HELPING TEACHERS IMPROVE THEIR USE OF COMPUTERS IN TEACHING

A paper arising from a project supported by a VITTA fellowship

Presentation at VITTA Conference, November 2002

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BACKGROUND

The findings of my recent PhD study (Chandler, 2001) concern the importance of teachers’ knowledge and its development on how they integrated the use computers with their teaching. Also emerging from that study was a personal theoretical knowledge base - a series of propositions or ‘suggestions to myself’ - relating to the things which I think need to be attended to when assisting, supporting and promoting the integrated use of computers by non-ICT-specialists.

In essence, I have come to believe that professional development related to assisting, supporting and promoting the integrated use of computers must address the development and implications of teachers' knowledge in its broadest sense; my own experience also suggests that we are often insufficiently deliberate or holistic when addressing the knowledge base which is most likely to lead to the effective integrated use of computers by non-ICT-specialists. The objective of the project supported by the scholarship is to develop and evaluate a PD program based around my ‘suggestions to myself’. The venture provides an opportunity to ‘test’ the propositions and refine the set.

THE PROJECT

After much discussion in committees of the school, we decided that rather than investing in equipment that we should invest in people; that what we should do ‘next’ is to help teachers refine, reform or improve their practice - and include substantive computer use within it, rather than buying more gear that only a handful might use.

To this end, the group of four Year Eight SOSE teachers have taken up the challenge of having most of their (Year 8 SOSE) classes for the year scheduled into a computer laboratory. The idea was to contrive some longitudinality and to challenge the teachers to think is there a good reason why I shouldn't use computers in this lesson rather than hoping that occasional use will lead to rethinking pedagogy and curriculum. To support these teachers, the school would provide training and support in the software packages to be used, team-teaching and other pedagogical support, and computers both on these staff members’ desks, and at home. In other words: immerse the teachers in the technology, expect that very frequent use will be made within and outside of the classroom, support them, expect them to be the creative, wise and knowledgeable professionals that they are, and let things take their course over a relatively long period of time.

Our investment in people, therefore, took relatively simple forms: scheduling classes into computer rooms, providing computers for staff, providing responsive support for in-class technical problems, and regular, structured training and support of about one hour per week. The challenge, actually, is in having the nerve to 'hold the line’ in terms of room allocations, staffing, what is expected of staff, and support over a period of several years. Whilst there are a whole range of benefits to the teaching and learning of SOSE (not least of which are providing a motivating environment, and being seen to be ‘modern’), the nub of the project is to trial an evolutionary approach to the transformation of pedagogy.

In addition, we have integrated a previously semester-long Computer Skills course with SOSE. Formerly, SOSE was scheduled for six lessons per cycle, and Computer Skills for two. Now, the timetable reads eight periods of SOSE per cycle. An ICT specialist ‘hijacks’ an average of one period per cycle for ICT-specific content, and the SOSE teacher

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1 I understand pedagogy to mean “the function, work or art of a teacher; teaching” (The Macquarie Dictionary, 1991).
2 Our position has been to provide ”as much or as little support as you need”, but in practice it has averaged out to about one hour per week during this school year.
specifically teaches ICT content for the equivalent of one period, and uses the technology for the teaching/learning of SOSE in the others.

There are several reasons why we decided to integrate the two subjects, rather than being content with the work that might be done through SOSE alone, and they include:

- from a staffing point of view, there was a strong chance that non-ICT-specialists would be involved in the teaching of Computer Skills, so why not engage those teachers who are involved in the intensive program at the same year level;
- about 50% of the Computer Skills course could be reasonably taught by a non-specialist, so to find a way in which an ICT specialist can be engaged with 50% of all classes, rather than 100% of half the classes, seemed desirable;
- if an ICT-specialist is going to have to spend quite a deal of time supporting non-ICT colleagues, then that would be more productive for this to have benefits on a fairly 'wide canvass' (that is, to a 'major' subject such as SOSE, rather than the 'minor' subject of Computer Skills);
- experience, borne out by the PhD study, suggests that teachers who use computers (i.e. occasional visits to the computer lab) do not readily, of their own volition, teach important computer skills and techniques – the curriculum is either too crowded or they feel ill-prepared to do so. The idea of having teachers scheduled regularly into a computer labs who are going to be resistant about teaching basic skills is potentially quite a curious one. The solution was to 'give' them a specific range of skills to teach, and 'give' them time to teach it in;
- Richards (1997, p. 6) has observed that whilst not teaching computer skills may seem to serve the simply the life (and angst) of the non-ICT specialist, such teachers may find it quite uncomfortable, wondering what their role is, if they are left to be "mere facilitators", leaving it to someone else to teach the ICT content; allocating the SOSE teachers some specific ICT skills to teach is a way of striking an appropriate balance;
- 'hijacking' a class implies that the SOSE teacher would not be scheduled to teach another class at that time. Whilst the SOSE teacher would not be required to be present with the ICT specialist, such an arrangement left open the possibilities of team teaching and modelling of ICT pedagogy, which would not otherwise be possible.

It is important to note that the integrity of both SOSE and Computer Skills as separate subjects has been preserved. There are separate curriculum documents for both subjects, and end-of-semester reports have been kept separate. We have not altered the curriculum balance, either – the number of periods each subject should be allocated is a debate for another time or occasion, but to which the teachers involved in the current initiative will be able to contribute in a more informed manner. In organisational terms, we have tinkered a little with room allocations and staffing, deliberately leaving the more contentious issues alone. My role in the project has been as the ICT teacher, and overall program facilitator.

THE SYLLABUS

In order to preserve the integrity of SOSE and Computer Skills as they were as pre-existing subjects, we have paired up the SOSE topics with one or more IT topic, as follows. As well as class work, there is SOSE homework and some Computer Skills homework each week.

<table>
<thead>
<tr>
<th>Term 1 (5 Weeks)</th>
<th>SOSE Topic</th>
<th>Computer Skills Topic</th>
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| Weather          | GUI operation and file management  
                  | Keyboarding        |
|                  | DTP using Publisher            |
| Terms 1 & 2 (6 Weeks) | Ancient Rome | Word processing  
                          | Using the scanner    |
| Term 2 (5 Weeks) | Antarctica | Word processing  
                  | 'Idea processing' using Inspiration |
| Terms 2 & 3 (7 Weeks) | Medieval Society | Web site development using FrontPage |
| Term 3 (6 Weeks) | China       | Multimedia presentation using PowerPoint |
| Term 4 (6 Weeks) | Local Communities | Data analysis using Excel  |
For each topic, there was at least one activity that taught new ICT skills or revised previously-taught ones, followed by an application of these in a slightly different context that also, in some cases, extended the initial activity. For instance, students created a simple Web site “about me” prior to creating a large, inter-linked site residing in several students’ Intranet sites on an aspect of Medieval society. The introductory activities formed the basis of staff computer training activities.

Where possible, the ICT content of the course has been benchmarked against the Australian Computer Studies Competition (ACSC) (Junior and Intermediate) levels and the International Computer Driving Licence (ICDL). That is, students experiencing success in the Year Eight program should be well placed to experience success in the relevant sections of these programs. The assessment for Word, PowerPoint, FrontPage and Excel was conducted via a skills checklist, completed either by teacher, student or peers, or a combination of these three. The assessment for typing skills was through demonstrated improvement in typing proficiency. File management was assessed through a combination of an extensive multiple-choice test (based on questions similar to the ACSC), and teacher inspection of file management practices.

PROFESSIONAL DEVELOPMENT

FOUNDATIONS OF THE APPROACH

The PhD study suggested that, when helping teachers to integrate computers in their teaching, it would be important to concentrate on the following inter-related factors:

- engage teachers with the technology\(^3\)
- develop teacher confidence\(^4\)
- modelling of teaching with computers
- promote the development of knowledge about ICT\(^5\)
- promote the development of pedagogical content knowledge\(^6\)
- create opportunities for teachers to identify and reflect upon their practical theories of teaching\(^7\)
- continue to reflect, investigate and research the factors which are important in helping a particular group of teachers integrate the use of ICT in their teaching

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\(^3\) A number of scholars, such as Becker and Ravitz (1999), Ringstaff, Sandholtz and Dwyer (1992) and Confrey, Piliero, Rizzuti and Smith (1990, p. 6), have reported projects in which growth in subject matter knowledge and reconceptualisation of subject area have been promoted through the provision of technology (i.e. technology-induced belief change). I did not find this effect in my own study (Chandler, 2001, pp. 263-264), and I have wondered (pp. 58-61) whether it is the provision of technology that is the singular factor that drives the change. More importantly, in my study, the teachers were ‘visiting’ the computer laboratories once a week, and this is not being immersed in technology to anything like the degree that teachers in the projects reported by these other scholars were. Thus, in the current project, it became important to engineer as much ‘immersion’, because if we have any aspirations to open the doors to any possibility of reconceptualisation of SOSE curriculum and pedagogy, such would seem unlikely without high levels of engagement with the technology. This arrangement would also provide an opportunity to ‘test’ the importance of engagement with the technology as an influence on subject reconceptualisation.

\(^4\) Numerous studies (eg Marcinkiewicz, 1993/4; Albion, 1999; Borchers, Shroyer, & Enoch, 1992; Enoch, Riggs, & Ellis, 1993; Jacobsen, 1998; Olivier & Shapiro, 1993) have both identified ‘confidence’ as a good predictor of computer attitudes and usage patterns, and that the development of confidence is related to a range of other factors, notably: knowledge of teaching methods, knowledge of the technology, access to the technology, and classroom experience with computers.

\(^5\) A good understanding of the relationship between content knowledge and pedagogy in general, is in its infancy (Borko & Putnam, 1995, pp. 43-46). Whilst the relationship between content knowledge by itself and pedagogy is unclear, it seems that content knowledge is an important influence on other factors which in turn influence pedagogy, such as confidence, planning and implementation of classroom practice (Tobin & Espinet, 1989) and pedagogical content knowledge.

\(^6\) Pedagogical content knowledge, derived from Shulman’s work (Shulman, 1986) is a special kind of knowledge which teachers develop, in one sense a restructuring of content knowledge, "a unique interface of content and pedagogy, an understanding of how topics and skills can be organised and taught to pupils” (Kagan, 1992, p. 158). Strategies to enhance pedagogical content knowledge are relatively in their infancy (Pollingsworth & Clarke, 1998), and the importance of it seems to under-recognised in the ICT arena. Strategies include: adequate content knowledge, immersion in the field, and exposure to examples, particularly in settings that facilitate discussion, debate and consideration.

\(^7\) Marland (1995) has observed that it is broadly accepted that the classroom actions of teachers are guided by internal frames of reference deeply rooted in personal experiences, especially school-based ones, and are based on interpretations of those experiences. Because they directly relate to a teacher’s practical action and possess considerable explanatory and predictive power for the teacher concerned, in line with Marland, Kennedy, Forlin and Sturman (1997) I use the term “practical theories of teaching” to describe these internal frames of reference. There is, therefore, an need to promote deep teacher reflection to help them understanding the implications of their practical theories of teaching for a particular situation, and possibly even reconceptualise their practical theories of teaching. In the literature on professional development for ICT teaching, the need to work with (pre-existing) practical theories of teaching seems to be under-recognised.
THE PROFESSIONAL DEVELOPMENT PROGRAM

The intention has been to provide a ‘360 degree’, holistic professional development program. It should be noted that we are close to the end of what we hope to be a program which will last several years; one implication is that during the first year, there has been a concern with meeting the teachers’ immediate needs and providing training in ICT skills. It is to be hoped that, as years progress, we will be able to more effectively address other dimensions of the program, and that the teachers will increasingly identify with other factors as being important to their professional development.

The training in ICT skills has been based, in part around the “introductory activities” of each of the topics. In terms of providing staff support and training, the school is fortunate that the author has a teaching load allocation for providing staff training, and the services of a retired member of staff who returns up to two days a week to provide training. On these bases, training was provided on either an individual or small group (up to three) basis, and was specifically tailored to the requirements of the Year Eight program. It should be noted that all except one of the SOSE team had quite low entry-level computer skills. We have also been preparing these staff to complete the assessment for ICDL in several modules, particularly module 2 (file management), module 3 (word processing) and module 7 (information and communication).

Our intention has been to provide a long-term professional development program based on the following:

- PROVIDE TEACHERS WITH A FREQUENT, REWARDING AND RECURRING CLASSROOM EXPERIENCE, BECAUSE THAT WILL BUILD CONFIDENCE AND ASSIST IN THE DEVELOPMENT OF PEDAGOGICAL CONTENT KNOWLEDGE
  - just-in-time technical and in-class support
  - just-in-time ICT content and pedagogical support
  - modelling of teaching with computers
  - longitudinal and frequent
  - not just a one-year program

- ENCOURAGE TEACHERS TO BE SUFFICIENTLY ENGAGED WITH THE TECHNOLOGY TO PRESENT CHALLENGES TO THE PREVAILING CONCEPTS OF THE SCOPE AND CONTENT OF THE TECHNOLOGY
  - provision of a computer on each teachers’ desk, and at home
  - longitudinal classroom contact
  - modelling of teaching with computers
  - training in ICT content
  - conversations on technology, pedagogy and possibilities

- PROVIDE OPPORTUNITIES FOR TEACHERS TO INCREASE THEIR KNOWLEDGE OF THE TECHNOLOGY, BECAUSE IT WILL HELP THEM IMPROVE THEIR CONFIDENCE WITH THE TECHNOLOGY, INCREASE THE APPRECIATION OF THE VALUE OF COMPUTERS FOR TEACHING OF THEIR SUBJECT AREA (PEDAGOGICAL CONTENT KNOWLEDGE), AND HELP THEM EXPERIENCE SUCCESS WHEN WORKING WITH THE TECHNOLOGY
  - at least one hour per week of content training; ICDL expectation
  - provision of computer at work and home

- PROVIDE ADEQUATE TECHNICAL SUPPORT FOR TEACHERS BECAUSE THAT WILL ASSIST IN PRESENTING A REWARDING AND CLASSROOM EXPERIENCE
  - just-in-time technical and in-class support

- CREATE STRATEGIES TO INFLUENCE SELF-EFFICACY BELIEFS
  - enhance content knowledge through ICDL-related training
  - enable teachers to demonstrate that they have extended and rewarding experiences using computers
  - providing examples in verbal or written form of other teachers having extended and rewarding experiences using computers;
  - focused team discussions

- CREATE STRATEGIES TO IMPROVE PEDAGOGICAL CONTENT KNOWLEDGE
  - enhanced content knowledge through ICDL-related training
  - reflection on case study material, immersion in the field
  - opportunities for reflection through semi-structured interview with change agent

- ENCOURAGE TEACHERS TO BE REFLECTIVE PRACTITIONERS, IDENTIFYING THEIR PRACTICAL THEORIES OF TEACHING, AND TO CONSIDER THE IMPLICATIONS OF THESE ON TEACHING WITH COMPUTERS
• enhanced content knowledge through ICDL-related training
• opportunities for reflection through semi-structured interview with change agent

• TO CONTINUE TO INVESTIGATE THE INFLUENCES ON THE PEDAGOGY OF COMPUTER-USING TEACHERS
• It is only by appreciating the full depth and breadth of issues facing the computer-using teacher, and by choosing to deliberately learn more, that improvements in the professional development of computer-using teachers can be made.

PROGRAM EVALUATION

As a result of my earlier study (Chandler, 2001), I would suggest that 'success' in facilitating improved integrated use of ICT will be indicated in several ways, and I am still looking for other indicators that would be helpful in the evaluation of our program. The indicators that I would suggest are:

• increased self-efficacy with teaching with computers
• development of ICT skills.
• development of pedagogical content knowledge
• development of reflective practice (particularly related to practical theories of teaching).
• teaching ‘about’ the technology as appropriate
• exploiting a range of possibilities offered by the software
• ownership of the solution of technological difficulties by the teacher
• ask the teachers, students or parents

Satisfactory completion of certain ICDL modules gives some indication of ICT skills, we have not yet felt it appropriate to ask parents or students what they believe would be an effective ICT/SOSE program, and we are still searching for appropriate ways to make judgements of the development of pedagogical content knowledge, reflective practice, and how the teachers use the technology in the classroom. The area in which we have made the most advances is in the monitoring of self-efficacy with teaching with computers.

As noted earlier, numerous studies have both identified ‘confidence’ as an important component to non-ICT-specialists preparedness to use computers in their teaching. Particularly, perceived self-efficacy - “individual’s beliefs about their ability to perform particular actions or attain certain goals” (Gorrell, 1990, p. 77) - is consistently reported as a good predictor of computer attitudes and usage patterns. As Mabel Kinzie writes on her Web site, http://kinzie.edschool.virginia.edu/research.html,

[The] nutshell version of the theory that I … (and lots of other folks too) subscribe to is: People that feel self-efficacy in the use of computer technologies will tend to invest more time and be more willing to take chances and learn new things. To feel this self-efficacy, individuals need to hold positive attitudes, and positive attitudes require training and applied experience with computer technologies.

We were interested in testing these relationships, so we developed two instruments. "Attitudes Toward Computer Technologies" (ACT) is made up of two subscales that measure perceived "Usefulness" and "Comfort/Anxiety" with computer technologies. "Self-Efficacy with Computer Technologies" (SCT) is reflected by scores on six scales, measuring self-efficacy with "Word Processing," "E-Mail," "Spreadsheets," "Databases," "Statistical Packages," and "CD-ROM databases."

As noted above, we have endeavoured to construct a professional development program that would positively influence self-efficacy beliefs of the participating teachers. We are interested to know whether the teachers’ perceived self-efficacy is actually improving (because of the consequential positive impact it is likely have on pedagogy), but also to examine whether the predictive relationship articulated by kinzie – that training and experience lead to attitudes which in turn lead to self-efficacy – can be seen to be true in our case.

To that end, we have enhanced and adapted Kinzie’s SCT (Kinzie, Delcourt & Powers, 1994) to match the software products which were being used in our program. This is a questionnaire of approximately 12 pages that the participants will have completed four times during the year. Analysis of the results is still pending, but it is hoped that it will quantitatively demonstrate improvement in one aspect of teacher development, and thus lend weight to the merit of the professional development program.
CONCLUSION

From the facilitator's point of view, the most significant frustration has been how over-ambitious we were with the extent to which a holistic professional development program (such as described above) might be delivered. In practice, it has been considerably narrower, but for very good reasons – the need to address the teachers' immediate concerns.

Has the professional development program been a success? It's too early to say. It needs to be let run its course for 2 to 3 years. It has been most definitely a success in the sense that all participating teachers are enthusiastic about 'doing it again' in 2003. There will be a whole range of management, curriculum, training and immediate concerns which we will be more 'under control' at the outset. This will hopefully allow us to bed-down the program some more, and concentrate on the breadth of professional development, and thus enhance the curriculum and pedagogy further. In 12 or 24 month's time, we will be in a much better position to pass judgement on the professional development model.

In concluding, I would make one particularly suggestion, unsubstantiated by anything except by a 'gut feeling'. That is, that I began the program in the belief that practical theories of teaching and pedagogical content knowledge where vital areas of teacher knowledge to which we need to attend. I don't doubt their significance, but I do believe that participation in a structured program in conjunction with targeted training, and supported technically and pedagogically – all with an emphasis of improving confidence – has led to teachers being both very willing and able incorporators of ICT in their pedagogy. I do believe that professional development for effective ICT integration needs to be more carefully constructed than 'doing a bit of training', but my sense is that schools could do worse than construct a program around these five elements.

REFERENCES


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