the computer coordinator's skill level. While the computer coordinator was available to all staff for informal professional development, the two Year 1 teachers stated they were happy to leave the bulk of computer use to RFF lessons where they were sure the students would get all the computer skills they would need to have by the end of Year 6.

The school was working towards a school-wide ratio of one computer for every four students. The principal stated that new and old computers were distributed where they saw the need. The computer coordinator elaborated stating that all new computers went to the upper primary classrooms and the older computers were reallocated to the younger grades. In the final year of the study, the Year 6 classroom teacher, the new assistant principal, had gathered all "extra" school computers to acquire a total of seven computers for his classroom.

Cabling of classrooms for the school network followed a similar pattern with Years 5 and 6 classrooms being cabled first then, as the principal stated, they were working down to Years 1 and 2 classrooms and finally kindergarten which were cabled three years later. Internet access appeared to be an issue in the younger year levels. The Year 3 teachers stated "I used to have three Internet-ed ones [computers], but they [the principal and computer coordinator] took one of mine and gave it to the infants' class, to get infants on the Internet as well". Infant classes refer to kindergarten, Year 1 and Year 2. In 2003, the kindergarten teacher interviewed stated that while the school had acquired a lot of new computer resources "not a lot had changed for the age group she teaches".

Understandably, given the way cabling of computers was approached at the school, use of Internet over the four years of the study was only observed in some upper primary classrooms and the library. The principal was enthusiastic about upper primary's use of the Internet and hoped for increased use in the middle primary. No Internet use was observed in the early primary school years' classes. The Year 1 teachers did not identify any plans to use the Internet. The Year 2 teacher stated that with the Internet now connected she had plans for how it could be used; she explained, however, that with only one computer connected it was too difficult to do. The principal did not express concern about the lack of Internet connection and use with the younger students nor expressed plans to encourage it. He stated that he was not really expecting any use in the younger year levels.

Classroom observations of computer use in the younger years indicated heavy reliance on drill and practise software, which focused on repetitive practice of basic literacy and mathematical skills. Students generally used the computer once a week as part of reading groups. Use of this software was repetitive, often the same software for a term. A number of Year 2 students commented “the teacher never comes because we never need any help; we’ve played this game lots and lots of times”. A number of teachers were observed using the same software in the same way over the entire period of data collection.

While all classroom teachers agreed it was important for students to develop computer skills for future workforce; they were however divided in their views of how this fitted into school teaching and learning. All upper primary and middle primary teachers were enthusiastic about the place of computers in school, with one Year 4 teacher stating, “Particularly from Year 4—it’s the sensible thing to do”. All but one teacher in the early primary school years’ classes indicated that they were not convinced that the computer developed the necessary literacy and mathematical skills students of this age group needed any more than traditional teaching methods. There was also scepticism among teachers in the younger year levels that over-use of computers interfered with the need for students to play, socialise, and develop their motor skills. Teachers in the younger year levels were sure, however, that students would have all the computer skills they would need by the end of primary school.

In conclusion, the environment for ICT-based learning in this school was found to have several features: (a) resourcing policies that placed the best computers and most Internet access in upper primary classrooms; (b) some use of the Internet in senior primary classes; (c) a reliance on and repetitive use of drill and practice software in early primary school year levels; (d) little use nor expectation of use of Internet in early primary school years; and (e) the majority of teachers and the principal were not convinced of the value of ICT-based learning for early childhood classes.

Sterling Crescent Public School

Sterling Crescent Public School is a K-6 government school located in a satellite city of Sydney. At the outset of the study the principal had recently been seconded from a previous principal position at a primary school celebrated for its high achievement in the use of technology in education.

The principal described his vision for ICT in the school as an “educational vision”. He wanted to improve teaching and learning so that it was more reflective of a constructivist approach. He saw ICT as the catalyst for this change.

All classrooms at Sterling Crescent Public School had two or three computers and all classrooms were cabled for Internet access. In 2002, the school acquired 10 new laptops, which were housed in the library. Old library computers were distributed throughout the school. The principal, however, was not involved in the distribution and stated he was unsure of where they “ended up”. Classroom observations

however indicated that the better quality computers were placed within Years 4, 5 and 6.

As a means of motivating all teachers to use ICT in their teaching, specific software was introduced for use with classroom computers across all year levels. Professional development centred on the use of this software. Midway through the study however Year 5 and Year 6 teachers discussed the lack of value of using some of this software in light of the external pressure created with the introduction of the CSA for other specific computer skills. In the final year of the study the Year 6 teachers happily reported a shift in the school's focus for teaching with ICT. The new focus was for students to spend time learning skills needed for the CSA, such as those needed for using spreadsheets. In the final year of the study the technology goals in the school annual report indicated that students in Years 3–6 would produce at least one multimedia product linked to class work. There were no technology goals stated for kindergarten nor Years 1 and 2.

Students' computer skills were also developed in the context of the library. The librarian expressed concern that students didn't consider computers as an educational tool. When describing a typical kindergarten lesson, the librarian stressed that it was familiarisation with the parts of the computer that the young students needed. She elaborated on this illustrating a typical teaching scenario with kindergarten, "Put your hand on the monitor, put your hand on the keyboard, touch the mouse ...". The teacher stated, "I haven't jumped straight into a program because for young kids unless they know they're touching a mouse there's not much point!"

Uses of computers observed in primary classes included both independent and collaborative Internet searching and word-processing. Only one class from the younger year levels was allocated to us to take part in the study. In 2003, the kindergarten teacher, a recent early childhood teacher graduate specialising in information technology (IT), reported using the new school-wide software that had been introduced twice with her class; outcomes from both lessons were included in her university assignments. The teacher expressed concern that students see the computer as a game machine rather than an educational tool. During the course of data collection, the research team observed this kindergarten teacher using classroom computers for reading groups. The teacher stated that she felt supported by the principal in her use of ICT with the class and students in her classroom used the computer regularly. She stated however that in general not much consideration was given to young students' use of computers. One example of this she stated was the lack of availability of Internet sites suitable for young students.

In conclusion, the environment for ICT-based learning in this school was a found to have several features: (a) resourcing policies resulting in uneven distribution of resources favouring the upper primary years; (b) limited range of uses of ICT across the year levels; (c) repetitive use of ICT in the early year levels; and (d) friction between approaches to ICT-based learning undertaken by the principal, teachers' role, and system expectations of computer use within a primary school.

Wattle Point Public School

Wattle Point Public school is a government K-6 primary school in a rural part of NSW. During the initial visit to the school, the principal stated that his vision was to see all teachers and students working with ICT across all key learning areas. The principal, Year 5 and 6 teachers were largely identified by school staff as the school ICT experts and decision-makers.

In the first visit to the school, the principal stated that he was working towards a school-wide target of four computers for every classroom. In the final visit to the school he declared this target had been reached; Year 5 and 6 classrooms had four computers and Year 3 and 4 will have reached this target with the next DET computer roll-out. The principal then stated that he planned to start working on this target with Year 2, 1 and kindergarten. In addition to quantity, quality of classroom computers varied across the year levels. The Year 1/2 teacher stated, "Kindergarten, Year 1 and Year 2 had been given the oldest computers that Year 5 and 6 teachers refused to have any more". The principal however discussed student access to computers as equal across all year levels.

With the exception of the Year 5 and 6 teachers, the principal labelled the ICT expertise of teachers within the school as the 'lowest common denominator'. He stated "the majority (of teachers) were unable to turn on a computer a little while ago". All staff had completed TILT, a basic computer skills workshop run by DET. As a further strategy to develop staff ICT expertise, the principal initiated digital portfolios into the school. In 2002 Year 5 and 6 were using digital portfolios and in 2003 Year 3 and 4. The principal stated Year 1 and 2 was the next focus. There was no mention of kindergarten.

The most recent initiative for staff professional development had been the opportunity to participate in a series of workshops run by the computer company Intel. While the workshops were open to all teachers, only teachers from Years 3, 4, 5 and 6 participated. The teacher nominated as the school liaison person for these workshops stated teachers from the early primary school years within the school "just didn't want to be involved".

The two teachers from the early primary school years' classes participating in the study questioned the value of computers for learning. One teacher stated she was "a bit 'iffy' about using computers with little kids". In an interview with the principal discussing teachers' enthusiasm and commitment to computer-based learning the principal stated he was happy with what was happening in Year 5 and 6 but was concerned that Year 3 and 4 were not as engaged in using the computers for student learning as he would like. The principal asked if the research team could discreetly have a word to these teachers regarding this. The principal described the Year 1 and 2 teachers as dabbling with the computers, but he was not concerned with this. He made no mention of kindergarten.

The Year 1/2 teacher reported that she did not have enough computers for her class, nor did she like students playing games on the computer. As a means of addressing this dual concern, she used the computer on behalf of her students to

create worksheets, which she then printed off and photocopied for the students. Only those students in the most advanced reading group were given the opportunity to use the computers in their learning. Occasionally, the teacher gave these students an Internet address and one question to answer which was to be drawn from the information on the site. The students located the web site, found the answer and wrote it in on their worksheet. The teacher stated that she saw some really exciting ways of using the Internet, PowerPoint and digital photos in the Year 5 and 6 classrooms but she was unsure of “how to get it to a level where the littlies could actually start using it”. She also stated that she would like to use the digital camera with her class however they were difficult to access as they were housed in the Year 5 and 6 classrooms.

In conclusion the environment for ICT-based learning in this school was characterised by: (a) resourcing policies that favoured the upper year levels in terms of quality and quantity of computers and peripherals; (b) lack of teacher expertise on effective integration of computer-based learning in the early primary school years; (c) lack of principal commitment and expectation for computer-based learning in the early primary school years; (d) decision-making for ICT in the school over-represented by teachers in upper primary; and (e) early primary school years teachers negative views on the appropriateness of computer-based learning for young students.

Discussion

The three case studies illuminate some aspects of environments for ICT-based learning that have been established in primary schools. They indicate a number of emerging patterns that suggest ICT-based learning is being approached differently in the early primary school years compared with the later primary years. These differences are evident in the opportunities provided for students to learn with ICT and the curriculum commitment to ICT in the early primary years. The discussion is organised around these two themes.

Limited Opportunities for Young Students to use ICT in the Primary School

In all schools the later primary classes were prioritised over classes in the early primary school years in terms of opportunities for use of ICT-based resources. This was evidenced in a number of ways. Compared to the later primary classes, all early primary school years’ classrooms in all case study schools had comparatively fewer computers that were often of poorer quality and “hand-me-downs” from the later primary classes. This consequently resulted in comparatively less opportunity for younger students to use computers and the Internet in their learning than the older students. While this issue has been observed and discussed in the context of limited ICT-based resources available for primary schools (Downes, Arthur, & Beecher, 2001; Swaminathan & Yelland, 2003), these case studies suggest that this phenomenon still applies even in schools with ample computer-based resources.

Furthermore, teachers of classes in the early primary school years placed additional limitations on the time their young students could spend using ICT in their learning. These additional restrictions served two rationales. In part they were the teachers' solution to the issue of limited ICT resources, such as in the case of the kindergarten teacher from Wattle Point Primary School using the classroom computers on behalf of her students. A second rationale for limiting the opportunities of students in the early primary school years for using ICT in their learning was linked to a lack of knowledge and understanding, on the part of teachers of this age group, of the learning capabilities and needs of young students and how to use ICT to support their learning.

Limitations on the time students could spend using ICT in their learning was evidenced in the explicit, linear teacher centred instruction used with young students for ICT skills learning. The computer teacher at Sterling Crescent Public School saw it as a necessity that students in the early years of primary school spend large amounts of time pointing to parts of the computer and remembering them by rote if they were to be able to use the computer correctly. The computer teacher at The Pastures Public School consistently used cardboard cut-outs of a keyboard for students to learn to key on rather than using the computer keyboard itself. These strategies were not observed with any students in the later primary years. It may be suggested these strategies be attributed to too few computers for students be able to manipulate the keyboard themselves. However, these lessons were taking place in a computer lab where each student worked on their own computer. Furthermore, each of the computer teachers had highly developed ICT skills herself and had been in the position for a number of years. Using ICT in such highly structured ways is at odds with the student-centred environments that best enable the potential learning gains that ICT may be able to facilitate.

Furthermore, the strategies described above used by the computer teachers at Sterling Crescent Public School and The Pastures Public School indicate the teachers decision to engage children ICT activities that didn't allow them to actively use computers, even though they were working in computer labs. This suggests a lack of expectation of students in the early primary school years to be able to use a computer independently, purposefully and "without wrecking it". This is at odds with research in ICT in early childhood, which firmly promotes the competence of young students to take charge of their learning with ICT. For the kindergarten teacher at Wattle Point Primary School who chose to allow only the academic elite in the class to use the classroom computers suggests that a particular level of academic ability is seen as the benchmark for children to be able to use a computer productively.

Restrictions were also placed on the content young students could work with when using a computer. In each case study, students in the early primary school years only used classroom computers during reading lessons where groups took turns using the computers. Furthermore, there was an over-reliance on the same type of drill and practise software during this time. In comparison, the later primary years' classes

were observed using the computers across different key learning areas in more varied ways and for more varied purposes. For the kindergarten teacher at Sterling Crescent Public School this issue was fuelled by lack of resources suitable for this age group. The kindergarten teacher at Wattle Point Public School didn't see computer games as educational. She expressed the desire to use the computer with her class in other ways such as she had seen in the later primary classes, but was unsure how to simplify this for the "littlies". As a solution she used the computer herself on her students' behalf to make worksheets. She occasionally allowed only the advanced readers in the class to use the classroom computers and for these students their own use was a comprehension type activity. Compartmentalising of learning which can take place using the computer works against the possibilities ICT offers young children to work with ideas in creative and non-linear ways.

A consistent theme in the research literature on teachers' use of ICT is lack of professional development and understanding of the pedagogy of using ICT (Webb & Cox, 2004). In a direct comparison of teachers in the early primary school years and later primary years this issue appears to be more profound for those teachers teaching in the early primary school years. What the above examples indicate is not only are many teachers in the early primary school years limited in their understanding of how to use ICT in the teaching and learning context, but of the unique needs and capabilities of young students and how the two can be merged together. Professional development available to these teachers was of a technical nature or a generic professional development broadly addressing teachers using ICT in schools. The one early childhood trained teacher with technological expertise was on the other hand frustrated by the lack of computer-based resources available to meet the specific learning needs of young students in the early years of primary school, for example Internet sites with suitable language for beginning readers.

The three case studies indicate that students in the early primary school years have fewer opportunities for using ICT in their learning. Furthermore, limitations in opportunity for use may be linked to a lack of understanding by teachers of these year levels of how ICT can be used to support and enhance the learning of students in the early years of primary school.

Fuel to the Fire: Curriculum, ICT and the early years of primary school

Overall, the attitudes and practices of many case study teachers and principals convey a lack of commitment to ICT-based learning in the early primary school. Some early primary school years teacher expressed issues reflective of longstanding criticisms of ICT during in early childhood (Cordes & Miller, 2000; Healy, 1998) regarding the negative impact of ICT use on a young students' development. Other early primary school years teachers' judgements regarding the value of ICT this time were however based on how effectively and efficiently they thought ICT would enable students to develop the necessary literacy and mathematical skills students of this age group needed, compared with more traditional methods. Two principals not

concerned by the minimal or in some cases, no use of computers or Internet by the early school year classes within their schools, but they communicated these sentiments in a tone suggesting that this was a generally accepted and expected state of affairs.

Recent academic literature suggests that the longstanding polarised debate about whether young students should use ICT in their learning is over (Clements, 2003). The research literature has firmly established that ICT supports and enhances early years learning (Kilderry *et al.*, 2003; Lewin, 2000; Yost, 2003). These case studies indicate that in practice this debate is not resolved. What is suggested is that the playing down of ICT-based learning in the early years of primary school remains intact because it is being fuelled by current curriculum requirements.

At present the Board of Studies (BOS), which is the curriculum authority in NSW, does not explicitly require young students to use ICT-based resources in their learning. Explicit curriculum requirements are still largely aimed at older students. For example, where the use of the Internet is included as a requirement in curriculum documents, the requirements generally begin with students aged 8-years-old and older. In fact only two of the six NSW syllabuses propose computer use, albeit as an add-on rather than as a catalyst for new thinking and learning, with students in the early primary school years. It is understandable that ICT is therefore questioned by teachers as to when, how, and whether they are the most effective means for learning and achieving during this time (Cook, 2003).

Furthermore, at present there is intensive policy commitment to literacy and numeracy development in the early primary school years. For example, this is the driving force behind the class size reduction program recently implemented by DET to reduce the class sizes of kindergarten, Year 1 and Year 2 across all NSW government schools. In line with global educational trends, assessment procedures in place for tracking student literacy and numeracy development rely heavily on achieving high scores in standardised tests targeting the “basics” (Learning and Teaching Scotland, 2003; Swaminathan & Yelland, 2003). The pressure on teachers to prepare students for major standardised tests does not encourage trying out new or alternate strategies for teaching—teachers do not have time—nor do they want to take the risk. In response, there is pressure on teachers and schools for more explicit teaching; to focus on “old forms” rather than new (Cook, 2003; Kilderry *et al.*, 2003) so that young students may achieve high scores.

Moreover, decisions regarding how ICT resources are distributed and used in a primary school reflect local decisions. There are currently no guidelines or policies for either a school’s use of discretionary funds, or distribution of computers accessed via the DET computer roll-out. Therefore, when reflecting on the principal at Red Hills decision to place computers where he saw the need, it may be suggested that if his vision was to address curriculum requirements for developing computer skills and he placed value on the process and outcome of the CSA, that ensuring Year 6 students had maximum computer access to allow for intensive preparation for this final exam was understandably a top priority. The same may be said for the principal

at Sterling Crescent Public School who shifted the teaching/learning focus of ICT in the school to address the needs of the CSA.

These three cases studies indicate differing curriculum priorities for the various stage levels and a lack of policy guidelines on student opportunity for computer-based learning in the early years of primary school. While a spread of ICT throughout the school is seen as important by principals it appears that equity is not viewed as equitable distribution but rather as the most efficient way of using ICT to address “whole-school” curriculum priorities.

Conclusion

The three case studies of ICT-based learning environments in NSW government primary schools suggest that ICT-based learning environments are being established differently in the early primary school years compared with the later primary years. With particular reference to three case studies, several aspects of the differing practices and attitudes have been described. These included (a) restrictions in terms of computer-based resources, time available for computer use and type of use; and (b) current curriculum which works against valuing of ICT in the early years of primary school.

These themes illustrate a number of practices and attitudes that have resulted in inequitable environments for learning. In comparison with students in the later primary years, the case studies indicate that students in the early primary school years have reduced potential for the benefits of learning with ICT in the school environment.

In this paper the argument has been made that factors both internal and external to the school are a vital aspect contributing to this inequity. These factors include: deficit and uninformed attitudes to young students as learners, insufficient system guidance and support for the use of ICT in the early primary school years, and a lack of government and system curriculum priorities for both the younger year levels and the older primary years.

To address these issues, this paper makes three recommendations. Firstly it is recommended that guidelines be implemented that consider equitable distribution of ICT through all year levels of the primary school. Guidelines of this kind would emphasise the belief and commitment to computer-based learning as a priority for students of all stages of learning. Secondly it is recommended that professional development, which focuses on using ICT to support students in the early years of primary school, be made available to teachers of these year levels. Ideally professional development of this kind would further develop teachers' understanding that young students are capable users of ICT and further develop their skills for supporting young students in using ICT in their learning. Finally it is recommended that further study focus on early childhood education in the context of the primary school and how this is distinct from early childhood education in the before school years. Greater depth of understanding can then be applied to the specific needs of

ICT-based learning environments in the early primary school years. Through the research described in this paper, stakeholders in school ICT-based learning environments may reflect on the various aspects which contribute to inequitable practice in this area and possible other factors to consider in their own decision-making.

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