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Digital technology in- and out-of-school : a comparative study of the nature and levels of student use and engagement

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executive summary

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Abstract

Today information technologies are everywhere. Digital technologies are seen globally as essential to a country's economic success. A major consequence of the advent of the technological age is that young people today live in a 'techno culture'. Some argue, however, that since education moves slowly, the adoption of technology in schools has not been at the same progressive rate as in the wider community. They go further and hold that there is a difference between the technology experience of young people in school and in their everyday lives.

The focus of the study, of which this provides a brief summary, is specifically on comparing students' experiences of digital technology use in- and out-of-school within Australia, and on exploring whether the nature of these experiences act as significant predictors of students' school engagement.

Three questions were addressed in the study: (i) How does students' use of digital technology in school compare to students' use of digital technology out-of-school? (ii) What are the associations between selected factors and student use of digital technology in- and out-of-school? and (iii) Do the levels of students' technology use in- and out-of-school correlate with levels of student engagement?

The final outcome of this study has been to present the implications for future research, policy and practice which will help educators to better align students' in- and out-of-school experiences, and thus to capitalize on students' motivation and interest in using digital technologies.

Executive Summary

Introduction

Technology now plays a significant role in many aspects of our lives. The following points go some way to illustrate this:

- Digital technologies are everywhere.
- Technological change underlies the remarkable increase in living standards experienced by developed economies over the past 100 years (Carlwa & Lipsey, 2006).
- Information and communication technologies' (ICTs) are now seen globally as essential to a country's economic success.

Australia is no exception when it comes to these trends. The Australian government sees developing a world-class Australian communication's and information technology sector as essential in providing a better future for Australia (The Department of Communications Information Technology and the Arts, 2006).

Australia is also interesting in another regard. In the last 100 years, there has been a global shift from dependence on infrastructure and trade in commodities, to international exchanges of knowledge. Going against this trend, Australia remains primarily a major exporter of agricultural products, minerals, metals, and fossil fuels. Thus, unless Australia develops the capacity to produce and export technological products it is likely to keep losing ground to the countries that do.

A major consequence of the advent of the technological age is that young people today live in a 'techno culture'. In this regard they have been distinguished as a unique cohort through the use of such terms as the 'net generation', 'the Millenials' (Oblinger, 2003, p. 38) and Digital Natives (Prensky, 2001). Glen Boreham, Chief Executive Officer of IBM, has even gone so far as to describe young people's instinctive use of technology as driving the development and application of technologies (Boreham, 2007).

As technological innovation has interacted with social transformation, this, in turn, has led to calls for a variety of social institutions to respond to associated change. Technology in schools is not immune from this call (Lei, Conway, & Chao, 2008) and education has not escaped the plea for change. On this, there exists a debate in education about what are the basic skills which students require for the 21st Century (Morgan, 2007; Sandford, 2008). There are more traditional curriculum approaches with a 'back to basics' style, and then there are the competency-based curricula where the emphasis is on developing mental abilities rather than specific subject content. Other developments include the call of those who embrace curricula for self-actualisation and social reconstruction and that of those who claim that much more attention should be given to digital technology to realise their aims. The outcome is a myriad of models reflective not only of the various curriculum frameworks in discrete form, but also in various combinations.

Regardless of which curriculum approaches are adopted, however, the importance of digital technologies tends not to be overlooked. Alongside the pressure which technology has exerted to transform educational curricula have been movements aimed at making greater use of digital technology in the pedagogic process. At the same time, in recognising the impact of digital technology on curriculum and pedagogy, it is important to have an understanding of what students are currently doing with digital technology so that current practice can be taken into consideration in policy, curriculum and pedagogical planning.

Understanding students' current digital technology practices opens up a large

research agenda in the area of digital technology use. The focus of this study was specifically on comparing students' experiences of digital technology use in- and out-of-school. The specific questions addressed were as follows:

1. How do students' use of digital technology in-school compare to students' use of digital technology out-of-school?
2. What are the associations between selected factors and student use of digital technology in- and out-of-school?
3. Is there an association between the levels of students' technology use in- and out-of-school and levels of student engagement?

Methodology

This study relied predominantly on quantitative research methods. This approach was chosen because it was most suitable given the research questions posed. For each of the three research questions descriptive statistics were reported. Then, in responding further to the questions, survey instruments (Robson, 1993) which lent themselves to the collection of the required data were utilised. Item Response Theory (IRT) was chosen to inform the method of test design and data analysis for the study. IRT was also used to analyse survey data to establish reliability, validity and existence of different underlying constructs. The focus was on modelling individual item responses.

Construct modelling was used as the framework for developing the survey instruments used. These instruments, which were developed in the form of questionnaires, were applied to students between the age of 11-18 years, their parents, teachers and the school they attended. The data were then analysed using a Rasch measurement model. In order to look at the associations RUMM was used to obtain the Individual Person Fit Statistics for each subtest. Bivariate correlations were calculated to measure the relationship, association, between variables for specific types of characteristics across patterns of activities.

Overview of the Findings

The findings of this study support the findings of previous research in America and the United Kingdom (Downes, 1999b; Hayward, Alty, Pearson, & Martin, 2002; Kent & Facer, 2004; Kerawalla & Crook, 2002; Lenhart, Simon, & Graziano, 2001; Livingstone & Bober, 2005; Livingstone & Bovill, 2001; Prensky, 2001; Somekh et al., 2002). Students are experienced and prolific users of a wide range of hardware and software. The findings also clearly indicate that there is a difference in students' use of digital technologies in-and out-of-school. However, even though student access to, and use of, hardware and software, may be higher out-of-school, students are gaining access to, and using, a diverse range of technologies in both environments.

> "Students are experienced and prolific users of a wide range of hardware and software."

Students have access to a wide range of technologies at home, in school and in friends' houses, with 96% of them being able to gain access to the Internet at home. Schools play a key role in providing a small number of students, who would otherwise have not had it, with access. The role schools play in this regard in overcoming the digital divide could shape teachers' attitudes to technology in the classroom.

Teachers desire to be inclusive and ensure that all students have a range of skills could mean that the needs of a minority of unconnected students is having a far reaching impact on the majority of students.

Students are less likely to have their Internet-use filtered, or monitored, at home, and as schools have banned the use of a number of hardware devices, students clearly have greater access to a wider range of software and hardware out-of-school.

Across many of the software items included in the study, operational skill level has been high for students. The more students use a software item the higher their level of operational skill. However, the study also indicated that the operational skills required for many software activities are fairly basic and even with infrequent use the operational skills will be developed.

"The more students use a software item the higher their level of operational skill."

The software activities in which students participate most frequently, and the ones in which they display the highest level of operational skill, are the ones they use outside of any formal learning activities. This does indicate a major mismatch between in- and out-of-school activities. Yet, schools appear to be ignoring students' almost universal access to mobile devices and their rapidly increasing functionality. Also, students' participation in digital technology-related activities is clearly influenced by the availability of resources.

Students indicate reasonable cultural skill levels (appropriate ICT for specific needs and contexts) with digital technology, whereas their critical skill levels (discriminating use and understanding the value of ICT) arguably, lag behind somewhat. The study found that there was a slightly stronger association between students' in-school use of hardware and software, than out-of-school use and students' cultural and critical skill with technology. This could indicate the importance of instituting a formal learning environment for developing cultural and critical skills. However, students in the study demonstrated that, despite regular use and high levels of operational skill, students' lower levels, of critical skills could be exposing them to negative experiences on the Internet.

Wegeriff (2002) affirmed that the knowledge economy requires transferable thinking skills and the ability to learn new things to keep pace with accelerating technological change. Students' use of digital technology both in- and out-of-school, but predominantly their activities outside of any formal learning environment, show that they have the desired transferable skills and abilities. Therefore, it is likely that the activities that students participate in outside of formal learning environments hold the most relevance for developing skills for the knowledge economy.

Many of the parents of the students in the study were frequent users of a wide range of technologies and engaged in a wide range of activities. The parents were found to be experienced and competent users of technology. Also, parents' views on technology were generally positive and they saw it as important in both their own and their children's lives. However, computer games were viewed negatively. On the other hand, both students and their parents clearly saw digital technologies as contributing to a fulfilling lifestyle for students.

When selected student background factors were considered, it was identified that for female students frequency of use of technology has a stronger association with developing operational skill level than it has for male students. When selected parental background factors were considered it was identified that parental skill level has a

strong association with students' skill levels and their use of technology.

When selected parental and students' background factors were disaggregated it was possible to indentify further associations. For younger students, the association between a) their use of hardware and software in- and out-of-school and b) parental skill, was very high. Although the study was not designed to identify causal relationships, it does seem plausible that parental influence is greater on younger students. This is because for younger students a number of very strong associations were identified that indicate an important relationship between parents' experience, skills and views with technology, and their children's experiences, skills and views with technology. In this regard, there is also a body of research that has shown factors that affect the digital divide go much deeper than physical access (Facer, 2002; Krause, 2007; Warschauer, 2003). This study has shown parental skill level to be one of those factors.

The descriptive statistics for schools' background factors, indicated a positive approach to pedagogy, professional development, leadership and technology development in all of the schools participating in the study. There were two areas of concern, firstly in the very low rating of teachers' capability with digital technology and, secondly, in teachers' limited access to professional development in the use of ICT. Both of these factors can inhibit the use of ICT in teaching and learning.

> high users of technology outside of school were more likely to be engaged and to participate in school.

It was determined that there was an association between students' technology use and their levels of engagement. Teachers observed higher levels of engagement in students when they were using technology in school. Interestingly, teachers also observed that when students were high users of technology outside of school they were more likely to be engaged and to participate in school. The findings of the study also indicated that students' positive experiences with digital technologies at home enabled them to become more engaged in the school learning context. Furthermore, teachers reported that those students with good technology skills, whether operational skills, or cultural and critical skills, were more likely to be engaged in, and be participating in, school.

Finally, although the findings for Research Question One demonstrated a mismatch between students' in- and out-of-school experiences, teachers did not view this as impacting on students' levels of engagement and participation in school. Rather, it was considered that students who use technology outside of school have more occasions to engage in learning opportunities that have a positive impact on levels of engagement and participation in school.

Limitations of the Study

Because of difficulties gaining access to the sample population, it was recognised when the study was planned that some level of convenience sampling would be necessary. Although every effort was made to gain access to students from schools selected as part of the stratified random sample, the study inevitably relied upon willing volunteers. The outcome was a balance between achieving large scale data collection and a stratified random sample.

The student participants were from eleven different schools, with an equitable divide between male and female students, but only a small number of students were of

Aboriginal and Torres Strait Islander background, or from an ethnic or cultural minority. The students' ages were spread across Years Seven-to-Twelve, but the vast majority of students were in Years Nine and Ten. Both the students and parents who completed the survey instruments for the study provided a sample representative of the total population. The aim was to provide generality and the sample population involved in the study fulfilled the systemic criteria selected.

The students were drawn from only eleven schools. However, they provided representation for government and non-government schools, primary and secondary schools, a range of socio-economic levels, and students with special educational needs. Nevertheless, the eleven schools involved in the study fulfilled the systemic criteria selected.

Contribution

Not withstanding the limitations, this study has contributed to the body of research examining students' digital technology use. It has made a particular contribution for the Australian context and supports the body of evidence that shows that Australian students' are prolific and skilled users of digital technologies (Downes, 1996, 1997, 1999a, 1999b; Kennedy, Krause, Judd, Churchward, & Gray, 2006; Snyder, Wise, North, & Bulfin, 2008). Along with *Being Digital* (Snyder et al., 2008), this has been one of the first large scale studies of digital technology use by secondary school students in Australia. Also, Australian students' practices with digital technology have been shown to be comparable to students' practices as portrayed in research conducted in the UK and America. Overall, the study provides an Australian reference point and context for future reports and investigations into student use of digital technology in Australia. It is particularly useful in that it has examined students' skills when broken down into operational, cultural and critical skills, with a range of digital technologies.

As technology changes so do the parameters under which any study can be conducted. This study has investigated a wide range of digital technologies and has been able to incorporate the most recent advances and availability of technologies.

Implications of the Study

The findings from the study have implications in two areas. These two areas are a) theory, (indicating areas for future research) and b) policy and practice.

As already discussed, the study has added to, and extended, the existing body of research examining students' use of digital technologies. It has also highlighted the importance of the role of the school in overcoming the digital divide for a small minority of students in terms of providing access to technology. Further research in this area would help to establish if schools are playing the same role in bridging not only the digital divide, but also the knowledge divide (Cobo, 2009), in terms of developing e-competence.

It is also noteworthy that students were found to be high users of technology outside-of-school for entertainment, communication and productive purposes. What was most surprising for the present author was the level of use for productive purposes. Further research is now needed to investigate what students are producing outside of school.

The study also found that students have a high level of operational skills with a wide range of technologies. Again, further investigation of how students gain these skills and what motivates them to do so could be useful. On this, Hoffman and Vance (2005) found that students learn what

they want to know and generally learn this informally. Their results are similar to the findings of this study, which demonstrated that the software activities students' participate in most frequently and the ones in which they display the highest level of operational skill are also the ones they are using outside of any formal learning activities. Building on what we know about the students' learning in informal learning environments with friends, it would be interesting to consider further how effective this collaborative learning could be in a formal environment for acquiring ICT skills or for learning other skills.

Within the study it was also found that students' use of wordprocessing and presentation software was higher in-school than out-of-school. In terms of preparing students for the workforce, both of these items of software could provide students with useful skills. Further research could identify how current school strengths in both impact on students in their future learning.

A relationship between students' and parents' skills and experience was also indentified. The importance of the family in overcoming both the digital divide and knowledge divide has long been recognised (Hart, Bober, & Pine, 2008; Snyder et al., 2008). Further research to determine if parental skills and experience are the causal factor in developing student skills would be of interest. As discussed, students have stronger operational skill levels than is the case regarding their critical skills. This could indicate an area where parents also have a gap in their knowledge and maybe do not have the skills to impart what they have to their children. On this, it is particularly noteworthy that parents were overwhelmingly negative towards the use of computer games in education. Thus, further investigation into parents' attitudes towards games in schooling would be of interest.

This study has also raised a number of implications for both policy and practice for ICT in education in Australia. Most students have access to a wide range of hardware and software which has enabled them to develop a wide range of skills. They are learning to use technology from a wide range of sources and, it would seem, in a constructivist manner. Where schools are not providing formal instruction, students are seeking out the support and resources they need. There is an opportunity for schools to build on this in terms of utilising these skills and harnessing not only the motivation students have found to learn, but also their ability to learn.

The fact that students are so skilled with technology is of great relevance to Australia's human capital agenda and the desire to create a technologically-skilled workforce for the growing knowledge economy now and into the future. However, the learning that is taking place as students use technology for communication and entertainment purposes is perhaps not normally associated with the acquisition of skills. Nevertheless, the learning at home, although perhaps different to that which takes place at school, does highlight areas of consideration for schools in the future.

Some, argue that the use of computer games and their relationship to learning has value to the knowledge economy and may be of more relevance than some of the more traditional skills upon which schools focus (Facer, 2003; Gee, 2003; Heppell, 2006; Sandford & Williamson, 2005). Students have been shown to be skilled and prolific users of computer games, especially those who use them most frequently. This points to an area for policy makers and schools to consider, particularly in relation to how students' motivation and skills can be utilised.

This research also indicated that while students' operational and cultural skill levels, which tend to be developed informally, are high, their critical skill levels lag behind. The discriminatory use of technology and the understanding of the value of ICT are areas in which schools could play a key role by way of promoting development. On this, policy makers should take account of Crook and Harrison's (2008) observation that teachers need to be involved in the learning process and not "overestimate learners' familiarity and skills in this area" (p. 3). This study, having found that the development of critical skills is the weakest skills area amongst students, suggests that it is also an area where formal education could play an important role and work on establishing associated practices which will offer relevance to students.

Again, the research indicated that students' Internet access at home was higher than in school, with a wired router being the most widely used method of connection. On the other hand, use of a wireless connection in school was higher. Again this contrasts with the notion that students have access to the most up-to-date technology at home (Comber et al., 2002; Harrison et al., 2002; Kerawalla & Crook, 2002). It also indicates that schools are able to provide unique learning experiences to students, opening up a whole raft of mobile learning opportunities. There may be the possibility to exploit these opportunities in schools without waiting for the home to 'catch up'.

"schools are able to provide unique learning experiences to students."

The study further indicated that students have a very high daily usage of communication items and this usage tends to be out-of-school. Many of the communication activities, accessed through mobile devices, are also the ones banned from use in school, or banned from use in lesson time. The use of this technology for entertainment purposes, being highest out-of-school, is perhaps to be expected. However, the fact that the use of technology for productive purposes out-of-school is higher than in-school does indicate that schools are perhaps not utilising students' skills, or motivation, in using technology for productive and communication purposes. Yet, both can contribute greatly to the learning process.

Participation by students in the use of blogs and wikis both in- and out-of-school is also generally lower than the use of other software activities. As with website design, this demonstrates a missed opportunity for students to engage in the creation of content for an authentic audience. Furthermore, what use there is, is out-of-school. This is suggestive of students' using their own initiative in taking advantage of the opportunities that blogs and wikis offer for communication with a wide audience.

Although most students studied have access to a wide range of hardware and software, there is a small number, some five percent, for whom school is bridging the divide. This serves to highlight the argument that while the important role schools play in overcoming the digital divide in terms of access is already recognised in policy, it needs to be extended to ensure schools play a role helping students overcome the knowledge divide (Cobo, 2009), especially in terms of developing e-competence. On this, schools must find a balance in their policy between recognising and utilising the access most students have to digital technologies, while offering equal opportunity to those students lacking in access and all that is associated with this situation.

"there are a small number of students, for whom school is bridging the divide."

As has already been pointed out, parental skill level is a key area in influencing students' skill levels and their use of technology. From a policy perspective, this could have implications for guiding the direction of resources used in developing students' ICT skills in terms of promoting a partnership with parents. On this, there is a body of research that has shown that factors that affect the digital divide go much deeper than physical access to technology (Facer, 2002; Krause, 2007; Warschauer, 2003). Thus attempts to overcome the digital divide will need to focus clearly on the role of parents.

> "parental skill level is a key area in influencing students' skill levels"

It also emerged from the study that teachers' capabilities and professional development in the use of ICT are areas for concern. Both of these factors can greatly inhibit the use of ICT in the classroom. Thus, there is a clear indication for policy on teacher education to focus on teacher capabilities with ICT.

At a broader level, the implications from the literature which has been reviewed are that children's lives are so immersed in technology that education needs to be transformed if it is to meet their needs and provide familiar and comfortable practices for them when it comes to learning, playing and living. Transformation is required if schools are to provide and support children with a wide range of access to technologies, to learning opportunities and to teachers confident and sufficiently skilled enough to cultivate development.

To conclude, it is hoped that the study has identified areas for future research and will inform the policy and practice with regard to the use of ICT in education by assisting educators to better align students' in- and out-of-school experiences, and thus to capitalise on students' motivation and interest in using digital technologies.

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