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Technology and teachers in rural schools: Diversity and similarity

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Abstract

This paper reports on a project situated in regional areas of Victoria in which 16 primary and secondary teachers participated in an intensive professional development program designed to assist them in embedding Information Communications Technology (ICT) into their classroom practice. The project provides some insight into the availability and use of current technological resources in the rural schools and examines the impact of an intensive professional development program on the implementation of ICT into the curriculum.

The results identified a large diversity of circumstances experienced by the schools in the project, not only in terms of ICT availability and use, and teacher experience, but also in more general issues of cultures of curriculum planning and integration, size, communication, and pedagogical presumptions. The successful integration of ICT into their pedagogical practice was influenced by a complex of factors including the availability of ICT resources, the teachers' ICT skill level, the teachers'

ability and opportunity to integrate ICT in classroom, the level of support provided, both technical and pedagogical, and the curriculum requirements.

The results of the project have been positive with evidence of increased networking among the teachers, changes in teaching practice and increased teacher proficiency and awareness of ICT resources. The project has highlighted common difficulties that teachers experienced including frustrations with the unreliability of technology and a lack of time for necessary training and preparation. In response to the constraints, teachers have been resourceful and inventive in developing pedagogical strategies to aid the integration of ICT into their classroom practice.

Technology and teachers in rural schools: Diversity and similarity

Introduction

This paper reports on a project designed and conducted by the Association of Independent Schools in Victoria, (AISV)¹. The project called *Using ICT to Support Literacy and Numeracy in Rural Schools* took place in 2006. The main goal of the project was to enhance teacher capacity through professional learning which targets the teaching of literacy and numeracy supported by ICT for students in need. The AISV approached educational researchers at Deakin University to conduct an evaluation of this project. This paper provides an overview of the project and summarises the key findings of the evaluation.

Theoretical Underpinnings

There are three areas examined in this study:

- Pedagogy: The effective use of ICT in the classroom by teachers
- Resources: The ICT resources available in rural schools
- Professional Development – the format and the support of the instruction

Many students are competent users of ICT, such as computers, the internet and CD-ROMs. Prensky (2001) has described individuals who have been brought up with computers and technology as digital natives compared to those, for example teachers who have not grown up immersed in technology, as digital immigrants. Digital technology is influencing the way students use information and the way they learn (Elliott, 2005) and the digital divide therefore impacts on teaching and learning. Schools have invested heavily in ICT infrastructure and provided professional development to teachers to enhance the use of ICT in the classroom, but this has not always been effective. Despite

¹ Abbreviation AISV will be used for the Association of Independent Schools of Victoria

the fact that the literature recognises that ICT can have a positive effect on teaching and learning it is often under-utilised in classroom (British Educational Communications and Technology Agency, 2004; Osborne & Hennessy, 2003). Teachers who lack competence and skills in using ICT are unlikely to risk using ICT in their classrooms (Levin & Arafeh, 2003). In tackling the digital divide the teacher plays the critical role “in creating conditions for ICT-supported learning” (Osborne & Hennessy, 2003 p. 4). The integration of ICT in the curriculum is dependent on a number of factors including effective professional development (Chalmers, 2002) and teacher competency with ICT (Lim et al., 2003).

A recent Australian national survey (Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006) has reported on the difficulties faced by regional and rural schools attracting and retaining suitably qualified teachers, providing adequate professional development to teachers in remote and rural locations, and in the supply of resources and support for all students included gifted and special needs students. The report found that the problem with teacher ICT competence and ICT resourcing is exacerbated in rural areas. This data warrants the focus of professional development and support for teachers in rural and regional areas.

Short term ‘skills and knowledge’ approach to professional development in ICT that develops teacher skills in various applications has been shown to be quite ineffective in helping teachers to use ICT more effectively in their classroom (Carrick, 1989; Hoban, 1992; Owen, Johnson, Clarke, Lovitt, & Morony, 1987). There is almost universal agreement amongst education researchers that long term PD that is sensitive to the needs of teachers and schools, is necessary to support significant teacher development. Teachers need to ground new ideas in their own personal experience (Hall & Hord, 2001; Hargreaves, 1994) and site professional development within the school context (Joyce & Showers, 1995). This approach reflects more accurately the emphasis of the Victorian

curriculum (VELS) with ICT skill a dimension that is applied across all disciplines. Many writers (Hall & Hord, 2001; Hargreaves, 1994) have emphasised that change requires of teachers that they ground new ideas in their own personal experience. Joyce and Showers (1995), drawing on research from a large number of studies, argue strongly for the need to site professional development within the school context.

The Design of the Project

In response to the research literature reporting strong links between improved learning outcomes and effective use of learning technologies as reported by (Calnin, 2006), the AISV proposed the trialling of an intensive and sustainable professional development program in the use of ICT.

The project was based in three regional hubs of Victoria – Gippsland, Shepparton and Hamilton. A number of schools near these hubs were invited by AISV to participate in the project. Teachers from each of the schools were nominated or invited to represent the school in the project. The project was designed to train, instruct and support the staff at the participating schools throughout Victoria. Initial meetings between the researchers, consultants and the selected teacher(s) at each their respective schools allowed for an assessment of the schools resources and infrastructure as well as an evaluation of the participating teachers ICT skill level. Armed with this information, the consultants designed tailor made professional development programs for each of the three hubs. In addition infrastructure needs were ascertained and plans begun to address these (eg computers, Internet access, satellite provision, TLF licensing agreements, etc) prior to the commencement of the program. AISV were active in assisting those schools with limited or no ICT resources in acquiring the resources necessary for participation in the project.

This professional development (PD²) program was designed to support rural and regional schools by improving their access and use of ICT to improve student learning in key curriculum areas. The cohort of schools were varied with degrees of advantage and disadvantage. The areas of disadvantage or need included low socio-economic background, geographical isolation, size of the school professional isolation, lack of resources, lack of availability to expertise or other factors. While there was no cost to each school, they were asked to commit to: the release of one teacher for a 5-day intensive training program; the training of at least 2 staff by the ‘trainer’ during Semester 2, 2006; on-going professional learning activities for their staff beyond 2006 in the areas of literacy, numeracy and ICT; participation in the local network and in the end-of-year showcase; the writing of a report in the form of a case study or personal journey diary, and ; participation in the research element of the project .

The teachers participating in the project assumed the role of coordinator. They attended a five day intensive professional development course in *The effective use of Information Technology Communication (ICT)*³ in the classroom which focused on the skills and competencies necessary to integrate ICT effectively into their teaching (see Table 1). The intensive training program covered areas such as curriculum development, inclusivity, pedagogy and ICT integration in addition to introducing a variety of new skills such as blogging, using search engines and learning computer programs. This program was based on the pedagogical approach of integrating ICT seamlessly into the teaching across the curriculum. It was not a program of mastering software applications. The teachers were required to assimilate new skills and ideas into their own unique learning situations. This requires thinking, application and creativity and time so that the ICT add value to the learning tasks.

Day	Content
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² Abbreviation PD will be used for Professional Development

³ Abbreviation ICT will be used for Information Communication Technology

1	What research says about effective use of ICT Curriculum frameworks - VELS, NCC, Inquiry based learning
2	The learning federation, learning objects and digital resources, interactive whiteboards Exploration of learning objects, and their pedagogical use Mathematics, numeracy learning objects Mathematics interactive web resources, Microsoft student, Graphical calculator
3	Digital storytelling Microsoft producer, photostory, movie maker Mid training exploration of use of resources in the unit of work that is to be created
4	Planning and support for unit of work creation Development of resources
5	Finishing touches to resources Presentation to group. Discussion of how to train others. Blockers to PD. Feedback session

Table 1 The schedule for 5-day intensive Professional Development program for one hub

Following the professional development intensive the coordinators were expected to implement changes in their own classroom as well as providing professional development to colleagues at the school under a “train-the-trainer” model. This required the coordinators to train at least 2 staff members from their own school in the skills and competencies which they had learned. The consultants maintained support for each school throughout the six months of the project with on-line advice, e-mail and support and two one-day visits per school to work with teaching staff on the development of their teaching programs. A showcase of teaching skills and curriculum innovations was held at each hub towards the end of the project. The outline of the project is presented in Figure 1.

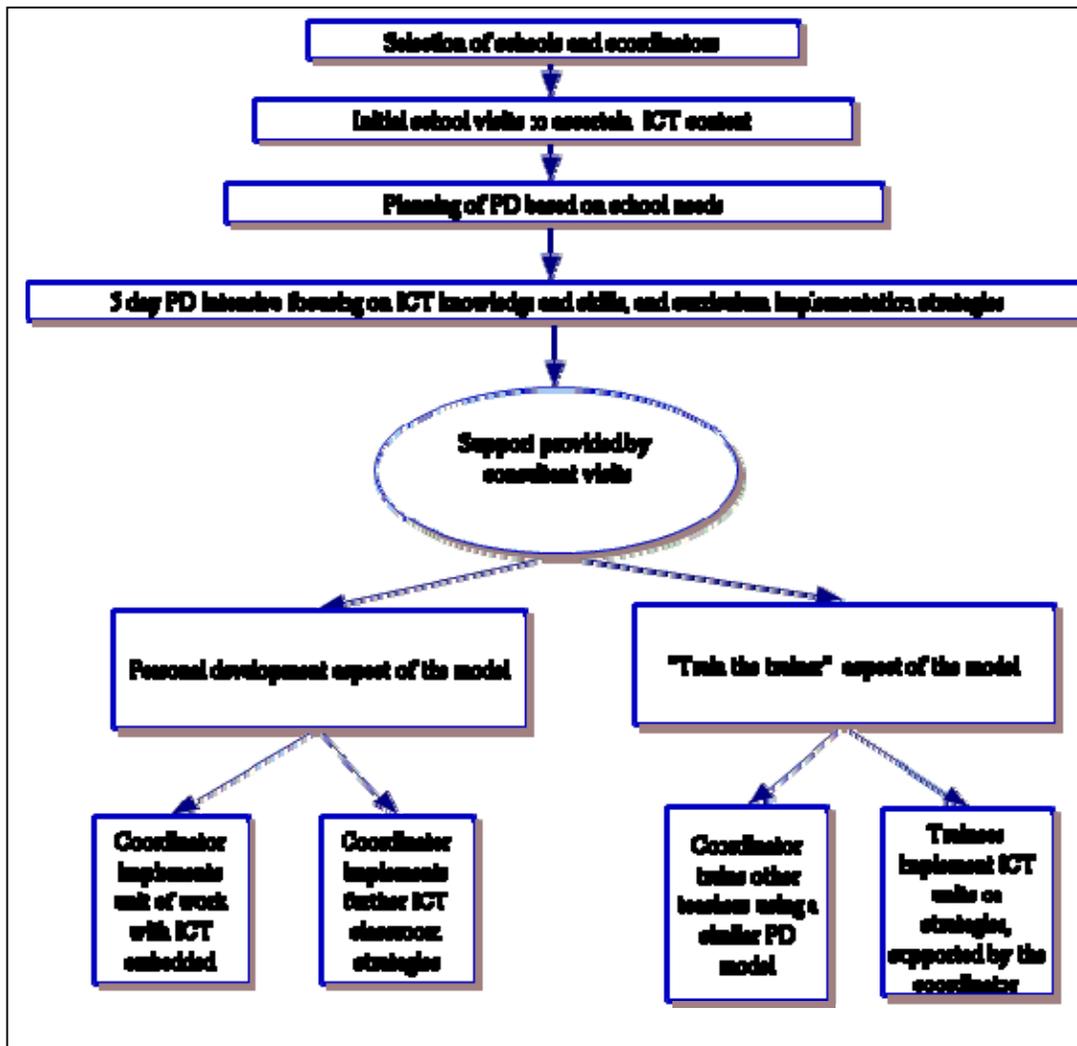


Figure 1 Diagrammatic representation of the PD program

The Research Questions

The project has three major areas being examined - pedagogy, resources and professional development, which are included in addressing the research questions.

1. What are the particular circumstances in these rural schools and communities that affect the use of ICT in supporting teaching and learning?
2. What has been the impact of the PD and ongoing support provided through the project on

- i. teachers' confidence, capabilities and pedagogies in using ICT?
 - ii. student use of ICT in the classroom?
3. What aspects of the PD model were successful in improving teaching and learning using ICT based approaches in rural areas?

Research instruments

Multiple data sources were collected to provide opportunities for validation of proposed themes or issues through cross-referencing. Both qualitative and quantitative data sources were intentionally collected – providing an overview as well as specific individual case studies (Altheide & Johnson, 1994). The data sources included: Interviews with participating teachers and trainers, consultants, and selected students; Focus group discussions with trainers, and cluster teachers; Analysis of student work samples in relation to ICT and literacy and numeracy; Questionnaires of workshop participants and participating teachers, and principals; Field notes of classroom practice, and workshops; and Questionnaires for trainers, students, and participating teachers.

With the small sample size, the analysis of the quantitative data included descriptive statistics only. The quantitative data was transcribed and coded where necessary. Each school and coordinator presents a unique situation which necessitates each be compared to its own position before the project and not to other schools or coordinators. Pseudonyms are used in this report.

Setting

The initial data provided a window into each of the schools and an overview of the whole group. The description of diversity applies here. The schools were diverse in terms of size, religious affiliations, location, resources, and ICT facilities. There were 5

secondary, 4 P-12 colleges, and 5 primary schools. Of the 14 schools: 5 were small (<100 students), 4 - medium (100-300 students), 3 - large (>600students) (1 not reported). Some schools were located in large regional towns, while others had more remote locations.

The sophistication of resources, such as the age and number of computers, accessibility, support, software, internet speed varied enormously, *E.g. from a large very well resourced P-12 school (900 students) with wireless Internet, Smart boards, data projectors, 500 computers, where all staff have laptops to a small P-6 school of 23 students with no operating computers in the classroom at present.* The use of ICT in the schools also varied. There is a variety of support for PD and innovation from the school administration. Lastly the curriculum policies for the use of ICT varied – from informed and detailed to none.

Despite high level of ICT resources at some schools the integration of ICT is not guaranteed. There was little evidence of integration of ICT with other discipline areas at any schools. Prior to this project, there were little or no connections between the schools at the three hubs. The expectations of the commitments to the project by various participants varied. The backgrounds and ICT skill level of the coordinators was diverse. Some were responsible for teaching and managing ICT in their schools, others were selected because of their lack of ability in ICT. Two thirds of the co-ordinators indicated they used computers to: create diagrams, send email, create presentations, research using the Internet, use a scanner and a digital camera. Fewer teachers had previously used or created spreadsheets or digital videos. Six out of fifteen teachers had definite ideas about using ICT in units of work they were planning or developing.

A frequently mentioned criterion by the coordinators was that the PD should result in a general improvement of the teacher's ICT skills and a better understanding of how those skills might be used in classroom practice. The most frequently mentioned criterion for success was that the PD should result in transformative leadership.

Results

The successful integration of ICT into teachers' pedagogical practice was influenced by a complex of factors including the availability of ICT resources, the teachers' ICT skill level, the teachers' ability and opportunity to integrate ICT in classroom, the level of support provided, both technical and pedagogical, and the curriculum requirements. The results of the project have been overall very positive with evidence of increased networking among the teachers, changes in teaching practice and increased teacher proficiency and awareness of ICT resources. In some cases coordinators demonstrated considerable innovation and leadership skills, whereas for others, either confidence or lack of initiative seemed to impede progress. The support of the principal was also a major factor in setting expectations of the coordinators, and other staff, regarding extension of the PD within the school

The results of the project has highlighted common difficulties teachers experienced including frustrations with the unreliability of technology and a lack of time for necessary training and preparation. In response to the constraints, teachers have been resourceful and inventive in developing pedagogical strategies to aid the integration of ICT into their classroom practice.

The diverse cohort of schools meant that there was a large diversity of circumstances experienced by the schools in the project, not only in terms of ICT availability and use, and teacher experience, but also in more general issues of cultures of curriculum planning and integration, size, communication, and pedagogical presumptions. The results provide evidence of the complexities of the relationship between curriculum, ICT and learning, and the difficulties in effecting change in the use of technology in the curriculum and in teachers practice. Five aspects of the project are discussed:

- The PD program

- Implementing change in the classroom
- Student learning and practice
- Training other teachers
- Integrating ICT

The PD Program

Teachers' responses to the survey indicate a very high level of approval about most aspects of the 5-day intensive PD program. For example, teachers responses (shown in brackets) to an open-ended question from the survey, namely: "What are the most useful and/or valuable thing that you have learned in this PD?" related to three areas - *acquiring technical knowledge and skills* (13)— such as resources, software packages (folio, photo story) and web sites; *the pedagogy of using ICT* (5) — such as models of teaching, varied presentations, how to integrate ICT, working with the available resources and including ICT in curriculum planning; and *the nature of the PD* (3) — having small group support, a full week, and guidance and support.

The teachers appreciated that the PD was tailored to the individual needs of each coordinator. They valued the time they had to explore and trial ICT resources. As part of the PD, teachers reflected on a daily blog. This gave the teachers experience with blogging and provided each coordinator with an opportunity to be reflective about the days experience and also provide feedback to other teachers in their hub. In this way the PD was modelling metacognitive practice. All the coordinators appeared to write openly and honestly about their feelings of insecurity, fear, successes and failures. This is demonstrated in the excerpt shown in Figure 2 which is a typical example. The success of the blog for each hub after the 5 day instruction varied. The most successful blog provided an ongoing communication channel for the group till the end of the year.

The intensive training period of five consecutive days, with small group sizes and personalised instructions, while very expensive, proved to be the significant feature

of the program. The allocation of this time communicated to the schools and teachers the importance of the project and the recognition of the importance of investing in teachers by providing this time for training, learning new skills and developing new curriculum programs which incorporated ICT. This time was essential in giving each teacher time to learn and practice new skills, build relationships with the other participants and gain confidence to teach using these new skills.

Day 1 blog – *“...a great day!! WOW! SO much exciting information. Can’t wait to show the others at school.” ... “...the children will delight that I have had to be a student again”.*

Day 2 blog – *“feeling less nervous about the course today but totally embarrassed with what I don’t know!! (morning)...really enthused and excited with this afternoon’s session. Look forward to tomorrow.(afternoon).*

Day 3 blog – *“started out feeling confident...frustrations with my computer...my confidence and enthusiasm waned...what I had in my head when you first showed us, was not what I could remember an hour later...others were all excitedly showing their photo slides!!! I wanted to make a quick exit to the Ladies to have a cry and say I had reached my limit .. told myself not to cry and worry others and do what I encourage my students to do – stop what you are doing, take a deep breath, remind myself that I haven’t got it this time I can try again later and then get back onto the bike...I am still daunted and feel inadequate to meet the challenge.*

Day 4 blog – *I keep thinking how wonderful it would have been for our graduate teacher to be here who is technologically proficient and would have picked this up so quickly. I am so disappointed in lack of ability to pick this up.*

Day 5 blog – *going through the pain barrier yesterday was hard but I’m glad I persevered. I really started to get into it last night and enjoyed it.*

Figure 2 An excerpt from a teacher’s blog during the PD

Implementing Change in the classroom

Participation in the project influenced all the teachers practice. Identifying change in teaching practice was not dependent on the range or frequencies of the ICT resources. Small changes can be equally as significant as large changes. For example one teacher was provided with a Smartboard as a direct result of being involved in this project. She developed many ways of using it in a Preparatory-grade class. Another teacher, at a school with more limited resources, used a data projector in the class for the first time.

She also used the mobile mouse – having students taking turns to interact with the task on the screen - with her class working collaboratively as a group. Evidence of the extent of teachers' use of ICT, comes from three teacher's blog entries:

Sarah: In my class I am using ICT rotations in literacy and numeracy, and the children go to the computer lab once a week. So I think it s generally incorporated through and it overflows into their integrated studies. It's all built in.

Roslyn: The students are spending at least 1 period in the computer lab each week and 3 periods in our mini-class lab. They are busy publishing narratives, making an Excel data-base about dogs and their suitability as family pets, trialling Mark Hennessey's Switch on Maths units, and Photo-story 3 to recount School Showcase. I set up the task in the main lab, and the students work on completing these tasks throughout their mini-lab time.

Rae: I was always competent but didn't know how to do it. Now it's an integral part of my teaching. There's hardly a class where I don't do something with ICT ... I use it all the time

People think preparation of curriculum takes more time with tech. This is true initially but you need to convince them that in the long term time is saved.

While all participants reported being influenced by the project positively, there was a variation in the degree of implementation of the project objectives by the participants. Not all participants completed all the objectives of the project. Table 2 shows that approximately half (7/15) of the participants taught a planned unit of work. Twelve out of fifteen of the participants provided some form of PD to the staff back at their school, and one third of the participants had the next generation – the trainees – teaching planned units of work. The applications and success of the participants was not dependent on the resources available at the schools. There are examples of teachers from

very well resourced schools using this time to learn how to use a IWB and equally there are examples of teacher learning to make better use of the schools one data projector. The application and success of the participants was influenced by individual factors such as: their own motivation, their recognition that their effort will add value to their teaching willingness to instigate change, and external factors such as the reliability and availability of the resources at the school, the attitude of the other staff and principle, and the allocation of time to complete the expected training and continued learning. The variation in the “change” that occurred in the teachers’ practices and the variation in the completion of the objectives by the participants is demonstrated by the following examples of variation:

- Widely varying resources such as server access, speed, resources, licensing issues that were available to the coordinators in their schools. Some schools had limited resources, no ICT organization and infrastructure and inconsistent support.
 - The expertise of the co-ordinator in being able to move on from the PD instruction varied enormously.
 - Complexity of the situations facing coordinators in implementing the program in their schools. No time was allowed at school for the instruction of the trainees.
 - In some cases coordinators demonstrated considerable innovation and leadership skills, whereas for others, either confidence or lack of initiative seemed to impede progress.
 - The support of the principal was a major factor in setting expectations of the coordinators and other staff regarding the extension of the PD within the school.
 - Fitting the project into an already crowded curriculum - adapting and integrating the ICT components

Table 2 Coordinators implementation of the PD in their schools n=15

Teach planned ICT Unit	Implementing new ICT sequences	PD other staff at home school	Trainee teaches ICT unit
7- yes	8-yes	6-yes training 12	5- Yes
8 - no	2- partial	teachers	3 -partial
	4 -no	6-partial	7- no
	1 -unclear	3 no	

Student learning and practice

As expected, data shows there was an increase in the variety and frequency of ICT used by students as a result of being involved in the project. A wide variety of applications were used, in a variety of classes and situations that had not been used before the project; for example, Photo-story, Kidpix, Html files, Animation. Interviews with selected students showed how they were familiar with programs and able to pass critical comment about the hardware and software they were using. For example:

Grade 4 student: *We have been making animations using lego ... so we have been making photos of the with digital camera so far my group has made two movies – just normal lego and we take photos and go into windows moviemaker and cut to one second. We made a movie that lasts 10 minutes.*

Some students kept a journal recording critical evaluations of the software programs they used. Two examples are shown in Figure 3 and 4

Catch a Thief - learning object
Helps you process your thoughts and think
through and you can go back and check your
answer and get your person.

Figure 3 A student's comments in his journal on the Learning Object program called

Catch a Thief

Switch onto Mathematics.

- Fractions, Percentages and Decimals
- Good to make students interactive with the program.
- It was good to let students understand the basics of maths and how to work out mathematical problems.
- One bit of the program was not correct so the producer should fix that bit of the program but apart from that it was really good and fun.
- It doesn't tell you whether your answer is right or wrong.

From the producer's perspective

- Overall it was a really good interactive program.

Figure 4 Grade 6 student writing about Switched on Mathematics Program

Training other teachers

Only 6/15 coordinators implemented full training sequences with the trainees at their school. There are a variety of common factors identified from the data to have contributed to the lack of success of the PD. These factors can be classified as general and ICT related. General factors include a lack of support from the school administration with no time allocation for time, space or training; Miscommunication - with some coordinators not understanding their role in training other staff; Changes in the circumstances either of the school or the coordinator. ICT factors include financial constraints limiting the availability of new resources; a lack of confidence and experience in the coordinator to use and teach ICT and not seeing a need to show other teachers (at very well resourced schools) because they were already very computer literate.

The six successful coordinators worked within their individual schools with its unique conditions and constraints to successfully train other staff members. All successful coordinators demonstrated their enthusiasm and determination in their training, for example some teacher held classes at lunchtime and in the holidays, others had sessions after school. The coordinators displayed leadership by providing instruction to trainees and helping them implement ICT into their teaching program. This was exemplified by the coordinator co-teaching with trainees, sharing new resources and techniques e.g. blogging, smartboard, photostory etc. The success of the training program was dependent on the enthusiasm, leadership and computer skills of the coordinator.

Some trainees were resistant to using ICT because of a lack of expertise and confidence. Some trainees expressed concern about initiating a change, fearing a resulting lack of control in their classroom, for example:

Trainee: I felt quite intimidated by the whole setup and I didn't feel I had the skills to handle a crisis and when things were going wrong I didn't know the steps to help the children so it was in the too hard basket

With limited ICT experience, most trainees had previously used ICT in the classroom as a reward, motivator, or time filler; not really regarding ICT as a sound learning tool. Some teachers expressed concern about the importance of ICT in the early years of learning when the focus is justifiably on numeracy and literacy.

Trainee: The other problem that I have is that with the junior primary children I just believe that it is so important that they get literacy basics and that is what I see as my goal, the computers are just an extra bonus for them. If they are good on the computer but can't read and write independently then I just feel that I don't want to take up any extra time on the computer but I do want to supplement what I do on the computer – but need reliable computers.

This comment from a teacher at a small community school demonstrates the professional and careful consideration the staff gave to the school's participation in the project. The time needed had to be negotiated with consideration for other important learning opportunities.

Integrating ICT

The role of ICT in the classroom has changed dramatically over the past decade and an important focus of the PD was in understanding the role of ICT in promoting learning through alternative formats. The Victorian Essential Learning Standards (VELS) curriculum reflects this approach with ICT a learning domain that extends across the whole curriculum. Students often have more experience with computers and have better skills than their teachers. Some teachers lack confidence in their own computer skills, and are not prepared to take risks with it in their classrooms. The PD intentionally distinguished ICT technological skills from ICT pedagogical skills – drawing on teacher's pedagogical experience, encouraging them to identify software and applications that could be used effectively in the classroom to promote learning.

The results of this project has highlighted that teachers need time to develop their own computer skills and learn specific software and applications. Teachers must be willing to using ICT in the classroom which may require teaching computer skills to children, as well as acquire pedagogical content knowledge concerning the use of ICT in the classroom.

Conclusions

There was a surprising and extreme variation in the level and quality of ICT facilities available in the schools. Generalizations cannot be made about the schools because even for this small sample there were a variety of situations with respect to wealth, resources, organisation and teacher skills. The particular circumstances in these rural schools and communities that affect the use of ICT in supporting teaching and learning of literacy and numeracy include the availability of ICT resources - more to do with the wealth of school rather than the rurality; the support from the school; and the teacher's attitude to the use and role of computers in the classroom.

The successful integration of ICT requires teachers to be confident ICT users and through this project all coordinators improved their ICT skills and some developed their leadership skills. These results correspond to teachers expectations expressed at the beginning of the project. The development of ICT pedagogical content knowledge was a key outcome, with teachers developing ways of using and integrating the ICT into their teaching. This is evidence through initiatives such as the interactive whiteboard, animation, and digital stories. Corresponding to the teacher's use of ICT, student's use of ICT in the classroom increased.

The success of the PD and ongoing support provided by the project was variable, and needs to be considered on an individual basis – identifying specific reasons for success and failures. The five day intensive instruction was valued highly by all

coordinators, however for some coordinators, the train-the-trainer model was not achievable. The aspects of the train-the-trainer model that promoted change included having a colleague (the coordinator) ready to provide instruction and support; working with other staff with the same goal, having online and ongoing support from the consultant and the need for initiative and leadership by the coordinator. The aspects of the train-the-trainer model that made it unachievable for some coordinators included the lack of support from the school, a lack of understanding by the coordinator of their role in training other staff; and a lack of confidence to teach other teachers. The limited success of the train-the-trainer aspect of the project is disappointing and has highlighted the difficulties in meeting the professional needs of teachers in rural and regional locations.

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