Examining the use of ICT

in mathematics and science teaching

Australian science and mathematics teachers are leaders in the use of ICT in school education according to an international comparative study, and ACER is set to lead further research in this area. **John Ainley** explains.

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Information and communication technologies have changed the environment in which students develop and impacted on the way they learn in schools. The importance of information and communication technology (ICT) in education is acknowledged in the policy documents of many countries. Here in Australia the Commonwealth Government's Digital Education Revolution is providing significant support for improving ICT provision in schools through the delivery of computer equipment, enhanced internet connectivity, digital curriculum resources and teacher development in ICT.

We have known for some time that Australian students are among the world's leading users of ICT both at school and at home. Several international studies including the Organisation for Economic Cooperation and Development (OECD) Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) show us that Australian students are already among the most computer savvy in the world. For example, an analysis of 2003 PISA data found that access to computers in Australia was among the highest in the OECD with 94 per cent of Australian students reporting that they have access to a computer at home for school work compared to the OECD average of 79 per cent. All (100 per cent) reported having access to a computer at school. Australian students were the highest users of computers for word processing and among the most frequent users of the internet.

While these studies have told us a lot about how students around the world gain access to and use ICT, less has been known about the international

differences in the outcomes of students' computer use or the extent to which ICT is used in teaching. ACER is leading research in both of these areas.

ACER is the international study centre for an international comparison study of the outcomes of students' computer use. The International Computer and Information Literacy Study (ICILS), conducted by the International Association for the Evaluation of Educational Achievement (IEA), will use computer-based assessment instruments and include surveys of students, teachers and schools as well as an online national contexts survey. About 20 countries plan to take part in the study, and work is underway to prepare for a field trial in 2012.

Meanwhile, ACER has released a report on the extent to which ICT is used in teaching. The recently released study has revealed that Australian teachers are leaders in the use of ICT in the teaching of science and mathematics at Year 8.

The IEA Second International Technology in Education Studies (SITES) is an international comparative research program studying the use of ICT in education. Its central focus is on understanding how ICT affects the way teaching and learning takes place in schools. The SITES project was conducted internationally in 22 countries during 2006 and then implemented in Australia as a comparison study in 2007. The resulting Australian report, prepared by ACER, was released in December 2010.

In Australia an online survey was administered to a nationally representative sample of Year 8 mathematics and science teachers.

Information was also provided by school principals and ICT coordinators.

Overall, SITES showed that Australia is well placed to take advantage of the benefits of using ICT in education. Among OECD countries Australia recorded the second highest level of computer use at school, after the United Kingdom.

Teachers' use of ICT

SITES also showed Australian science teachers to be leaders in the use of ICT. A significantly greater percentage of Australian Year 8 science teachers used ICT in teaching than in all other participating countries. Australian mathematics teachers were also among the leading users of ICT. Australia was also a moderately high user of other ICT resources such as smart boards but is relatively low in

terms of providing email facilities for students and data logging technologies for use in science classes.

Information from SITES suggests that while Australia is already a leader in the use of ICT in teaching, there is more to be done in extending professional development for teachers. Given Australian teachers' relatively high ICT competence, this should not be at the level of introductory courses.

SITES tells us that Australian teachers of science and mathematics have relatively high levels of confidence in their capacity to use ICT. Where ICT is not used in teaching it is not generally due to a lack of confidence or knowledge on the part of teachers. In all SITES participating countries the most common obstacle cited to using ICT in teaching was 'the time necessary to develop and implement the activities'. Within Australia, more than 60 per cent of mathematics and science teachers saw lack of time as an obstacle to using ICT in teaching. In contrast, less than 40 per cent of teachers saw a lack of digital learning resources in their

school as an obstacle to using ICT in their teaching.

Despite their confidence in being able to use ICT competently, fewer Australian science and mathematics teachers than their peers in other countries had participated in ICT-related professional development (over introductory, technical, applications, internet, pedagogical use of ICT and multimedia). According to ICT coordinators in schools, science and mathematics teachers most frequently acquired knowledge about ICT and teaching through observation of and discussion with colleagues, informal contacts and communication with other teachers the ICT coordinator or technical assistants, in-school courses and training from a teacher who had attended a course.

The use of ICT is greater when teachers have a higher level of or confidence in ICT and when teachers have participated in ICT-related professional development. This suggests that the implementation of ICT in teaching would be enhanced by building the capacities of teachers through an expansion of professional development as well as removing remaining obstacles by improving the resources available to students and teachers.

Principals' priorities for the future were focused on developing teachers' and students'

skills rather than on resources. Three of the four top priorities nominated by school principals for enhancing the use of ICT in their schools involved improving the ability of teachers to make good pedagogical use of ICT, improving the technical skills of teachers and increasing the number of teachers using ICT for teaching and learning purposes.

Digital revolution

Comparative international studies such as SITES can provide a context for national perspectives on educational issues such as the use of ICT in teaching. When data from SITES in Australia are compared with data from other countries they suggest that ICT has been relatively widely adopted (at least in science and mathematics in secondary schools), that there is a relatively strong provision of computers in schools and that teachers are more confident in their ICT capability than their peers in other countries. This suggests that the digital revolution will be building on underlying strengths in Australian schools.

ACER is also leading large-scale research into Australian students' ICT skills. ACER will conduct testing for the Australian Government's National Assessment Program – ICT Literacy in October 2011. This study involves a nationally representative sample of around 12 000 students at Year 6 and Year 10 in 660 schools.

The report, *ICT in the teaching of Science and Mathematics in Year 8 in Australia: A report from the SITES survey*, by John Ainley, Frances Eveleigh, Chris Freeman and Kate O'Malley, is available from <research. acer.edu.au/acer_monographs/6/> ∎