

IF ONLY: CHANGING CLASSROOM LEARNING TEACHING WITH ICT

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Abstract

This paper aims to clarify certain causes of the apparent reluctance of some classroom teachers to assist students to learn through the use computers. The main emphasis will be on primary school teaching, but it will be argued that the same, or similar, issues affect teachers at secondary and tertiary levels. It should be noted that the focus is on planned learning with the assistance of computers rather than on whether teachers and students do or do not use computers in the classrooms.

Teacher communications, both formal and informal, together with classroom research reports indicate the existence of underlying concerns about promoting student learning with ICT. This paper proposes that the reluctance of some teachers to make ICT an integral part of their classroom teaching practices is related to factors over which they have limited control. This reluctance occurs even though teachers tend to use various forms of social networking as part of their non-classroom lifestyle in a technologically ubiquitous environment. Over the past decade the author has participated in several small-scale research projects conducted in Australian schools. Each project has been a mini-case study and data has been collected through video-recording lessons and interviewing teachers.

Introduction

The idea of using ICT, at least in some part of the teaching and learning process, is now commonplace in most schools. However few practitioners fully exploit the possibilities for learning and teaching offered by technology (Becta, 2007). Initial teacher education courses in most countries tend to focus on the content of school curricula and the cognitive, physical and emotional development of the pre-adolescent and adolescent students. Today, in the second decade of the 21st century, teachers are expected to possess a variety skills, techniques, and knowledge that will enable them to apply a range learning technologies in their school classrooms. Although it is some four decades since teachers began using computers in schools, neither practitioners nor researchers fully understand the links that exist and develop between learners, their teacher, and whatever learning technologies they use.

After some four decades of using ICT in schools we might expect that pre-service teacher education students would have had many and varied experiences with ICT during their schooling. However the quality and extent of those experiences differ greatly and consequently there are some new teacher education students who have had few opportunities to use ICT for learning. Several issues arise from including mandatory computer-related subjects in pre-service teacher education courses, and of profession development for practicing teachers. Of particular importance are the feelings, beliefs and perceptions of new and experienced teachers about their ability to perform a range of computing tasks that might be considered not normal classroom practice.

Throughout the world there are linguistic and cultural differences relating to the terminology used for educational applications of technology. In this paper the term “information and communications technology” and its acronym ICT are used as umbrella terms for any of the digital technologies used to assist with teaching or learning in schools. In various parts of the world ICT might be replaced by any one of IT, informatics, computing, learning technology, online learning or in recent times computational thinking.

Background

Over the past half century schools in both developed and developing countries have been acquiring increasing numbers of computers for student use. A recent study of information and communications literacy in Australian schools (De Bortoli et al., 2014) reported that the ratio of students per school computer in Australia was 3, while the ICILS average was 18. This would suggest that teacher and student access to computers is good in Australian schools.

At the same time the nature and style of educational software has changed dramatically. The first wave of educational software was characterised by text-based drill and practice programs that have been replaced by investigative or exploratory programs that often make extensive use of multimedia. As tablet computers become more common, especially in primary schools, it is interesting to note that many of the apps (tablet applications or programs) are very instructive and regulatory in nature and do not allow learners to have control of what, how and how quickly they learn. It was reported in an Australian national study of student ICT literacy that “there has been a decrease in the performance of students at both Year 6 and Year 10” (ACARA, 2015, p.117). This result for 2014 was different to the increases in ICT literacy recorded by both year levels in the earlier assessment cycles of 2005, 2008 and 20011.

One consequence of developments in hardware and software is that teacher education programs have had to undergo significant changes in their approach to educational computing. More than a decade ago it was common to read that surveys of teachers identified the major restrictions to classroom ICT use as a lack of teacher confidence in ICT use, and a perceived lack of access to quality resources such as hardware, software, and professional training. Similar barriers to classroom use of ICT by teachers continue to be reported in studies from a variety of educational systems, including Yildirim (2007), Drent and Meelissen (2008), Binglimas (2009), Morris (2011) and OECD (2015). Venezky and Davis (2002) conducted a project for the OECD that involved 94 case studies from 23 countries. They found that “successful implementation of ICT depends mostly upon staff competence in the integration of ICT into instruction and learning” (p.11), and noted that while it is rare for technology by itself to act as a catalyst for school change, technology can be a potent lever for planned change implementation. Discussing the internet and education they state that a “quality issue relates to the pedagogy employed in educational sites on the WWW” (p.33), and note that teachers who are neither aware nor competent with pedagogical strategies appropriate for using technology to enhance teaching and learning are unable to make effective use of what is available on the internet.

Several more recent large scale national and international studies have investigated computer access both at and outside school, uses and perceptions of use of computers for teaching and learning, and ICT related knowledge and skills. While the majority of these studies have focused on learners, they have also reported on school and teacher use of technologies. A suggestion from several studies is that teacher education has not been able to keep up with the pace and scope of technological change in schools and society. One of these studies OECD (2015) includes the comment “For the first time, today’s parents and teachers have little, if any, experience with the tools that children are going to use every day in their adult lives” (p. 185). The report also argues that “difficulties in locating high-quality digital learning resources from among a plethora of poor-quality ones, a lack of clarity on the learning goals, and insufficient pedagogical preparation for blending technology meaningfully into lessons and curricula, create a wedge between expectations and reality” (OECD, 2015, p.190).

In many countries there is ongoing debate concerning the place of the use of digital technologies in schools. The OECD (2015) research investigated how students are being prepared for life in a technologically enhanced world. In relation to student reading, writing and mathematics it was argued that students need to be proficient both with and without technology, and noted that “greatest benefits

accrue to those who have the ability to design digital solutions, adapting or creating machine algorithms to fit one's needs. These capacities build on advanced reasoning and problem-solving skills and require good mastery of symbolic and formal language" (p.187).

Programming (coding) is another issue that is the subject of debate. In their report update into computer programming/coding in 21 countries Balanskat and Engelhardt (2015) noted that: digital computing for students was listed as a priority in 19 of the 21 participating countries; that while coding was listed as a priority in 10 countries, in many others it was integrated with other ICT skills throughout the curriculum; and 10 countries integrated coding at primary level as well as at secondary. Moves to integrate computer programming into the school curriculum raises many issues for teachers, particularly primary teachers and secondary teachers of non-ICT subjects. "The picture as regards supporting teachers in teaching coding is diverse: official training as part of initial or in-service training exists but to various extents and is often coupled with offers from industry – but is this sufficient?" (Balanskat & Engelhardt, 2015, p.15).

The new Australian curriculum includes possibilities for types of programming from mid-primary level. For example, the following is in the Digital Technologies Processes and Production Skills description for Years 3 and 4: "Implement simple digital solutions as visual programs with algorithms involving branching (decisions) and user input" ACARA (2015b).

Recent reports arising from large-scale national (ACARA, 2015a; De Bortoli et al., 2014) and international (OECD, 2015) research projects clearly indicate that there are issues relating to both student and teacher use of ICT in education. Two of these issues relate to number of computers available to students in school and at home, and the number of times students are given able to access computers at school.

Table 1

Country	Ratio of students per school computer	Percentage of students using computers at least once each week at:		
		School	Home	other place
Australia	3	81	87	9
Rep. of Korea	20	18	71	30
Thailand	14	66	59	31
ICILS average	18	54	87	13

Year 8 comparative computer use (De Bortoli et al., 2014, pp 69, 117).

Australian data collected in 2011 indicated that 90% of Grade 6 students used computers one or more times each week at home compared with 85% at school. This is in line data from the 2013 ICILS study (De Bortoli et al., 2014) where the figures for Year 8 Australian students were 87% at home and 81% at school. As an international comparison, the figures for the Republic of Korea were 71% at home and 18% at school, and for Thailand 59% at home and 66% at school.

One of the difficult challenges facing teachers and school administrators is overcoming the following dilemma: "In schools as well as in other organisations, technology often increases the efficiency of already-efficient processes, but it may also make inefficient processes even more so" (OECD, 2015, p.190). In simple terms the question becomes, 'How can teachers utilise some of the opportunities offered by modern technologies to improve both their teaching and student learning?' While there is no single or straightforward answer to this question, there are things teachers can do in their use of technology that will benefit both teacher and learner.

A survey of Australian teachers in 2010 found that the average age of primary teachers was 42.1 years and secondary teachers 44.5 years (McKenzie, et al., 2011, p.24). This appears to imply that few current Australian teachers experienced learning with computers when they were students, and so they lack personal experiences to draw on when they teach with technology. This is very different to a range of subjects they would have studied for up to thirteen years at school. For many teachers teaching with technology is conceptually different to teaching in any other mode or subject area.

The national and international reports referred to in this paper make it clear that while Australian governments and parents have spent substantial amounts of money on providing access to digital technology available for use in schools by teachers and learners, there appear to be no measurable improvements in teaching or learning. There are several ways to approach and interpret these findings. One superficial and political approach that will not be pursued here is to take the findings as reported in the popular press at face value, and blame previous governments and administrations for wasting precious resources.

Case studies

In similar, but different, contexts to the two case studies presented in this paper, the author has investigated classroom use of ICT through video-recording and analysing lessons (Jones, 2010). This style of research has been implemented with primary and secondary school classes, and with experienced and beginning teachers. In both case studies data was collected in several ways, including classroom video-recording, observations by the researcher, and interviews with teachers. Although on a much smaller scale, this type of research fits in with the overall approaches and interests of the International Centre for Classroom Research (ICCR) based within the Graduate School of Education at the University of Melbourne.

Between 2010 and 2015 the author participated in two research projects in which data on teacher use of ICT was collected. In one project teachers were encouraged to use Web 2.0 applications to connect with students from their class who were in hospital for extended periods but wished to continue their education. In the second project teachers in a suburban primary school were observed and interviewed about their perceptions of online and paper-based testing that their students were taking. A different aspect of the teacher perceptions was investigated a year later when the same teachers were asked about their beliefs and attitudes to assessing multimedia stories generated by their students.

Academic staff members of a university that promotes research are both expected and able to conduct research in local schools. Some aspects of these projects are of relevance to this paper. One research project was based at a hospital for young people up to 16 years of age. Consequently the participating students between them covered the whole spectrum of primary and secondary schooling. The second project was undertaken at a government primary school located in a suburb on the northern fringes of Melbourne. From the perspective of the teachers involved there was a significant difference between the two projects. Teachers in the Hospital school project voluntarily agreed to participate and had the option of dropping out of the study, while those in the Primary school project participated following a recommendation from the school administrators that was agreed to at a staff meeting.

Case study 1: Hospital school

Commencing toward the end of 2007, Link 'n Learn was an Australian Research Council funded project based at the Education Institute of the Royal Children's Hospital (RCH) in Melbourne. The hospital caters for young people up to the age of sixteen years, and Link 'n Learn investigated how applications of digital technology could be used to connect hospitalised students with their teachers, schools and peers. The Education Institute is part of the RCH and has developed from a traditional hospital school. It has an interest in research, and was a partner in Link 'n Learn with Melbourne University's Graduate School of Education.

Link 'n Learn worked with students, both primary and secondary, who missed extended periods of school because of an illness. As soon as the medical staff agreed, members of the Education Institute staff contacted the young patients and discussed options for continuing their education while in hospital and at home recuperating. Many of the young people who wanted to use digital technology to establish ongoing contact with their schools agreed to become part of Link 'n Learn.

While these students were willing to explore how to learn in an online environment, there was a much lower level of acceptance and use by teachers. Interviews conducted with teachers indicated that often they were reluctant because they felt they possessed neither the technical nor the pedagogical skills needed to translate face-to-face classroom teaching into one-on-one online teaching.

One of the most significant findings from Link 'n Learn was the almost unanimous desire of young people forced to miss school because of a chronic illness to continue their education. The resilience shown by these young people in overcoming uncertainty and pain as they struggled to study was largely unexpected by the researchers, the medical staff, or parents. Link 'n Learn took this finding and attempted to utilise and build on it in order to the young people hospitalised with a chronic illness to continue their education at some level. Digital communications technology such as video conferencing was used to connect hospitalised young people to schools, teachers, and peers. This led to instances of intermittent visual contact between young people and some of their peers as well as pseudo attendance at lessons where the hospitalized student was not seen by the teacher or the class.

An unexpected teaching/learning problem confronts many teachers when one of their students is diagnosed with a chronic illness and consequently misses an extended period of schooling. Although in their private lives most teachers use digital technologies for social networking and other internet-related activities, they do not appear able to adapt the affordances of these online technologies to make teaching and learning more engaging and effective for themselves and their students. The use of terms such as digital native (Prensky, 2001) to describe young adults, including new teachers, is inaccurate because they are not dependent on technology, especially in the work and study that constitute the major activity in their life. For new teachers a normal day would consist of at least eight hours at school, then time spent travelling, eating, sleeping, and finally socialising personally or electronically if there is any time left.

Blended learning

The Link 'n Learn research project has been outlined in the previous section of this paper. Kev was one of the student participants in Link 'n Learn, and while his story has been reported elsewhere (Jones, 2011), it is a good example of how teachers and schools can overcome issues when they make the welfare of the student their prime focus. Kev spent Wednesdays at the RCH having treatment for a chronic illness, forcing him to miss two English classes. His English teacher, Tina, was not only part-time at Kev's school, but she had never used ICT in her teaching. With some very directed assistance from both the school and the Education Institute Tina eventually overcame her technology concerns.

At the start of a school term, Kev began connecting to Tina and the English classes using a Web-based video conferencing application. Kev's laptop was on loan from the Education Institute who also provided access to the Web-based software and a radio microphone for Tina. Teachers in government schools are provided with a laptop computer. Initially, Tina tried using the camera and microphone built into the laptop, but this was unsuccessful because if she moved around the room Kev could not see or hear her. When this was discussed at a meeting with the school Welfare Officer, the school head of ICT and a representative of the Education Institute, it was decided to acquire a radio microphone and to time-table an assistant teacher with Tina for the two Wednesday English lessons. The assistant teacher was trained to move the camera to follow Tina, and also to respond to any questions or comments Kev made via the messaging section of the software.

For the final two terms of the school year this system continued to be an effective means of

communication and teaching in an online environment. It resulted in Kev satisfactorily passing the subject and being able to continue his schooling the following year. All of this was only possible because the teachers concerned sought and found solutions to issues relating to teaching and learning in an online environment, how to enable an absent student to be both a member of the class and special case, and how to adapt to new technology that they had not used before.

Case study 2: Online and multimedia assessment

Online and paper-based assessment in mathematics

As noted in an earlier section, Australian students, teachers and education systems have a very high level of access to digital technologies. However surveys of technology use in primary school classrooms reveal that students spend very little learning time using this technology. Taking place in a medium sized government primary school, this research project aimed to investigate the perceived and actual differences of students between paper-based and computer-based testing.

The initial research plan was that students in grades 4 and 6 would sit for two mathematics tests, one paper-based and the other online. Both tests were versions of the Progressive Achievement Test in Mathematics (PATMaths) and were developed by the Australian Council for Educational Research (ACER) and were claimed to be normatively equivalent. Almost all assessment of Australian school students is paper based. However there are computer-based or online tests available to teachers. The participants in this study had used some forms of online testing available to government schools. In addition to the results from the ACER tests, data was collected through informal focus group discussions with students and unstructured interviews with the class teachers of the students.

A number of surprising and disturbing results arose when student results for the two tests were compared. Perhaps of most significance were the poor perceptions and beliefs expressed by both students and teachers toward the relevance in meaningfulness of online testing. These perceptions could be summarised as the existence of a dichotomy – paper-based tests were real and important while online tests were like a game and were therefore not important. Student results from the two modes of testing were disparate. In addition only the results from the paper-based test bore any correlation to results from the national testing (NAPLAN) that the students had previously undertaken.

Students were video-recorded while undertaking the online tests and two surprising observations came from the analysis of this data. First, very few students made any attempt to use the paper and pen provided for calculating or sketching, unlike what was observed when the tests were paper based. The second surprise related to the behaviour of teachers when they supervised an online test. Even though each teacher turned the video camera on when their students were ready to start the online test, there is evidence of teachers allowing students to talk, to look at another student's screen, or even for the teacher to provide assistance to a student.

The discrepancy between student results and teacher reactions to the two forms of testing caused the researchers to obtain permission from ACER to re-administer the online test, but in a paper-based format. This occurred several weeks after the original testing. The student results from this final test correlated closely with their results from both the original PATMaths paper-based test and the previous year's NAPLAN Mathematics test.

In summary, both the teachers and the students in the online assessment research project had some ICT knowledge and skills. Additionally all were used to the requirements of formal testing and assessment, and respectively regularly supervise or undertake computer-based and paper-based forms of assessment. However the research data demonstrated that both teachers and students behaved in unusual and unacceptable ways during online testing. Data collected from the interviews and discussions following the online testing clearly indicated that both teachers and students perceived a significant difference between paper-based and computer-based assessment. There was general agreement that paper-based assessments were “serious” and required a specific set of behaviours.

However computer-based assessments appeared different, and students in all six classes involved in the project perceived this mode as being similar to playing a computer game.

Assessing a new form of student work

At this primary school the participating teachers were either in their forties or were younger. They had government supplied laptop computers, and taught in classrooms with up to six desktop computers for student use, and all were expected to plan and teach at least one lesson each week in a school computer room. While the teachers might not have been technology wizards, all had attended several ICT professional development courses and were believed (by the school leadership team) to be capable of conducting lessons that involved using ICT to assist student learning. The school was located in a low socio economic area that had a large migrant population. In addition, almost all families work very hard trying to pay off a house mortgage and settle into an acceptable lifestyle. Not surprisingly very few students in the research project had a personal computer at home, although in excess of 80% reported that they had shared access to a home computer. As noted above, all students at the school were expected to use computers in their classroom and in the school computer room.

A year after the mathematics testing project described above, a group of students who had not been in the project because they were in Grade 3, were introduced to a multimedia software package that was new to everyone and were asked to create a multimedia story focusing on mathematics. Most produced an explanation of a mathematical fact with some examples. However several produced a story that involved mathematics, such as sharing a pizza as a fraction activity, or starting off with a given number of objects such as pets or toys and then selling/donating/losing various numbers of them.

Examples of the multimedia stories were presented at a staff meeting, and teachers were asked to discuss how they might be assessed. A majority of teachers said they would not set such a task as they had no idea how to mark and report on multimedia artefacts. This did not change even after the class teacher showed the assessment approaches he used. Even more confusion occurred when it was asked if multimedia artefacts could be assessed for more than one subject, such as mathematics, technology and English.

Discussion

Three issues that both experienced and beginning teachers have reported as being root causes of problems with using and integrating ICT into teaching are:

- These teachers did not learn with ICT when they were school students.
- Pre-service teacher courses focus on techniques for teaching whole classes in face-to-face mode, and never on teaching individuals online.
- Educational hardware and software available is continually changing.

When busy classroom teachers were asked to take on the additional burden of using digital communications technology to teach in an online mode for a student who was absent for an extended period, the second of these issues caused many problems. Other teachers, who had never taken an online test as a student or a teacher, were observed demonstrating very different approaches when they supervised students undertaking online and paper-based assessment tasks. These and other examples are discussed in the following sections, and implications for both teachers and students are explored.

Issue One: No experience as a learner with technology

Although computers have been used in classrooms and other educational settings for more than four decades, data collected from teacher interviews in the two projects referred here indicates that many current classroom teaching have little if any personal experience of learning with ICT. Even teachers currently in initial teacher education courses report that while they used computers in their secondary schooling, they have difficulty categorising any of it as being educational.

This lack of personal experience in learning with ICT appears to be partly a consequence of a lack of computers in the secondary classrooms of five years or more in the past. All teachers interviewed remember their school having a computer lab or room, but also recollect that typically they were timetabled into it on a weekly or fortnightly basis. They have few memories about what they did with computers apart from playing games.

Prior to the general introduction of wireless networks and laptops or netbooks into schools, it was difficult for teachers to create lessons that enabled every student to learn with the assistance of digital technologies when it is most appropriate.

Issue Two: Teachers are trained to teach classes in face-to-face mode

Initial teacher education courses focus on teaching a class or group of students, as this is the most common occurrence in schools. Little or no attention is given preparing new teachers to teach in one-on-one context, with or without technology. Beginning teachers might be introduced to the idea of have several groups within a class, but not of working with an individual learner.

Similarly, because of traditional school practice, new teachers are not taught how to teach in online environments. Many providers of initial teacher education offer some form of online learning, but it does not seem to be related in any way to teaching online. The focus is completely on face-to-face teaching and learning.

Issue Three: Technology is constantly changing

While this is inevitable and has become a fact of life in the twenty-first century, new technology can confuse users. The development of Web 2.0, and more recently of Web 3.0, has resulted in teachers having again to rethink and re-adjust their pedagogy and classroom practice. Currently many education systems work on a three-year changeover for teacher and student computers. While educational hardware might remain more or less constant for three years, this is not the case for educational software.

It appears that not all education systems are able to provide appropriate ongoing teacher development in ICT that keeps teachers abreast of current developments. One possible solution is to control the introduction of new hardware and software into a school system, however this is not acceptable to parents, students, and many teachers.

Even though many teachers use a variety of social media as part of their daily personal life, this use does not automatically translate into classroom protocols and practices. For example, using software such as Skype to communicate with family and friends does not necessarily assist teachers to teach online using video conferencing hardware and software.

Conclusion

Although participants in the studies reported on here were located in Australia, it is likely that similar results could come almost any developed country. Computer access and use at home and at secondary school would vary across and within countries, but such differences are not crucial to the focus of this report. The students who were surveyed in this study had a high level of access to computers and the Internet, however they were uncertain how to translate their personal ICT knowledge and skills into something that would be applicable and useful in elementary school classrooms.

Findings from the two research projects discussed in this paper show several shortcomings in teacher education, both pre-service as well as in professional development for practicing teachers. In these projects the majority of teachers had not experienced learning with ICT when they were students, and as teachers they struggled to determine how best to teach with the technology and assess the work

produced by students.

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