Participatory action research for professional development: Changing our approach to distance learning

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This paper details a mini-case of (a) the implementation of a professional development program which underpins the design, development and implementation of renewing curriculum for improved distance education learning experiences; and (b) using an alternative open-source learning management system, Sakai. The methodology of Participatory Action Research (PAR) has proved important for gaining deep engagement and conceptual change of teaching and learning practices. The min-case reflects the voices of various members of the project throughout the first PAR cycle. The focus of this mini-case is on 'who leads' in relation to professional development of/with academic staff. There is some focus on how the project came about, how professional development has been pursued and how one academic has experienced the process so far. The lessons drawn from the project at this first stage will be of interest to a wide audience especially in relation to the methodology. The lessons do not intend to be generalisable beyond this context but for many they will "ring true" and add to the substantive emerging field of professional development when using technologies for enhancing student learning.

Keywords: professional development, Sakai, participatory action research

Introduction: Professional learning context

In 2006 UNE underwent a considerable review of distance education and then in 2007 of its academic programs. It emerged, amongst other issues, that a reconsideration of how students engaged in distance education and associated technology needed rethinking. Funding was secured from two internal grants to support both the Distance Education Review and Academic Renewal priorities for two Schools. A team from the School of Education proposed a bold project which uses a Participatory Action Research (PAR) framework for the dual purpose of academic renewal of one of their programs and for the deployment of a new learning management system-Sakai. The project aimed at providing leadership within the University of New England (UNE) community and for others more widely who might consider using Sakai. By way of context Sakai has been deployed for three programs BTeach, MEd (e-Learning) and the BNursing to meet the needs of 4000 students. However, this paper aims to describe and explain the process to date of curriculum renewal and deployment of Sakai only within the School of Education.

Learning Management Systems (LMS) lay at the heart of many an institutional infrastructure for managing student learning. Over the past few years the LMS landscape has altered with emerging open-source alternatives becoming increasingly attractive and viable. Put simply, where once it was thought that 'building and supporting your own' was too expensive it seems that the field has levelled somewhat and proprietary solutions anecdotally appear to be as resource hungry or more so. Many institutions across the Australian higher education landscape are revisiting their LMS solutions in an attempt to rethink how they may best meet the changing requirements of their institutions, their staff and learners. The University of New England has recently deployed an alternative LMS, Sakai in response to the need to renew three programs and to evaluate the scalability and sustainability of Sakai as an alternative or even complementary LMS solution. No discussion is included here of other alternative LMS of which there are several others known. The intention is to focus on Sakai which was the choice of this particular project.

The academic renewal of two programs within the School of Education required careful consideration on a number of levels. Not least the requirement for professional development for those staff who would be involved. Both the distance education review and the academic renewal priorities of UNE had identified the need for fresh distance education approaches to student learning and the updating of

staff skills. The dilemma for the project steering group was how to provide much needed professional development in ways that would be engaging, purposeful and appropriate for the change required. At one level, the professional development agenda has revolved around the practical, short-term needs of academics and most often in the form of seminars, workshops, special funded projects and certified programmes (see for example Moore, 2006). There are considerable workload and policy issues which limit the capacity of staff to engage in innovation in learning and teaching.

> …we must publish; we must obtain research funding and carry out empirical research; we may have inadequate access to the technical support needed to attempt innovation in our teaching; we are evaluated in our teaching on the basis of student satisfaction and course completion, goals not always compatible with attempting innovative practice; or attempts at innovation, when they do occur, may not fit the organisational practice of our institutions; we may not perceive ourselves any relevance in all these calls for change within our own courses. And yet we are supposed to be educating our own students to become professionals in the new type of educational environments that we do not even know how to demonstrate ourselves. We need to practice the change we are preaching, if we even are preaching it. Who do we look to as models for ourselves? (Collis, 1998, p.3).

For some, there are inadequate incentives to devote additional time to teaching, compared to perceived career benefits of research. From another perspective academics have traditionally been the main drivers of their learning and teaching development. But over time it has emerged that many require the support of a team to develop effective web-based learning experiences. Like Fletcher (2004), Goodyear, deLaat and Lally (2006) state that there is a tension between rigour and prescriptiveness and that there is a requirement for a redistribution of "design power from technical specialists to those who inhabit (educational) spaces- in our case, teachers and learners" (p.213). The convergence of practice and research in this project takes this into account, and attempts to be sensitive to, the needs of the institution, the academic and their students by drawing upon Participatory Action Research methodology.

Project methodology

Key to the development of the project has been the use of PAR. PAR is well known as a research methodology. The four moments of reflection, planning, action and observation that make up PAR are best utilised when there is a high level of collaboration and planned group and individual reflection. Kemmis and McTaggart (1988) define PAR as "collective, self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social...practices" (p 5). There are numerous books and papers which describe the approach and the intention is not to detail those here but rather indicate how the methodology has been used. One example which is highly relevant to this project is demonstrated well by Levy (2006). She outlines her case for "…a broad conceptual framework for designing, facilitating and evaluating 'process support' " (p.226) in web-based learning. Here, action research methodology was used to explore with learning practitioners the relationship between educational design and their outcomes. Over 17 weeks participants engaged in a range of activities and the evaluation of the action research project is provided within the design itself and is one of the few studies identified that connects theory and *practice* fully. The resulting conceptual framework or 'living theory' provides theorising of the connection between domain and process learning which will be useful for the project at UNE.

Consistent with PAR the participants of the project were intending to:

- improve understanding about how to best enhance distance education students' learning experiences
- develop skills and knowledge about pedagogy appropriate for the use in online environments
- be empowered by the leadership opportunity to evaluate appropriate pedagogies and the open-source LMS –Sakai so as to make recommendations to the University community.

The group did not choose PAR but rather PAR found them. A proactive evaluation (Sims et al. 2001) project was planned to shape the project which in some ways it does however it emerged that staff engagement was more critical to the success of the project. Consequently, during the scoping and proposal development stage staff to be involved in the project worked collaboratively to define aspirations and this has provided a distinctly grounded and local flavour along with proud ownership. It has also become important for dissemination and acceptance of the project within the School of Education.

Developing staff capacity is "multifaceted and multiplayer, and all aspects need to be integrated, at the institutional level, the instructor level, the student level, the supporting-staff level, the technology-infrastructure level, the curriculum level, the user-interface level, the procedural level via which the managed change is to occur" (Collis, 1998, p.3). Further Collis is no less relevant from her statement of ten years past that change can be more adequately managed through specific and clear obtainable goals that are less about motherhood statements

> There needs to be a mixture of both top-down (leadership, policy, vision, incentives, pressure, coordination, funding, infrastructure provision) and bottom-up (acceptance of the value of the innovation by the individual involved, willingness to move through initial difficulties as well as the unavoidable "implementation dip" that accompanies having to deal on a personal basis with the small and large problems of change and technology, adequate personal skill, access and insight to continue productively) .(p.3).

Stakeholders

The project stakeholders included the Teaching and Learning Centre (TLC), academic unit coordinators, other staff involved in unit delivery within the School of Education, institution managers, an Educational Designer, a Sakai programmer and students. Each stakeholder had unique roles, responsibilities and rationale for being involved in the project, being directly involved to a greater or lesser extent at different points in the action research cycle. A Project Steering Committee consisting of the key stakeholders was formed to drive the project and ensure it met key milestones. The Steering Committee supported the Project Leader who was relatively new to managing a large-scale project but the project group felt it was equally important to build capacity of emerging staff and particularly to gain skills in project management, people and finance management.

Significance of the project

The project had three strands of significance. These were

1. Pedagogy
   - Researching the effectiveness of using Sakai for the professional preparation of students, specifically pre-service student teachers;
   - Applying and evaluating a social constructivist approach to learning in Sakai;
   - Developing and demonstrating pedagogical models that apply to the development and evaluation of Sakai that could be used and built upon by others in different disciplinary learning contexts.
2. Technology
   - Demonstrating a non-commercial built-for-university education Learning Management System;
   - Developing a technology infrastructure that can be built on and used by others in all disciplines across UNE
3. Professional Development of academic staff
   - Providing academic staff with contexts for situated learning (Lave & Wenger, 1991) relevant to distance education contexts;
   - Providing an alternative infrastructure to support cohorts of student teachers over the coming years;
   - Creating practical opportunities for academic staff to use Information Communication Technologies for teaching and learning;
   - Engaging academic staff in a professional community of practice.

Evaluation

Evaluation of the project is ongoing and both formative and summative in nature. The purpose of the evaluation strategy is to ascertain the success of the value, aims and outcomes of the project. Much formative feedback comes through the reflective discussions which are held informally and formally through both individual and group meetings. Summative data will be collected through a range of surveys, interviews and diarising by participants. Ethics approval was sought and has been approved. The key outcomes of the project form a matrix with the questions for evaluation:

Key questions for investigation

1. What processes were planned and what were actually put in place for the project?
2. Were there any variations from the processes that were initially proposed, and if so, why?

3. What were the short-term outcomes of the project (those produced within the project timeframe)?
4. To what extent have the intended outcomes been achieved?
5. What unintended benefits accrued from the project?
6. What has been the impact of the dissemination strategy?
7. What factors helped and hindered in the achievement of the outcomes?
8. What lessons have been learned from this project and how might these be of assistance to other institutions, researchers and practitioners interested in the use of LMS environments to support/enhance teaching and learning?
9. How best can other staff be encouraged to take up the outcomes generated by the project?

Project governance and brief

The project initially involved 24 units of studies from two programs; the BTeach and MEd (eLearning). The project was planned and developed using an action research cycle. It was divided into four discrete stages – reconnaissance, and three iterations of the action research cycle, with units within the BTeach scheduled as a staged *roll-out* over four semesters. The cascading iterations of the project's design allowed for the ongoing evaluation of processes and products, as well as the showcasing of units from one stage as inspiration for the next. In practical terms, allocating each unit to one of three Semesters for the purposes of redesign facilitated human resource and infrastructure sharing as well as the management of external factors, such as Academic staff turnover and leave arrangements. The project was governed and advanced by a three-tiered structure. The *project planning committee* determined actions to implement and advance the project's goals, and attended to administrative matters such as seeking ethics clearance for the project and developed the project's scoping document. This committee included representatives of each of the stakeholder groups (except students), including BTeach and MEd course coordinators, Teaching and Learning Centre representatives, Educational Developers, the project manager (Head of the School of Education), Project Coordinator and original project proposal authors (members of the Information Communications and Technology (ICT) teaching team). The *project development team* implemented actions as determined by the planning committee, mentored project participants (*the project implementation team*) and supported them in curriculum renewal and professional development, and provided technical expertise and support.

Academic staff

Unit coordinators were responsible for working with the educational designer to redesign their units for effective online distance learning and teaching. For many coordinators, this involved rethinking their approaches to distance education, and shifting the focus from teacher-centred to student-centred learning, and redesigning learning materials that had previously serviced independent and isolated self-study. To assist Unit Coordinators with this large task, they were provided with an incentive so that they could be released from marking duties for 45 hours for each unit they were redesigning. Unit Coordinators were asked to examine their learning design for ways to improve delivery that would take advantage of the online learning environment. Sims' et al. (R. Sims *et al.*, 2002) '*proactive evaluation'* framework was used to inform the online learning redesign. It presupposes that creating online learning environments is more effective if 'criteria by which the environments and resources might normally be evaluated, … are addressed during the planning phase' (R. Sims *et al.*, 2002). Criteria for effective, collaborative, participatory online learning environments were established prior to learning design, and individual coordinators and the educational designer jointly evaluated and redesigned units.

For many academic staff, changes to large cohort units needed to consider alongside student learning outcomes pragmatic solutions to managing learning activities. Incumbent on academic staff were the dual tasks of designing learning experiences that took into account multiple staff and large cohorts, as well as ensuring teaching staff engaged in professional development in effective online pedagogy and in using the online learning environment resources and tools. Teaching staff also needed to reconceptualise their conceptual models of distance education. Staff were also encouraged to participate in a number of other professional learning experiences provided by the educational designer working within the project. Besides one-to-one 'elbow support' a gala event was held to showcase the learning and teaching strategies and tools employed most effectively by Stage 1 Coordinators. All Stage 1 Coordinators were invited to present feature components of their units to Stage 2 Coordinators and other interested parties. This event was an opportunity to reflect on the processes and products of Stage 1 and 'inspire' the journey for Stage 2 coordinators. It was conducted at the start of the second action cycle of Stage 2 Redesign, to coincide with Stage 1's implementation of units. Following the Redevelopment and Implementation stages in Cycle 1, staff were asked to re-evaluate their professional development experiences, the learning strategies and tools used, as well as the Sakai environment. This was an ongoing process, and utilised formal and informal self-evaluation and evaluation by students.

Students

The student voice is of utmost importance in the redesign of learning experiences. Although, the data was mostly summative and quantitative in character there were a variety of student comments that could be drawn from that emerged through using CEQuery across student evaluations. Previous unit evaluations were also consulted regarding aspects of learning and teaching that worked well, as well as those that did not. The university-wide student satisfaction data was also consulted, as well as the findings of the University's Distance Education Review (UNE, 2005). Students also provided solicited and unsolicited evaluation of the Sakai learning environment, tools and learning strategies as they engaged during the Implementation Semester for each Unit. Students were also asked to provide evaluative feedback both formally through the official Unit evaluation processes, and informally by some unit coordinators who used tool such as anonymised forums and wikis within the learning environment.

Educational designer

The Sakai project utilised the expertise of an educational designer, who was located within the School of Education. The primary responsibility of the educational designer was to work with academic staff to redesign unit materials and learning experiences for effective online distance education delivery. This process involved determining the knowledge base, competency and confidence of academic staff to design learning for and operate within an online environment.

The educational designer provided professional learning for staff members in online learning pedagogy and design, as well as developing technology skills. Both of these areas were necessary to develop concurrently, but each to varying degrees in individuals. Owing to the large variations in learning needs, time commitments and preferred professional development delivery modes, a number of strategies were utilised, including 1:1 individual instruction (elbow support), often at the point of need, small group ad hoc support, as well as planned ongoing large group professional development opportunities. Importantly, the Educational Developer managed the professional development of staff and unit redesign in a manner that ensured new learning experiences for staff and students alike were oriented within solid pedagogical theoretical frameworks.

The educational designer was embedded in the school and located in physical proximity to all project participants. In particular it was non-threatening for academic staff to 'drop-in' small queries or make an appointment to discuss more involved ideas with their learning designs. This was a successful strategy as it provided opportunities for non--threatening interaction between individual and groups who were often grappling with similar issues.

Sakai web developer

The Sakai project employed a web developer to install, maintain and upgrade the learning management system. The web developer was required to both maintain and customise the system as the wants and needs of academics and the educational designer pushed the boundaries of Sakai. As Sakai is an open source learning and collaboration environment, it can be customised to meet the needs of its users (http://sakaiproject.org/). The Sakai community is constantly fixing issues and adding new features to the system, and many of these were incorporated into our system by the web developer. Similarly, improvements made by our web developer within our system were shared with the rest of the global community. In particular were a suite of web services that extended the existing Sakai web service framework for integrating other systems within Sakai, and a conversion utility to take content and assessments from other proprietary learning management systems, and bring it into Sakai (Swinsberg, 2007). As learning designs were mounted within Sakai, new learning tools were trialled. 'Bugs' were identified and rectified where possible, and ideal functionality and tools were defined as future development tasks. When Units became active in the Implementation Semesters of each Stage, Coordinators, teaching staff and students identified further issues with tools and the environment, and, these were either rectified by the web programmer or earmarked for future development as resources become available. In some instances, learning experiences were modified when tools and the environment did not behave as expected. While the focus of the project was using technology to support pedagogy, in such instances, learning was modified to accommodate existing technology.

Having only one developer focusing on Sakai brought its own issues. The web programmer was not solely working on Sakai so at times work-tasks had to be prioritised amongst others. In times of high workload, not enough focus was able to be given to Sakai in the timely fixing of any issues that arose. In addition, limited IT infrastructure behind Sakai caused some unexpected system outages. Not enough was

known technically about Sakai before implementation, in order to provide the best level of hardware infrastructure support. As the project progressed, more was learnt about the system and a set of recommendations were sought from the Sakai Foundation and the Sakai community about how best to proceed with a possible future scaling of the project. It has also been confirmed that the technical human quantity behind the project, the sole web developer, was insufficient to cope with the upgrades and support required for a project of this size. Like many projects much good will is relied upon.

The educational design process

Appropriate online pedagogies, incorporating an array of strategies supporting intellectual engagement, connectedness to the wider world, supportive environments, and recognition of difference, often require a review by educators of their conceptual models of teaching and learning (Laurillard, 2002; Salmon 2002; Goodyear, 2005) As Barnes & Tynan (2007) note the latest cohort of undergraduates and their teachers live in different technological worlds and the transfer of print-based materials, aptly described as 'shovel-ware' by Morrison & Anglin, (2006) does not achieve engagement or a buzzing learning environment. Whereas technologies have been demonstrated to afford the development of new pedagogies (Laurillard, 2002; Salmon, 2002; Siemens, 2002; Sims, 2006). Furthermore many academics tend to replicate what they have always done (Hannon, 2008; Kirkup and Kirkwood, 2005). Phillips (2005) states that the "major issues associated with the effectiveness of elearning environments are not related to technology" but to "our understanding of learning and the mismatch between empirical results about how people learn and ways that institutions and individuals conceive of teaching. (p. 544) " Individuals are often not aware of deeply ingrained beliefs about teaching and learning, and how they restrain alternative pedagogies (Raths, 2005). The inertia of deeply entrenched conceptual models can overwhelm; it can impede engagement and learning (Senge, 2006; Khosrow-Pour, 2000). To confront this challenge we designed situations where academic staff were encourage to question their conceptions of learning and teaching. In this case the role of the educational designer was complex and she was at times coach, mentor and a supportive peer providing invaluable interactions (Juwah, 2006). One aim being to encourage the use of pedagogies rich in "collaborative knowledge construction, information seeking and sharing, reflection, debate, and problem-based learning (Bonk & Dennen, 2002). When the opportunity arose, the educational designer also discussed various models of online learning, emphasising both the five stage framework of Salmon (2003) and the integrated networked models of Sims (2006) and Siemens (2005). Some coordinators engaged in debate about the effectiveness and usefulness of such models, while others were not ready to do so. The educational designer focused on sharing visions for an interactive learning ecology (Siemens, 2005), focusing energy on the learning design process, and explaining the technology and Sakai system and the pedagogy of each of the related tools.

Stage 1

Stage 1 of the redesign process for the Education faculty involved 11 academic staff. Multi-focused professional learning opportunities were made available according to demand. These included 1:1 educational designer consultations, formal workshops, quick 1:1 tutorials in Sakai, small group ad hoc training sessions on computers, online tutorials, an online team-based learning program, and informal conversation with colleagues and/or the educational designer. The project steering committee realised that a range of professional development options were required and Figure 1 illustrates the variety of professional learning activities that were made available to staff.

All academic staff had a 1:1 consultation with the educational designer. Workshops then followed and if appropriate were generally planned for groups where there were similar queries or needs. They were scheduled for participant convenience rather than expert provider convenience. The workshops were additionally considered as group problem-solving opportunities. Through multiple forms of engagement it was intended to foster a personal mastery paradigm, engaging with colleagues to share visions and engaging in discussion about personal conceptions of teaching and learning. It was felt that each interaction was enhanced by dialogue and supported both individual and group learning.

An example of the unit design process

An example of the process is shown in the re-development of a large cohort (130 students) distance learning primary science and technology pre-service teacher education course. Constructivist teaching approaches are commonly espoused for such courses, as it is important for academic staff to take into account the prior views and experiences of learners for meaningful learning to occur (Garbett & Tynan, 2004; Littledyke and Huxford, 1998). Pre-service teachers need to develop their own learning in the subject area, pedagogy associated with teaching the subject area and strategies for dealing with more

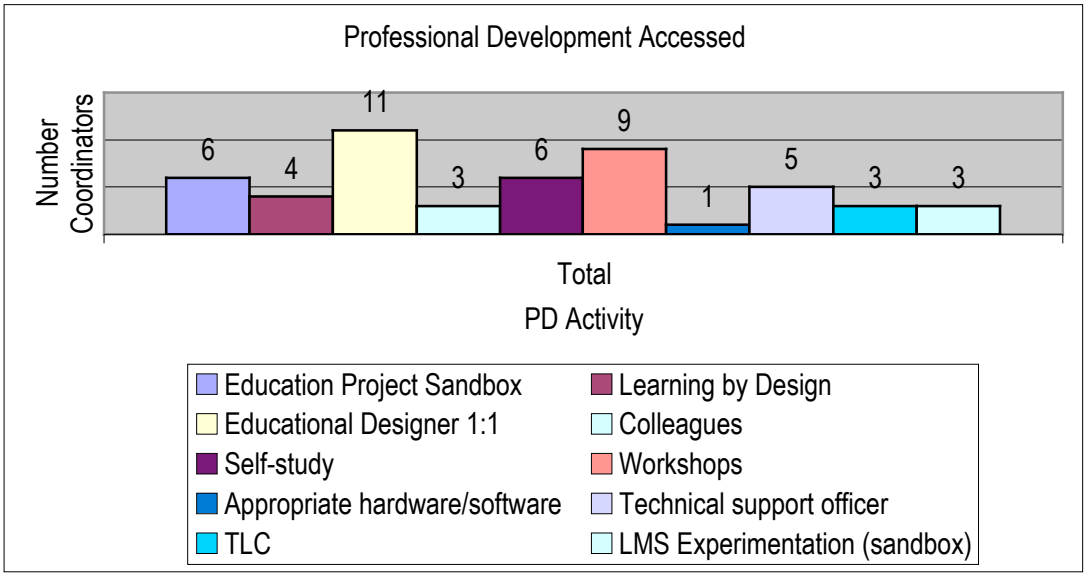

Figure 1 Professional development options

abstract ideas such, by way of example, as managing diversity in classrooms. Constructivist approaches to learning are based on social interaction so critical to the design of this unit were opportunities for pre-service teachers to hear others' views and have their own views challenged or extended.

The previous iteration had used learning materials that espoused constructivist teaching approaches and a residential school provided practical examples in a restricted time scale. The on-line environment was mainly used as a repository of learning materials for individual access, and an unstructured discussion forum that was mainly used for questions directed predominantly to the academic staff member. It was decided to create small groups of students for the on-line environment to facilitate focused discussion in manageable sized groups, which were called peer support groups (Salmon, 2002). Their primary function was to promote interaction and shared experience and expertise among the group. Collaborative group work is well known to enable deep learning and also met the design requirement for peer engagement (Head, 2003).The Sakai environment was designed in the following way to facilitate this:

All learning content/resources were initially provided in the unit materials section. These included pdf files of readings, other recommended library readings with access to selected linked e-reserve texts, full assessment details and audio podcasts summarising important topics, plus guidance for using the Sakai site and university support systems. A unit overview section provided the aims, purposes, learning outcomes and overall structure of the course. In this way students had immediate access to everything they needed individually for the course. An initial announcement directed students to the unit content/resources section to familiarise themselves with the course learning materials and an introductory podcast, which outlined the outcomes of the course, its structure to support their learning and details of assessment. It was important that this course had a meta-layer whereby pre-service teachers could experience constructivist design and recognise it for what it was - a model of good practice.

Using Salmon's 5-stage Model (2002) the initial announcement also invited each pre-service teacher to introduce him/herself in a forum thread, to provide a brief history and to state their aspirations for the course, as a way of promoting a sense of presence and identity in the group as a whole. The activity also helped the students familiarise themselves with the site, and was intended to make them feel at ease in the social environment and supported their navigation through the site. Thereafter announcements were made weekly throughout the course to introduce the learning activities and assessment requirements in a staged sequence, supported by audio podcasts produced by the coordinator to give a personal element to enhance communication and group identity. The weekly announcements also introduced reflective comments by the coordinator about important developments or any issues that emerged through the forum discussions. Each announcement on the site was also sent to each student's email address to ensure that all participants were reminded of developments and were engaged in the process. The sequenced activities, reinforced weekly though announcements, were included in the calendar, so the information was available via a number of routes, to make navigation through the site as easy as possible.

In keeping with Salmon's (2002) learning levels, a welcoming and encouraging stage allowing students to become familiar with the LMS was initiated. After initial introductions, students were invited to join peer support groups in the wiki, which was set up with 25 groups with space for six students in each, as experience of running seminars suggests that around six is an optimum number for group interaction. The peer support groups gave themselves names (such as 'Wiki Warriors', 'Science of Seven' [group 7], 'Hi 5ers' [group 5]), to personalise their group identity. Students self-selected into the groups on the basis of people they knew, similar postcodes, similar interests, or just to find a group that had space in some cases. Students demonstrated a great willingness to support each other in learning the LMS tools, and quickly moved into Salmon's stage 2 of online socialisation (2002).

Organising the units of study in this manner contributed to the interactivity between students, so that many groups were well into Stage 3 – Information Exchange (Salmon, 2002). Over successive weeks students were encouraged to listen to a series of podcasts introducing the central ideas of constructivism as an approach to teaching the subject, as well as being directed to relevant reading. They were asked in their peer support groups in the wiki to discuss and produce the group's summarised reflective views about what science and technology is, why it is relevant to primary children, what is important about teaching it, as well as their own aspirations and concerns as prospective teachers. The groups' summarised views were posted in appropriate form threads. The coordinator engaged in the forum postings by adding reflections, additional comments or summarising important ideas raised by all the groups. Such summaries were also added to the announcements for general reading. By week four of the semester groups were producing well considered summaries as illustrated by the group 'Three Thistle Thimble':

1. Showing them that science is actually a part of the world they live in, not separate from it, ie they are already scientists, and by integrating it as much as possible with other KEY LEARNING AREA'Ss (Student 1).
2. Curriculum integration; S&T is not a stand alone subject in school or in their communities (Student 2).
3. Making it relevant and using the wow factor for full advantage (Student 3).
4. Initially using a little 'Science Magic' to rivet the eyes and minds, but consolidated with achievable small group, stage appropriate 'hands on' work (Student 4).
5. Finding the topic that interests them and exploring it with a focus on science and technology. A lead by example approach with enthusiasm and interest (Student 5).
6. Making it real, not something contained in textbooks, letting them experience the thrill of scientific discovery in a hands on way, embedding learning in the context of their actual world and basing it on children's actual questions about this world (Student 6).

Students were encouraged to use the peer support groups in the wikis to share ideas and help each other as much as they could if there were issues they were not clear about. This was to promote the idea that any learning group has existing expertise and experience that is valuable and interesting to everyone in the group, as well as creating a structure that would produce group confidence and shared learning. The chat room was also available for real time discussions. When there were problems where other students couldn't help, forum threads were available for individual or group questions, which the coordinator and students from all the groups could engage in or view, so making the learning experience as transparent, democratic and efficient as possible. The blogger was also available for postings of ideas for resources, relevant websites and general sharing of reflections and summaries of the science activities that the students had been asked to produce for presentation to a residential school, so that the materials produced by all students were accessible to the whole cohort. In addition, there was an assignment e-submission section that also provided details of students' grades and details about agreed extensions.

Assessment included individual submissions of justified plans for teaching based on a constructivist framework to support children's' learning (90%), but 10% was also allocated for participation (not graded) in directed on-line discussion activities. The small allocation for grading rewarded the time students put into the process and encouraged all to participate beyond the minimum requirements as much as they needed to. The 10% allocation for directed discussion activities included the groups' reflections on the nature of the subject and strategies for teaching, plus reflective evaluative comments on the experience of the residential school and the course as a whole. Such reflection engaged students in shared metacognition of their learning process, which is an important part of the constructivist learning process for meaningful learning (Littledyke and Huxford, 1998).

The Sakai structure ensured that all students had access to learning materials, but they were able to interact with each other to facilitate the social element of constructivism. The structure was also

manageable for the coordinator, as it was made clear that group discussions in the wiki and chat room were the students' domain, while coordinator interaction was focussed on the forum threads of summarised peer group comments or threads for specific issues that could not be satisfactorily answered by peer support groups. Participation in the online activities was very high with some 95% active participation in directed activities, and with a high level of further interaction than was minimally required. This is far higher than was usual for on-line interaction. The evaluations of the course were very positive about the support provided for the students' learning (a detailed analysis of this will be presented elsewhere), which indicates that the structure was successful in promoting a sense of social learning and interaction to enhance reflective understanding of the students' progress as learners and teachers of science and technology.

Conclusion

This paper has detailed a mini-case of the implementation of a professional development approach to the design, development and implementation of renewing curriculum for improved distance education learning experiences when using an alternative open-source learning management system-Sakai. The methodology of Participatory Action Research has demonstrably engaged academic staff within the project and enabled deep engagement and conceptual change of teaching and learning practices. The voices of various members of the project throughout the first PAR cycle have been reported as demonstration of the scope and potential of this methodology as a way to underpin conceptual change of teaching and learning practices amongst staff. The focus of 'who leads' through PAR is significant to engagement and also the issue of empowerment. The lessons drawn from the project at this first stage include issues of flexibility and the ability of the project to alter quickly to meet the needs of the staff involved. It appears that individualised and group professional development has created energy and enthusiasm for attempting new ways of engaging and motivating students in the Sakai learning environment. Further, that it is important that pedagogy drives alongside technical capacity of Sakai learning opportunities for students. The big lesson for this project regarding who leads is perhaps more about 'what leads'. The arguments about pedagogy and technology and the *push pull* associated with this oft quoted has become redundant. Rather through PAR it has become a matter of academic staff leading their own conceptual change through engagement of the methodology and support from other stakeholders who can support change. The project will continue through two more cycles and further lessons will be drawn in the future about sustainability and scalability of the approach. The project team believe that this approach is useful for others intending to make significant contributions to enhancing student learning experiences in online earning environments.

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