# Immersive learning environments

## A study of teachers' innovation using The Le@rning Federation's digital learning resources

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# Introduction

The following issues raised in the study reported here are currently the targets of active research and development efforts in many educational jurisdictions in many countries:

- the use of 'learning objects' and digital repositories in teaching and learning settings;
- the educational uses of immersive digital environments; and
- teacher capacity-building and innovation.

In general terms, this study was aimed at enhancing teachers' ability to innovate with digital content. It consisted of the training of teachers in accessing and using immersive environments, enlarging the range of web-based collaborative platforms to which teachers have access and, specifically, introducing and summarising for teachers The Le@rning Federation's (TLF's) digital educational materials. Over the course of this study, teachers developed innovative materials and processes, working in teams across a range of school subjects, over a period of six weeks, familiarising themselves with the materials and processes, and planning collectively a unit of work for their students.

Their final reports, the record of their collaborative online planning, the materials they developed, and the research team's interviews with them together constitute the corpus of data summarised in this report.

## The research questions

The main research questions for the study were:

- How is TLF and other content being used by teams of teachers when they design interactive learning experiences for their students?
- What is the nature of these teachers' pedagogical innovations and what is the nature of their innovation processes?
- How can teachers' distributed work and knowledge-sharing be effectively supported, including through the use of online collaboration environments (in this case, web-conferencing and wiki-based document management)?
- How do teachers interpret and use resources (online and otherwise) to inform themselves about the nature of educational innovation processes and about research on learning in immersive environments?

## Background to the study

The project was funded by Curriculum Corporation of Australia, a body that has, via its project called TLF, produced learning objects across a range of curriculum areas, and a repository of educational digital materials, for use in Australian and New Zealand schools. One motivation for the study, therefore, was to continue the process of documenting:

- educators' awareness of TLF materials;
- the kinds of uses to which TLF materials are put; and
- educators' judgments of the efficacy of TLF materials in the improvement of students' learning and engagement.

# Conceptual framework for the study

## Educational reform and ICT

The integration of information communication technologies (ICTs) into schools has always been accompanied by aspirations for pedagogical reform, for example, by aiming to have teachers become more learner-centred, to increase the active role of students in their learning and to include more elements of inquiry-oriented and collaborative learning. Although educational reforms typically take years to bear fruit on a system-wide scale (Cuban 1993), expectations concerning the impact of ICTs on classroom teaching have been more ambitious, with many studies aiming for immediate or short-term (3–5 years) observable effects of the introduction of ICTs into schools. Examples of the kinds of ICTs for which expectations have been ambitious include hardware, the Internet and, more recently, digital whiteboards and 1:1 computing. Findings have by and large been sobering; Cuban's early verdict of 'oversold and underused' still sets the tone (Cuban 1993). Teaching practices in particular have not so far been shown to be affected by the inclusion of ICTs in schools (Kozma 2003; Law, Pelgrum & Plomp 2008).

Looking at the history of reforms in education more generally (for example, Cuban 1993), this comes as no surprise. Any rapid change in teaching practices on a system-wide scale is highly unlikely. This is not to say, however, that things stay inert locally. But the nature of the many local change processes that contribute to system-wide development has not received as much attention. This is because most of the educational research on the impact of ICTs on classroom teaching has:

- been of the 'what works?' variety;
- used more or less distal outcome measures (for example, surveys of teachers and students regarding teaching practices, learning outcome measures); and
- been aggregated over many classrooms and schools.

The research shows steady, incremental but small changes over time (Law et al 2008). Input–output studies, as important as they are, gloss over the variations in change processes at the local (teacher, classroom, school) level. A closer look at this local level reveals that change is not uniform across sites, but rather that there is a wide variety of pedagogical changes accompanying ICTs at the level of teachers, classrooms and schools. These changes range from inertia through incremental change to radical change. Arguably, to understand how change comes about at the system level, we need to analyse the nature of this variation at more local levels. Further, to learn how to accelerate change at the system level, we need to learn from those local cases where change has taken place quickly and has been sustained over time (Hubbard, Mehan & Stein 2006).

Another reason to conduct studies on local practices in order to gauge and understand system-wide change is the well-established but often ignored fact that there is no direct relationship between reform intentions and actual changes in institutions (Blumenfeld, Fishman, Krajcik, Marx & Soloway 2000). Reform intentions, interpreted individually and differently by actors at the different levels in a system, lead to a complex network of alignments and misalignments among personal and institutional goals (Barowy & Jouper 2004). As Rasmussen and Ludvisen (2008) argued:

> *... there seems to be a general agreement that prior studies have often: (a) overlooked the recipients' process of negotiating and making sense of the reform; (b) not recognized the impact of history on the institution; and (c) not accounted for the significance of artefact mediation in human activity.*

The research reported here looks at local innovation practices enacted by a group of teachers. It builds on concepts developed in organisational change research, in particular in Activity Theory (Engeström 1999), Adaptive Structuration Theory (Poole & DeSanctis 2004) and Critical Realism (Mutch 2002) to conceptualise the processes of innovation in practice. Using this framework allows consideration of both organisation-related and actor-related aspects of practice, whereby teachers are the actors at the centre of the analysis. Activity relates to the 'performative' aspect of a practice, and differs from the 'ostensive' perspective, which is the ideal or schematic form of a routine (Feldman 2003). Stipulating this dual nature of practice allows it to be conceptualised as continually produced, as something to be achieved in an ongoing way, rather than given (see also Orlikowski 2000).

The bulk of teachers' work is performed without reliance on division of labour or peer involvement, so variations in practice are perhaps best understood as being brought about by reflective activities (Mutch 2007). The premise examined here is that the 'autonomous reflective' stance in the taxonomy suggested by Margaret Archer (2003) is crucial to the act of innovating. (She distinguishes further between *communicative reflexives*, *meta-reflexives*, and *fractured reflexives*.) Autonomously reflective teachers, when working on 'projects' (areas of concern), undertake their own conversations in relative isolation from the concerns of others. This process has the potential to bring them into conflict with, and seek to change, the organisational structures surrounding them, thus creating a variation of a practice.

*Activities* as the term is used here, and as introduced by Activity Theory (Engeström 1999), are 'the actions of and interactions between actors as they perform their daily duties and roles'; *practice* in this context refers to 'activity patterns across actors that are infused with broader meaning and provide tools for ordering social life and activity' (Lounsbury & Crumley 2007, p 995). Practice subsumes activities. And while *activities* involve acts that are free of deeper social meaning (for example, starting a computer program), *practices* (for example, teaching a lesson or assessing students' knowledge) provide order and meaning to a set of activities.

Whether a variation of activities is interpreted as a change of practice depends on:

- whether or not the variation is noticed, remarked upon, and attended to;
- how it is valued, in particular, if it is seen as an appropriate or anomalous variety;
- whether or not it is theorised (for example, codified); and
- whether or not, in the case of an anomalous variation, sufficient proponents can be mobilised to defend the variation against critics and eventually to change the legitimacy status so that the anomaly can become part of the established and routine practice (Lounsbury & Crumley 2007).

These factors are set out and arranged in Figure 1.

The Lounsbury and Crumley model of practice innovation focuses on the process of institutionalisation and has comparatively little to say about how variations of practice are produced by individual actors. This requires equal attention to the performative and the

ostensive aspects of practice, and requires that the material side of activities is taken into account (Orlikowski 2007). When the technologies in a site become integral to a set of activities, then both the idealised and actual practices are reshaped. In the terms of the model, when organisational elements (routines, roles and information) become embedded in technology, their material aspect interacts with and affects their ostensive and performative aspects (Volkoff, Strong & Elmes 2007). Building on Norman (1988) and Suthers (2001), we suggest that the impact of ICTs on activities and practices be considered in terms of:

- affordances;
- constraints;
- representational guidance; and
- salience.

In order to bring these elements together, we suggest a model of practice innovation as depicted in Figure 1. In this model we also take into account that most organisational discourse, including discourse about practice variations, is itself mediated by (for example, communication) technology and therefore needs to be represented in the artefacts at hand in any given setting (often the documents) in order to have impact at the organisational level (Phillips, Lawrence & Hardy 2004). The documents become both causes and effects of institutional diversity and change.

Investigating technology use by teachers and their students with a practice lens (Orlikowski 2000) rather than only an activity lens allows a better combination of the actor-oriented view with the organisational perspective (a recent example of this being shown in Yamagata-Lynch 2007). Practice is made understandable and durable by its interpretation in the terms of wider cultural rules (Scott 2001). As an outcome of how organisations 'make sense' of a sequence of activities, and of diverse and changing activities, practices are often codified (written down), disseminated and integrated into procedural and policy documents.

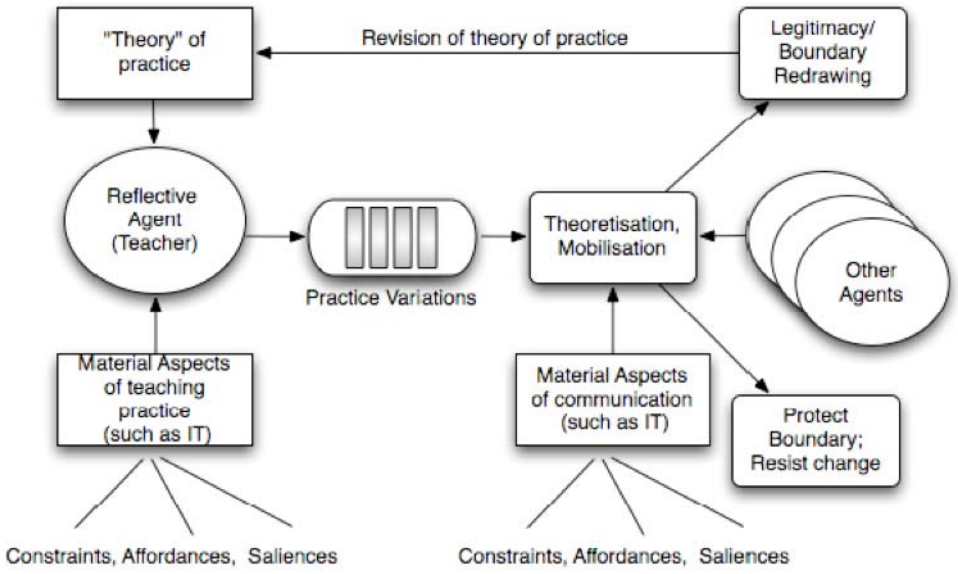


**Figure 1: A process model of practice change**

## Personal involvement in innovation

It is widely acknowledged that the involvement of organisational members is of great importance in understanding organisational change. It is a notion that has become the focus of important theoretical contributions to innovation research, such as transformational leadership, individual sense-making, and member resistance (for a comprehensive overview, see Shavinina 2003). Here, we explore constructs helpful not only in understanding why people do or do not become involved in organisational innovation, but also in understanding why some people sustain their engagement with innovation and change and others do not.

A pivotal concept here is professional identity. People's relatively enduring sense of identity has a profound effect on the activities they engage in, and the activities they find worth sustaining. In an institutional context, personal identity is a particularly relevant concept precisely because innovations often result in changes to work roles and practices, with the consequence that people might see their professional identities under threat. This in turn might lead them to adopt a resistant stance (King 2003).

While threat to professional identity has been frequently used to explain resistance to change – that is, seen as a barrier to engaging at all with innovation – the notion of adaptive expertise is helpful in order to explain why some teachers sustain innovation, and many others do not. Research on expertise (Barnett & Koslowski 2002; Crawford & Brophy 2006) indicates that adaptive problem solving is pivotal to 'life-long' professional development. This kind of problem solving comprises (a) learning from solving problems, even familiar problems, in a non-routine way, while (b) being cautious not to lower one's level of performance too much. Adaptive experts frequently construct new knowledge from experience, but they keep performing at a high level of proficiency. Routine experts perform well in the application of skill and knowledge in a familiar problem setting, whereas adaptive experts are able to construct new knowledge as they solve problems (Crawford & Brophy 2006). As a consequence, adaptive experts are better prepared to solve new kinds of problems.

The tendency of adaptive experts to create learning opportunities out of their problem solving and to exploit these opportunities for knowledge building seems closely related to the notion of epistemic agency, first introduced into educational research by Scardamalia (2002). *Epistemic* refers to knowledge and what it means to know something, and *agency* refers to humans' ability to exert control over their course of actions and to decide how to apply their will in concrete acts (Reed 2001). Epistemic agency, hence, refers to people being responsible for what they know and being in control of activities that extend their knowledge. In the educational context, the concept is now discussed as a characteristic of students, in particular in the context of students' collaborative work in creating knowledge (for example, Schwartz & Okita 2004), but can also be applied to people in general, including teachers engaged in learning from experience (Erstad 2004).

Note that we do not refer to the 'standard' models of innovation adoption and diffusion such as that of Rogers (1995), for a recent overview of which see Straub (2009), because our concern is less with the question of how teachers adopt innovations produced by others, but rther how teachers generate innovations of their own. Furthermore, Rogers' model of innovation diffusion in organizations takes an overly simplistic (quantitative) view of the diffusion of innovtion as basically an aggregation of individual adoption decisions. We think models such as Lounsbury's (Lounsbury & Crumley 2007), which conceptualise the spread of innovation in terms of concrete activities (such as writing memos), are more productive.

## Spreading innovation

While the elements of autonomous reflectivity, professional identity, adaptive expertise and epistemic agency can help us understand how and why people make decisions to engage in or with innovation (or not) and to sustain innovation of their practices (or not), they do not shed much light on the manner in which innovations are communicated throughout an organisation. Given our focus here on local innovation and a 'bottom-up' direction of change, answers to the questions of what helps and what blocks dissemination of knowledge about local practice innovations are central. Effective use of social and symbolic resources, such as discussions, meetings and documents, is a key requirement for innovators to affect others.

Lounsbury and Crumley's (2007) model of practice innovation (see also Figure 1) points to the importance of 'theorisation', that is, specific forms of symbolic encoding (for example, in narratives) that need to be marshaled and put to work if an innovation is to 'travel'. Symbolic artefacts, such as memos, digital slide presentations and, increasingly, videos are essential means of spreading innovations across people and across organisational hierarchies. Artefacts and tools are not only essential for the dissemination of an innovation, but also for its generation: whether an individual person is the innovator or whether the innovation is brought about by a group of people, tools and artefacts are essential to support the innovation process; and sometimes they are themselves the object of the innovation. This is simply because human activity is almost always mediated by tools and artefacts.

A heuristic framework that is valuable in expanding on the significance of artefacts in activity and change revolves around the notion of *activity systems*, as developed in Activity Theory (Engeström 1999). In the graphical representation developed by (Engeström 1987) the mediated nature of human activity is depicted in the upper triangle (Subject – Tools and signs – Object) in Figure 2. This triangle is only the 'tip of the iceberg'. Underlying individual activity is a community, its rules, and its ways of dividing labour and tasks. In order for an innovation to take hold in an organisation, the change created by an individual or a small group must be propagated in such a way that it changes the community's interpretation patterns, the rules and values it upholds, and ways in which its members work together. In other words, this mobilisation of the whole network, as it were, requires activation of social and symbolic resources.

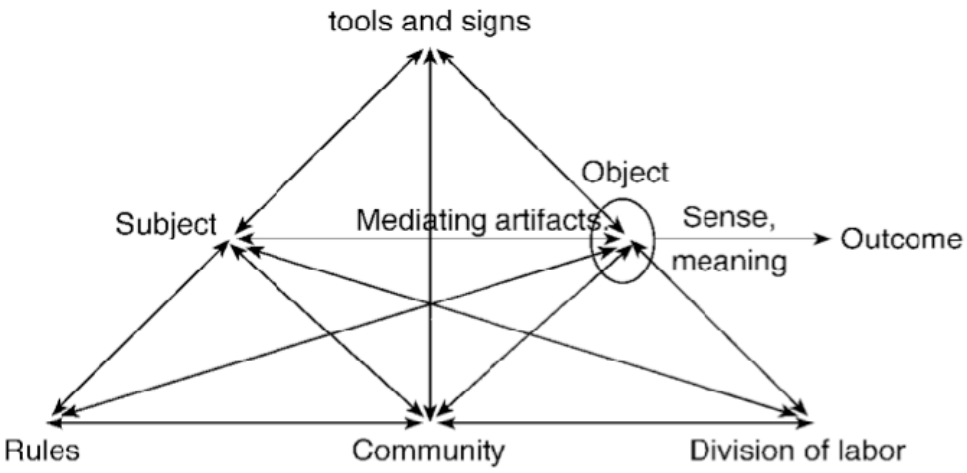


**Figure 2: The structure of a human activity system (Engeström 1987, p 78)**

Knowledge building is a genuinely collaborative endeavour: knowledge must be shared with and found useful by others in order to count. This directs our attention to the social dimension. Edwards' work on relational agency in the context of the professional development of educators is relevant in this respect. Relational agency involves the 'capacity to offer support and to ask for support from others' (Edwards & Mackenzie 2005) and, more precisely, the 'capacity to work with others to expand the object that one is working on and trying to transform by recognising and accessing the resources that others bring to bear as they interpret and respond to the object' (Edwards 2005). It is therefore a concept related to engaging with others for the business of creating knowledge and changing practices, a special variant of help-seeking 'skill' in general.

With respect to the symbolic resources – document-like artefacts – their role in the creation of innovation can be described using the taxonomy suggested by Norman (1988) and Suthers (2001): affordances, constraints, representational guidance and salience. Different representational notations make it more or less difficult to grasp a new idea and to invent a new idea. Equally, different representations make it easier or harder to allow others to grasp an innovation. In addition to this representational vocabulary, the significance of the ways in which language, in particular written language, is used to communicate ideas to others is important.

In this study, we analyse, among other things, the uses of documents as collaboration and communication tools, at the group level rather than at the organisational level. Participating teachers worked together in teams over a period of about six weeks. They were charged with the task of developing a new way of using ICTs in their teaching, building on TLF content, on other digital resources and on the tools readily available to them. In order to document their instructional design ideas and their work with students, and to learn about how their innovations played out, participants were encouraged to use a wiki. We focused on wikis as the main medium of collaboration not only because wikis are frequently used to get work done in (virtual) teams, but also because they play an interesting double role in often operating as both the medium and the product of collaboration. As a product, they function as a knowledge object (Paavola & Hakkarainen 2005). As a medium, they function as a coordination device (Olson, Malone & Smith 2001).

Wikis are frequently used by cross-divisional innovation teams. In such groups, we find collaboration typically conducted through a combination of face-to-face meetings, synchronous remote communication (for example, phone conversations), and an asynchronous textual medium such as a wiki. The artefacts created on wikis and in version-controlled collaborative document repositories can be seen as combining task-based work with interaction and coordination functions. This is why such artefacts are used not only to document work but also to coordinate team members' activities and to structure their interactions. Using such document-like artefacts is convenient because they often form part of the groups' work anyway and hence constitute only a small communication overhead (MacMillan, Entin & Serfaty 2004).

With the rapid spread of blogs in wikis on the Internet, wikis have become part of popular culture. Although the interest in wikis has been boosted by the success of Wikipedia, the use of a wiki engine specifically to orchestrate mass cooperation around an online encyclopaedia is not the most typical use in higher education. Wikis were originally developed for fostering writing and collaboration in small teams – software development teams in particular (Leuf & Cunningham 2001) – and it is this form of use that we analyse here.

Wikis are frequently used by teams not only because they are easy to set up and use, but also because they typically provide excellent support for a deep notion of document versions, making it clear who created which changes and which are key versions. The wiki can be the immediate object of users' activities (for example, a report), or play a supporting function in creating other artefacts such as computer programs or models. In the latter case, wikis are often used to explore the problem, communicate with clients outside the team, support coordination within the group (such as meeting agendas, minutes and other joint planning pages) and write documentation for the program or model. In all these cases, a wiki page, or set of wiki pages (we use the singular 'wiki' here for ease of reference) is appropriately seen as a 'document for action' (Zacklad 2006), as 'a set of fragments contributed by various authors, the final content of which remains largely indeterminate, while its fast dissemination makes it a useful tool for conveying information, assisting decision-making and probing situations' (Zacklad 2006, p 206).

## Focus of innovation in this study: new uses of digital resources

Participating teachers were encouraged to design uses of resources such as those available through TLF, so as to engage students in their learning, in particular those students who do not usually engage well with textual learning materials. It was up to teachers to decide if these resources would be made available to their students as a whole-class group (for example, on a digital whiteboard), in small groups, or in the interaction between an individual student and a computer. We suggested to the teachers that they consider including elements of game-based learning or 'immersive' learning. To that effect, examples from Second Life and Whyville were demonstrated during the first workshop. Readings that focused on the pedagogical aspects of using such virtual environments were made available on the wiki.

We decided to focus on games and immersive environments because they require a combination of pedagogical and technical understanding if they are to be employed creatively for the purpose of learning, and because they hold the potential to engage students who are not reacting well to current teaching practices. For teachers who are experienced in using ICTs in their classrooms (digital whiteboards in the case of the participants in this research) and who are familiar with learning objects and digital resources (such as those provided by TLF), immersive and game-based learning looks like a logical next step. Further, the nation-wide implementation of 1:1 computing in Australian schools for Years 10–12 makes it necessary to think more carefully and creatively about how to engage students in learning through using ICTs in ways that are not completely orchestrated and monitored by the teacher. Because we know that young people engage for hours with social and game-based ICTs (Squire 2005), building on that level of engagement for the purpose of learning seems a strategy worth pursuing.

The evolution of virtual worlds began in the 1970s with text-based multiple-user dungeons (MUDs) developing into 'multiple-user dungeons object-oriented' (MOOs), based on fantasy role-playing games such as 'Dungeons and Dragons'. The development of educational multiple-user virtual environments (MUVES) such as 'River City' and 'Quest Atlantis', and massive multiplayer online role-playing games (MMORPGs also known as MMOs and MMOGs) such as 'EverQuest', 'World of Warcraft' and 'Civilization III', is indicative of increasing technological richness and educational use.

Several factors underpin the move towards the use of game technology in an educational context. With engagement and motivation of learners recognised as a problem faced by many institutions (Gee 2005), the use of games is viewed as a way to access the 'Nintendo age' or

‘video game generation’ – the generation of learners that has grown up with rapid developments in the game industry. In fact, the use of computer games is so ubiquitous that Ferdig (2007) indicates that 70 per cent of college students in the United States play some form of game, whether it be online, video or computer, single player or multi-player. The widespread use of games provides educators with opportunities to harness motivating factors such as fantasy, challenge, immersion and communication to enrich the learning experiences of students.

For many reasons, however, games are not always viewed positively in the education sector as commercial issues need to be considered before institutions adopt games as part of the curriculum, as not every type of software marketed to children and young people is a success, and as software of the ‘edutainment’ variety has not been well received by young people. As Gros (2003) explained, adults select the edutainment software for their children, but it is young players who select games. Hence, adults select games that they view as appropriate in terms of learning, while gamers play for entertainment and challenge.

## Innovating together: teacher-led design-based research

Teacher-led design-based research (TDR), a teacher-centred variant of design-based research methodology (The Design-Based Research Collective 2003), was proposed by Bannan-Ritland (2008b) as a form of teachers’ professional development. Instead of aiming at short-term ‘training’ or ‘upskilling’, TDR aims at developing teachers’ adaptive expertise: the capacity to develop and innovate, continuously and in a self-guided manner, professional skills and practices. TDR challenges teachers ‘to undertake research activities in their classrooms by designing and testing instructional material prototypes (including software) and participating in novel teaching procedures involving other teachers (working in teams with a research team) engaged in multiple cycles of data collection about their students’ learning’ (Bannan-Ritland 2008b, p 246).

Having its roots in learning research rather than professional development, TDR takes the form of a research project or inquiry project rather than that of a typical training program. TDR therefore has much in common with the aspirations and forms of action research. However, it is more specific in its theoretical and methodological orientation, as reflected in its core components of:

- developing pedagogical and technical designs;
- testing them; and
- improving them in the light of evidence, in terms of students’ learning.

Practically, TDR is closely related to the learning sciences (Sawyer 2006) both conceptually (how learning is conceived) as well as epistemologically (what constitutes valid warrants for knowledge claims).

A guiding assumption of TDR is that professional development should aim to build people’s capacity to innovate rather than to close gaps between skill demands and teachers’ current skill levels and practices (see also Markauskaite & Reimann 2008). TDR tries to overcome the ‘deficit’ view underlying many forms of training and move towards a competency-based approach. TDR aims to:

- immerse teachers in intensive experiences that focus on deep learning;
- have teachers construct their own meaning from current experiences;
- focus teachers on how students learn;
- develop sustainable innovation practices; and
- develop collaborative research competence, including cooperation with full-time researchers and research groups.

The TDR process can be realised in many forms (for more detail on this process, see Bannan-Ritland 2008a), but the main phases usually include:

- identifying a pedagogical problem and assessing students' needs (which would ideally include a formulation of the problem in the framework of a specific learning theory or a combination of specific theories);
- designing a prototype of an instructional solution (materials, methods, tools) for addressing those needs, taking into account research on and experiences with former solutions to the same or similar needs or problems;
- implementing the solution in teachers' classrooms and in research on students' learning;
- assessing and reflecting on the effects of the solution, including side-effects and long-term effects;
- recycling (1) or (2), depending on the outcomes of the analysis.

In addition to possessing organisational capacities, to engage successfully in TDR it seems necessary for teachers to:

- be able to engage in productive and sustainable team work, making increasing use of ICTs for collaboration and communication;
- be sufficiently familiar with the learning sciences to rapidly, and on demand, 'catch up' with research developments in specific areas;
- be familiar with methods of designing instructional prototypes and planning their implementation;
- have command of a repertoire of classroom-oriented research methods; and
- be able to rapidly further develop specific research skills or acquire new ones.

## Implications for the design of this study

The focus of this study was on how teachers design the innovative uses of digital (online) resources for their classroom teaching, and how they assess to what extent the designs work in terms of improved engagement and learning by their students. Participating teachers worked together in small groups.

To supplement other resources (such as phone and email), the teachers were provided with access to a wiki engine in order to document their work. We were interested, among other things, in teachers' documentation practices, because research on organisational change and change management tells us that such practices are pivotal for the spread of innovation in institutions, whether that innovation occurs top-down or bottom-up.

In consultation with representatives from the New South Wales Department of Education and Training's Western Region, it was decided to structure the research around a professional

development event. In the light of the huge geographic distances and our interest in teachers' documentation practices, it was decided to conduct the professional development activities in a 'blended learning' form, with a face-to-face workshop at the beginning and end of an online phase of about six weeks. Face-to-face contact has been shown to be a necessary preliminary step for any team-development activity, especially for online teams (Farooq and others 2007; Reimann 2008).

The design of the 'blended' professional development used in this project built on existing professional relations among teachers. Focusing on structured tasks, it took into account the lessons learnt from projects aimed at developing teachers' 'communities of practice' online. As Barab and others (2008) found from their extensive research into the ILF (online teacher) community, in order to attract teachers' sustainable involvement it is necessary to design for 'bounded participation' rather than for a general 'online community'. 'Bounded participation' is concerned with specific goals and activities, with a shared but concrete goal such as designing an assignment, lesson or assessment. The TLF project further revealed that teachers interact in a sustained fashion only when they can cooperate with colleagues whom they know personally. Personal mutual trust was also identified as a prerequisite for sharing *critical* comments on each others' contribution. In the absence of a strong sense of collegiality and trust, teachers are very hesitant to be critical of their colleagues' contributions.

# The teacher-led design research scenario

## Participants in the study

Participants in this study were drawn from schools in and around Dubbo, a town in the New South Wales Department of Education and Training's Western Region. This region covers approximately 385,000 square kilometres, about 50 per cent of the area of New South Wales and an area slightly bigger than Germany. The Western Region, while possessing a range of secondary and tertiary industries that assist in sustaining its economic base, is largely known for its mining and agriculture, and is dependent on natural resources. The region incorporates 26 local government areas and 198 government schools, many of which have high proportions of students, including Aboriginal students, who live in remote and rural areas.

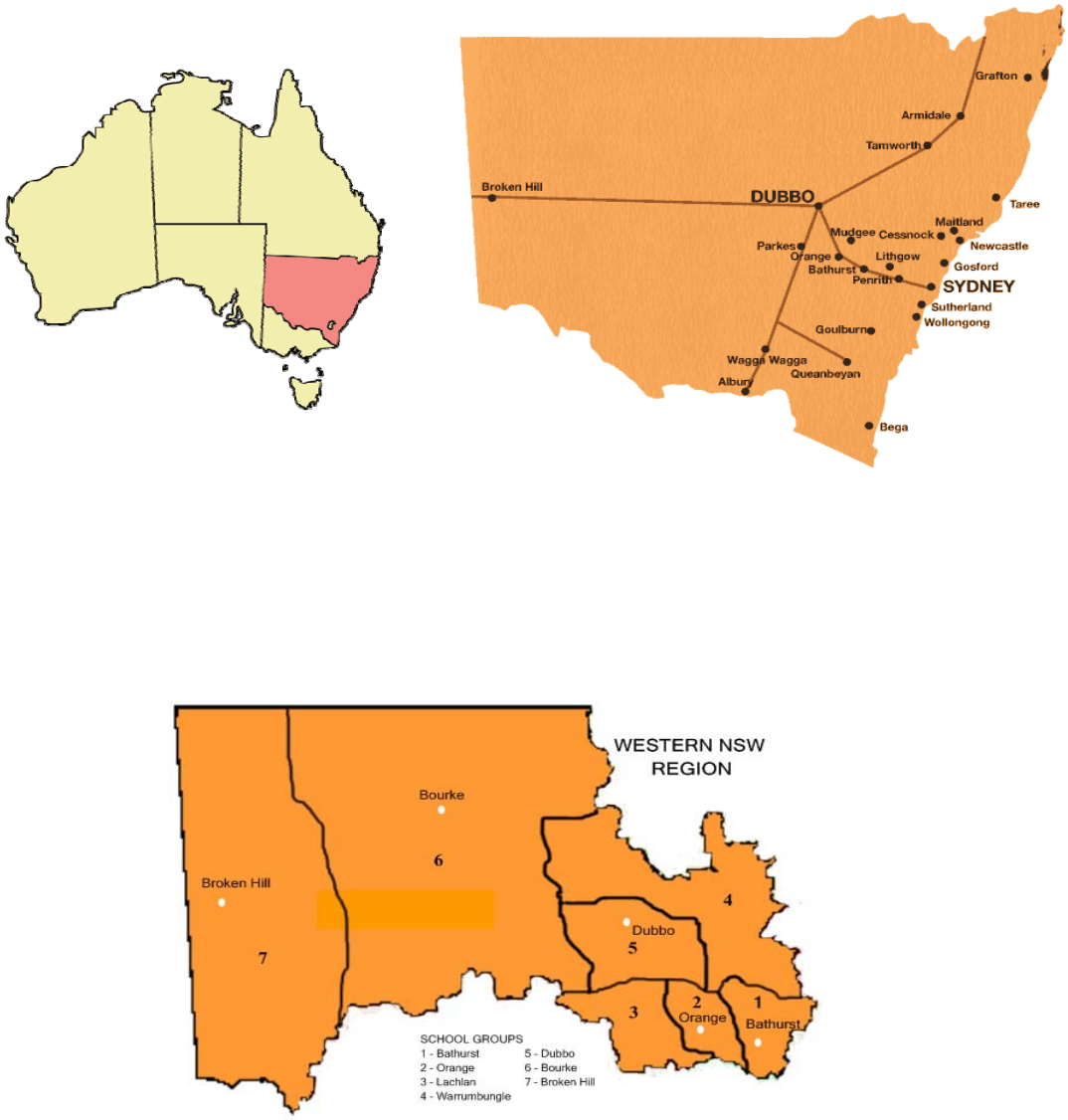


**Figure 3: Location of the Western Region**

The region, and in particular the schools in and around Dubbo, have recently focused their educational efforts on the use of information and communication technologies. They regard themselves as having a leadership role in that regard not just for their region but for New South Wales more generally. The teachers and students in Dubbo can be seen as 'change-ready', with higher than average levels of familiarity with digital technologies and thus more confidence in their own abilities to initiate and sustain digitally based technological improvements.

## Educational technology in the Western Region

The Western Region sees itself as a leader in the integration of information and communication technologies into teaching and learning in the government schools of New South Wales. Its schools have broadband Internet services and interactive whiteboards, and are well advanced in the use of video-conferencing to enhance the students' learning experiences.

As early as 2004, Regional Director Carole Mc Diarmid, who has responsibility for supporting principals and frontline teaching staff in the region's schools, recognised that classroom use of technology could make learning exciting for young students and become an essential resource in developing the skills needed for 21st century life. In addition, she recognised the potential benefits of students in remote locations being serviced by a variety of interactive learning experiences. This vision was shared by Anne-Marie Furney, School Education Director – Dubbo, who at the time was responsible for the Western Region's Teachers' Professional Learning portfolio.

Dubbo city schools were early adopters of digital whiteboards, the purchase of which was made possible by the sale of Fairview Heights Public School and its land under an agreement with the then Minister of Education, Carmel Tebbutt, that the proceeds of the sale would be spent on education in the Dubbo area. Dubbo principals participated in deciding that funds be spent on 195 digital whiteboards across 10 school sites.

This decision was accompanied by professional development opportunities for teachers, conducted at iTeach C21, a dedicated state-of-the-art training facility established in 2006 to support staff to integrate technology into teaching and learning so as to engage and support the 21st century learner. In the centre of Dubbo, iTeach C21 is equipped with technology that enables training for teachers in remote areas to be conducted via video conferencing as well as within the centre itself. The centre offers a range of courses for teachers at various stages of development. The regional leaders believe that the impact of these provisions is emerging over time as teachers learn, apply and modify their practice in the light of their growing understanding of the impact of technology on learning.

## Overview of the research design

The main task for the six teams of teachers (each of 3–7 members) was to design an engaging, interactive learning experience for their students, for instance, a design for learning that takes place in an easily accessible online 'world' such as Second Life or Whyville.

The design task comprised:

- defining learning goals;
- selecting learning content;
- deciding how the learning content would be presented in the learning environment; and
- planning for students' activities in the virtual space.

Learning content was to be drawn primarily but not exclusively from existing digital resources, in particular TLF digital curriculum resources. Teachers were encouraged to explicate their design decisions comprehensively so that their experience was of value to other teachers who might engage in similar projects in the future. Teachers were also asked to predict how their students would work in the learning environments, and what they might have to say about their experience. In summary, the goal was to have teachers produce materials that would form the bases for analysis and reflection on the learning design by the design teams.

We envisaged that most of the design teams' work would take place in face-to-face meetings, but could and should be extended into online cooperation, at least to an online representation of the teams' work. Online cooperation could include web conferencing and the use of an asynchronous team platform to document milestones, tasks and decisions and to store design artefacts. Figure 4 depicts the relations between the main elements of the design scenario.

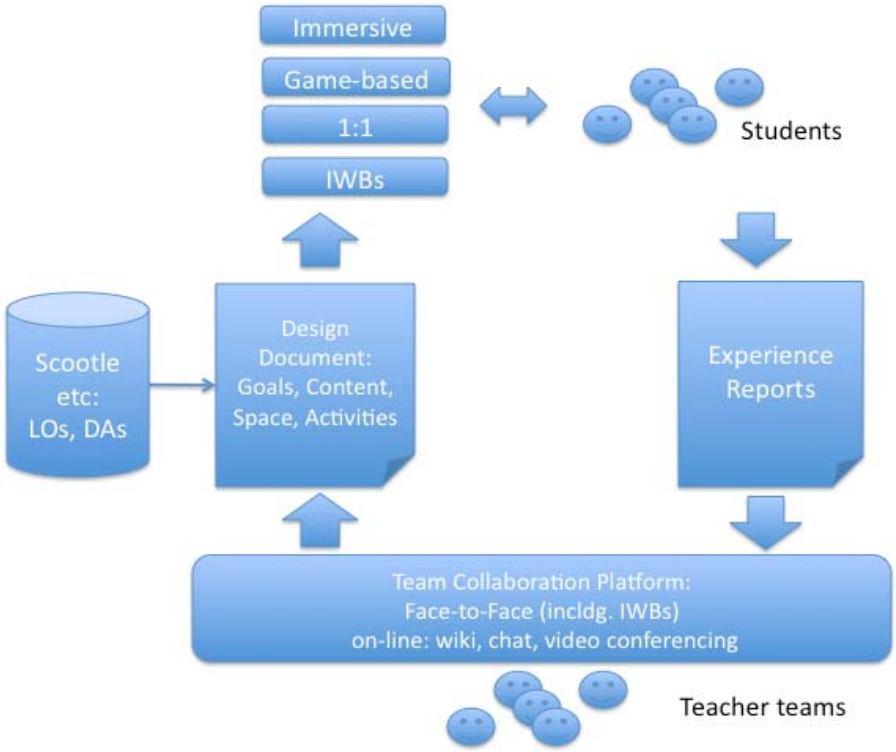


**Figure 4: Overview of teachers' design task**

The work with the teachers followed a 'sandwich' model of two workshop events at either end of six weeks of (partially online) team activities.

## Structure of workshops and online materials

### The first workshop

During the first workshop (Dubbo, 2–3 February 2009) the following topics were covered (see Appendix 1 for the full agenda):

- Introduction to the project
- Introduction to the Trac wiki and first practice with using this wiki
- Introduction to TLF materials and on how to access them through Scootle
- Overview of the pedagogical design task
- Introduction to immersive learning and examples from Second Life
- Overview of the learning research task
- Team formation

The four goals of this workshop were:

- to introduce participants to the main pedagogical principles of immersive and game-based learning;
- to explicate teacher-led design research;
- to introduce the Trac wiki as a documentation platform; and
- to instigate the team-forming process.

Hands-on experiences with the wiki and with at least one web-based immersive environment were provided. (With respect to the latter, because of access problems to Second Life, we were able to use only Whyville during the workshop.) Since the notions of design and research are pivotal to teacher-led DBR, the notion of teachers being involved in (team) design and research was expanded. For the teams of teachers charged with developing a design document and a research report as outcomes of their teamwork, page templates for these two documents were provided (see Appendix 3 and Appendix 4).

#### *Document and collaboration platform: the Trac wiki*

In order to document their work and manage documents and collaboration, workshop participants were given training on a the wiki engine Trac (see www.edgewall.com). Trac is a tool designed to assist people working in teams to build artefacts such as documents or software. It has three tightly integrated parts:

- a wiki for collaborative editing of web pages for general group communication and, in our case, for collaboratively creating the major report for the project;
- an issue-tracking system based on ‘tickets’: when a task needs to be done one creates a ticket, which is allocated to a team member; and the ticket is closed once the task is completed;
- a browsing interface to a repository – based upon the version control system called Subversion (SVN) – for storing documents of any kind.

As participants were not required to use either tickets or the versioning engine, only the wiki engine was introduced in the workshop. However, the ticket and versioning functionality was not blocked, and information was provided on those features for participants’ interest.

Trac is a free and open source. A project site set up on a server at The University of Sydney provided access to all participants in the study. Nobody outside the project had access to the site. Figure 5 shows a screenshot from a Trac wiki page. All pages can be edited freely.


**Figure 5: A wiki page in Trac**

### *Online resources (in the wiki)*

Through the wiki's 'homepage' (see Figure 6), online resources, made available for all teams, took the form of information resources on (a) immersive learning pedagogy (including examples), (b) TLF materials, (c) use of digital whiteboards and (d) teacher-led design-based research. The digital whiteboard background materials were included because digital whiteboards are well represented in Dubbo's schools, and because we were interested to see to what extent teachers with ample experience with these whiteboards would use them with game-based or immersive elements. In addition to content, the wiki's homepage provided access to Help information and to the teams' project pages.

## The second workshop

The second workshop (Dubbo, 30 March 2009) focused on presentations from all the teams. It was followed by the focus-group interviews described in the next section on research methods.

**Team Site for Immersive Learning Pedagogy Project**

**30-Mar-09:** Final workshop with team presentations, see FinalWorkshopDubbo for more information.

For the first workshop, see KickOffWorkShop.

## Information Resources

An initial set of information resources is provided. But there is much more 'out there', and you can modify and add to these resources at any time. Wikis pages are never "completed"!

- ImmersiveLearningPedagogy
- TheLearningFederationMaterials -- Digital learning resources for Australian Schools
- DigitalWhiteboards in classrooms around immersive learning environments
- TeacherDesignResearch
- ParticipantsProfilePages

## Team challenges and project outcomes

You'll be working together on two tasks, the DesignTask and the ResearchTask. By the end, each team will have created solutions to these tasks and in the process of addressing the tasks will have extended and enriched the information resources.

- TeamFoodTechnologyStageFourFive
- TeamScienceStageThree
- TeamBeingAussieStageTwo
- TeamPersonalDevelopmentStageTwoThree
- TeamLiteracy
- TeamMathsStageOne
- TeamMiscelleneous
- TeamSymbols

## Collaboration Tools

- GentleWikiIntroduction -- read me first if new to TRAC
- TracGuide -- Built-in Documentation
- WikiFormatting -- How to build nice looking wiki pages (Tip: this page is available when editing any wiki page; keep it open in a *second* window besides the one you are editing.)
- TracTutorialVideos
- Trac Participation

**Figure 6: The wiki ‘homepage’ with links to teams, tools, and resources. (Note that the team names changed after a while.)**

# Conduct of the study

## Research methods and tools

The study employed the following four methods of data collection.

**Online survey of participants' backgrounds:** This survey, administered during the first workshop, contained items inquiring into participants' education, professional experience, ICT experience and familiarity with TLF materials (see Appendix 5: Survey of participants).

**2. Survey of participants' attitudes and practices in regard to ICT:** This short questionnaire, also administered during the first workshop, inquired into participants' self-efficacy beliefs regarding the use of ICT in classroom settings and participants' self-evaluation of their ICT skills (see Appendix 6: Participants' attitudes towards use of ICT).

**3. Document production:** During the six-week online phase of the study, participants produced various documents in the form of wiki contributions, MS Word files, and MS PowerPoint presentations.

**4. Interviews:** After the second (one-day) workshop, semi-structured interviews were conducted with some of the participants. The interview questions (see Appendix 7: Interview guidelines) had been circulated in advance.

The data arising from these four methods of inquiry is analysed below.

## Analysis of data

### 1. Participants' backgrounds

The professional qualifications of the participants surveyed during the initial workshop is shown in Table 1.

**Table 1: Teaching qualifications**

| | Number | Valid % |
|---|---|---|
| Three-year diploma | 6 | 15.8 |
| Four-year Bachelor of Education | 23 | 60.5 |
| Undergraduate degree plus Graduate Diploma of Teaching | 9 | 23.7 |
| Total | 38 | 100 |
| Missing | 6 | |

The participating teachers' nominated areas of undergraduate specialisation are summarised in Table 2.

**Table 2: Undergraduate specialisation**

| | N | % | % of cases |
|---|---|---|---|
| Language/Literacy/English | 14 | 18.9 | 46.7 |
| Numeracy/Mathematics | 11 | 14.9 | 36.7 |
| Science/Technology | 15 | 20.3 | 50.0 |
| Studies of Society and the Environment /HSIE | 10 | 13.5 | 33.3 |
| Health and Physical Education | 13 | 17.6 | 43.3 |
| The Arts | 11 | 14.9 | 36.7 |
| Total entries | 74 | 100.0 | 246.7 |

The distribution of years of teaching experience among the teachers who participated in the first workshop is shown in Table 3.

**Table 3: Teaching experience**

| | Number | Valid % |
|---|---|---|
| 2–5 years | 19 | 50.0 |
| 6–10 years | 7 | 18.4 |
| 11–15 years | 3 | 7.9 |
| 16–20 years | 3 | 7.9 |
| More than 20 years | 6 | 15.8 |
| Total | 38 | 100.0 |
| Missing | 6 | |

In summary, all teachers who participated in the first workshop had current primary and secondary teaching qualifications, were spread across a representative range of curriculum/teaching specialisations, and were younger and less experienced than the average for teachers in New South Wales.

## 2. Participants' attitudes and practices in regard to ICT

The following tables 4 and 5 summarise the findings of this survey of all participants at the first workshop.

**Table 4: Trends in responses: means and standard deviations of survey items showing above and below median response ranges on a 5-point scale (i.e., only values < 2.0 and > 3.0 reported)**

| Item | Mean | Standard deviation |
|---|---|---|
| I believe that I could complete the job using the new software: | | |
| … if someone else helped me get started. | 4.03 | .758 |
| … if I had used similar software before this to do the same job. | 4.09 | .712 |
| I hesitate to use a computer for fear of making mistakes I can't correct. | 1.44 | .705 |
| I don't feel apprehensive about using a computer. | 4.06 | 1.278 |
| Using a computer does not scare me at all. | 4.09 | 1.288 |
| Computers make it possible to work more productively. | 4.12 | 1.066 |
| I can make the computer do what I want it to. | 3.85 | .834 |
| I need an experienced person nearby when I use a computer. | 1.52 | .712 |
| I avoid coming into contact with computers in school. | 1.35 | .812 |
| I will use computers regularly throughout school. | 4.53 | .992 |
| I know of websites that demonstrate experiments. | 1.74 | 1.286 |
| I can name topics that would be suitable for research projects using the web. | 1.82 | 1.141 |
| I can name ways in which I could assess students' web-based work. | 1.50 | 1.261 |
| I can name criteria on how to judge if interactive web resources would be good for learning. | 1.53 | 1.107 |
| I can name reasons why computer learning may not suit some students. | 1.71 | 1.001 |

Table 5 shows the significant correlations (Modified Bonferoni adjustment used, p<.0005, n=40, critical r =.50).

**Table 5: Significant correlation between items**

| Item | Correlates positively with | Correlates negatively with |
|---|---|---|
| CE and knowledge | I can make the computer do what I want it to.<br>I know how to create a web page (with text).<br>I know how to import graphics into a web page. | |
| I don't feel apprehensive about using a computer.<br>Using a computer does not scare me at all. | Computers make it possible to work more productively.<br>I will use computers regularly throughout school. | I need an experienced person nearby when I use a computer.<br>I avoid coming into contact with computers in school. |
| Computers make it possible to work more productively. | I will use computers regularly throughout school. | I need an experienced person nearby when I use a computer.<br>I avoid coming into contact with computers in school. |
| I can make the computer do what I want it to. | I will use computers regularly throughout school.<br>I know how to create a web page (with text).<br>I know how to import graphics into a web page. | I avoid coming into contact with computers in school. |
| I am not in complete control when I use a computer. | | I know how to create a web page (with text).<br>I know how to import graphics into a web page. |
| I need an experienced person nearby when I use a computer. | I avoid coming into contact with computers in school. | I will use computers regularly throughout school.<br>I know how to create a web page (with text).<br>I know how to import graphics into a web page. |
| I know how to import graphics into a web page. | | I will use computers regularly throughout school.<br>I know how to create a web page (with text).<br>I know how to import graphics into a web page |

Using a conservative level of significance, we see two general, negatively correlated clusters of variables regularly and reliably appearing in the responses of these teachers:

Cluster 1:

- CE + knowledge
- I know how to create a web page (with text).
- I know how to import graphics into a web page.
- I will use computers regularly throughout school.
- Computers make it possible to work more productively.

Cluster 2:

- I need an experienced person nearby when I use a computer.
- I avoid coming into contact with computers in school.
- I am not in complete control when I use a computer.

An initial step in the analyses that follow is to document patterns of responses to various items in the study, including the interview setting and the demographic features of the participants. For instance, we can examine the relationships between the experience, gender and professional qualifications of the participants, and their familiarity with ICTs generally, with digital and online materials and specifically with TLF materials. This will not only provide a sharper view of this particular group of participants, but may also reveal patterns relevant to the amount and kinds of epistemic and relational agency experienced and exercised by them in this setting.

One way of pursuing these questions is to employ cluster analysis, a technique that draws out associations among the profiles of participants on the variables at hand. Since both variables and respondents can be clustered, the logic in the following sections is first to reduce the variables to a statistically reliable and interpretable set of dimensions and then to cluster the participants into 'most like' families of profiles on the basis of those clustered variables.

This 'double-clustering' process is begun by examining the relationships among the demographic measures provided by the participants in the survey (see Appendix 5 for survey instrument). Figure 7 shows a 'proximity map' or dendogram of the four demographic variables: years of teaching overall, years of teaching at this school, gender and professional qualifications. Variables that join early in the line are assessing essentially the same dimension. In this instance, we see that years of teaching overall and years of teaching at this school join quickly, while gender and qualifications remain uncorrelated to that pairing and to one another.

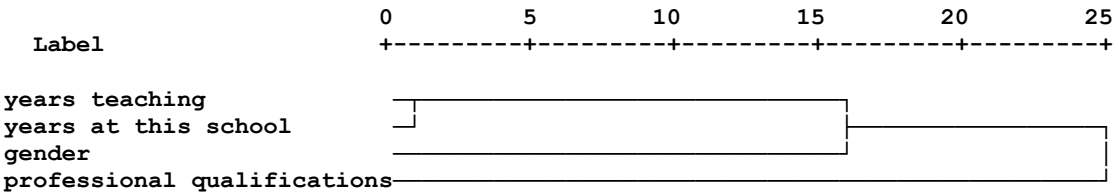


**Figure 7: Dendrogram clustering questions regarding teaching experience, gender and qualifications**

These three groupings of variables – dimensions, as we call them here – can now form the basis of the clustering of individual participants. Individuals are assigned standard scores (means set to zero and standard deviations set to 1 based on the overall group distribution) and then clustered on the basis of most similar profiles on the three grouped variables. Results are shown in Table 6. (Note that in reading this table, the convention for interpreting the scores will be that standard scores between -.5 and +.5 will be regarded as 'average', scores above +.5 as 'high' and less that -.5 as 'low'.)

**Table 6: Cluster centres (in standardised scores) for three demographic dimensions**

| | **Cluster (*n* participants per cluster)** | | | |
|---|---|---|---|---|
| | *1 (23)* | *2 (5)* | *3 (7)* | *4 (2)* |
| Years of teaching | -.36 | 1.76 | -.38 | .32 |
| Gender | .56 | .56 | -1.74 | -1.74 |
| Qualifications | -.13 | -.13 | 1.0 | -1.71 |

There are four statistically discernible clusters of participants on these dimensions, the first being the largest by a considerable margin:

- Cluster 1 ($n$ = 23) is of average age and experience, more likely female, with average formal professional qualifications.
- Cluster 2 is also more likely female, with average formal professional qualifications, but is significantly *more professionally experienced* and familiar with their current school setting.
- Cluster 3 is of average age and experience, male, and *more* highly qualified;
- Cluster 4 is of average experience, male, and significantly *less* professionally qualified.

In Figure 8 we repeat the double clustering procedure used above to determine the patterns of responses to questions concerning participants' familiarity with, and professional development (PD) in, basic ICTs such as MS Word, digital resources generally, online content and learning objects.

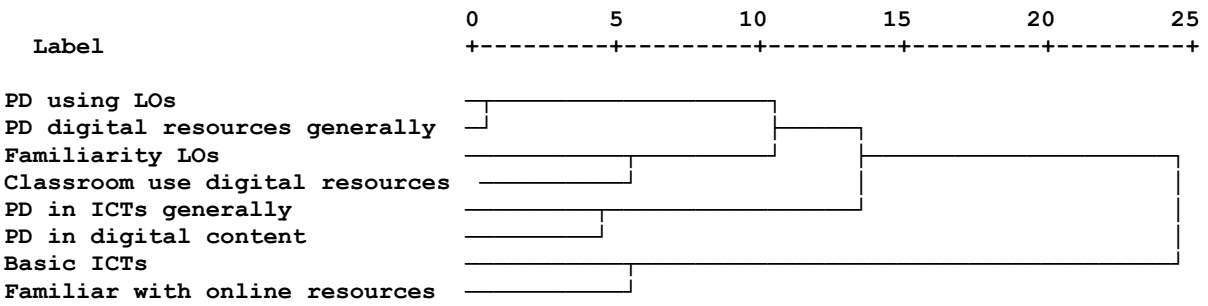


**Figure 8: Dendrogram clustering regarding teaching experience, gender and qualification**

These dimensions can now be interpreted and form the basis of the clustering of the survey responses of individual participants.

**Dimension 1** Familiarity with TLF materials

- To what extent have you engaged in professional development activities to enhance your familiarity with the use of these *learning objects* in the classroom?
- To what extent have you engaged in professional development activities to enhance your familiarity with the use of these *digital resources* in the classroom?
- To what extent are you familiar with the use of *learning objects*, such as those produced by TLF, in the classroom?
- To what extent are you familiar with the use of *digital resources*, such as those produced by TLF, in the classroom?

**Dimension 2** Initiating learning about non-TLF resources

- To what extent have you engaged in professional development activities to enhance your familiarity with the use of ICT of this kind in the classroom?
- To what extent have you engaged in professional development activities to enhance your familiarity with the general use of digital content in the classroom?

**Dimension 3** Familiarity with non-TLF resources

- To what extent would you say you are familiar with the use of information communication technologies in the classroom as they relate to standard ICT applications such as MS Word and/or MS PowerPoint?
- To what extent are you familiar with the use of digital online curriculum resources, for example, digital encyclopedias and websites, in general in the classroom?

Four clusters of participants were found to share profiles on these three dimensions. This solution is found in Table 7.

**Table 7: Cluster centres (in standardised scores) for ICT familiarity and professional development**

| | Cluster (*n* participants per cluster | | | |
|---|---|---|---|---|
| | *1 (12)* | *2 (10)* | *3 (4)* | *4 (12)* |
| Familiarity with TLF materials | .28 | 1.03 | -.83 | -.86 |
| Initiating learning about non-TLF resources | -.37 | 1.31 | -1.12 | -.34 |
| Familiarity with non-TLF resources | .62 | .58 | -2.16 | -.38 |

The solution found three moderately sized clusters and one small cluster of participants. These four statistically discernible clusters can be described as follows:

- Cluster 1 is above average in their familiarity with non-TLF materials.
- Cluster 2 is above average on all counts.
- Cluster 3 ($n = 4$) is well below the group's average on all counts.
- Cluster 4 is below average in their familiarity with TLF materials and average on the two other counts.

Less than one-third of the respondents reported familiarity with TLF materials and, significantly, all but 10 of them reported substantial exposure to the uses of ICTs in general, through professional development activities.

**Table 8: Kendall's Tau measures of association for demographic and familiarity/activity responses (bolded** entries significant at p < .01; italicised* entries p < .05)**

| | **Years of teaching** | **Gender** | **Qualifications** | **Familiar TLF** | **Initiates PD** |
|---|---|---|---|---|---|
| Years of teaching | | | | | |
| Gender | .08 | | | | |
| Qualifications | -.09 | -.23 | | | |
| Familiar with TLF | .20 | -.01 | .12 | | |
| Initiates PD | .21 | .21 | .10 | **.45**** | |
| Familiar with digital non-TLF | -.06 | .05 | *.27** | **.35**** | **.34**** |

It is notable that reported levels of familiarity with both TLF and non-TLF materials – and reported levels of professional development in relation to ICTs generally, digital materials and online materials – are unrelated to teaching experience (and thereby age), gender or level of qualifications in this group of teachers. Levels of familiarity with digital materials and extent of professional development are positively related. Unsurprisingly, reportedly higher levels of professional development are related to higher reported levels of familiarity with digital materials.

## 3. Document analysis

The various documents produced by participants during the online phase of the study, in the form of wiki contributions, MS Word files, and MS PowerPoint presentations, were analysed in a primarily quantitative form for this report.

While 32 teachers participated in the first workshop, only 26 took part in the teams that were formed in the days following the first workshop. The six teams were:

- Being Aussie Stage 2
- Literacy for Distance Education
- Maths Stage 1
- Miscellaneous (sub-teams 1 and 2)
- Science Stage 3
- Symbols Stage 3

The online phase of the study and the second workshop were conducted only with the 26 teachers who had joined a team. The six teachers who participated in the first workshop, but who did not form or join any active team, were included in the analysis of the survey data but not in the analysis of interviews or documents.

### *Participants' wiki activities*

A total of 58 pages were created, excluding the personal profile page produced by each participant and the pages created solely by the organisers. For those 58 pages, a total of 825 versions were created, with the smallest number of versions being 1, the largest 118, and the average 15. As the pages are of differing lengths, the following analyses are based on a word count of contributions.

On average, teachers contributed between 40 and 450 words per week, with a minimum of 0 and a maximum of 3,500 words. Figure 9 shows the weekly distribution.

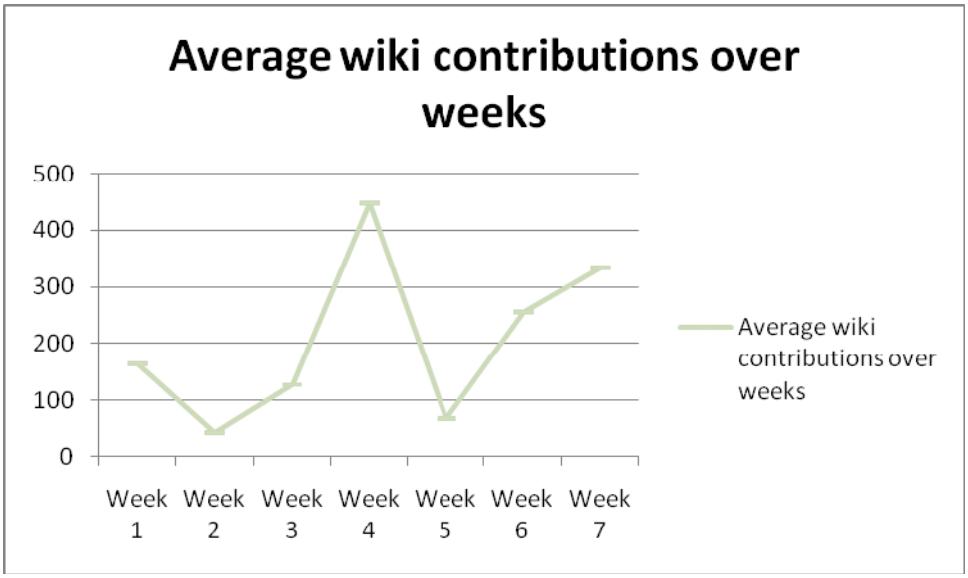


**Figure 9: Average weekly wiki output (number of words)**

In addition, over the seven weeks, participants contributed MS Word documents (as attachments to wiki pages) containing a further 28,600 words, an average of 1,100 words per participant. Participants' final output consisted of (mostly MS PowerPoint) presentations, which are not included in the word count presented here.

When looking at these figures, it needs to be kept in mind that the main form of meeting chosen by team members was a weekly face-to-face meeting. A pattern developed of one member of the team producing the meeting minutes and uploading these minutes, along with other artifacts generated by the team members, to the wiki site. Due to this practice of using the wiki as a repository rather than as a team writing tool, the wiki contributions cannot be interpreted as reflecting all of the individual work. Team members contributed much more than is reflected in their wiki contributions and in their individual file attachments.

Not only did the level of individual contributions vary considerably, there was also substantial variation among the teams, as shown in Table 9. Teams' use of the wiki varied widely, both in terms of quantity of contributions as well as in patterns of use over time. While most groups used the wiki only sporadically, some groups made more regular and substantial use of this medium. Since groups were mainly meeting face-to-face, an 'oral' meeting culture dominated the 'textual' culture that has been shown to be important in disseminating innovation in institutions. The textual culture is not one to which teachers are generally exposed, given that teachers work in relative isolation from each other, in closed classrooms.

**Table 9: Contributions (number of words) to the wiki site per team**

| Teams | Wk 1 | Wk 2 | Wk3 | Wk 4 | Wk 5 | Wk 6 | Wk 7 | Total | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Being Aussie | 106 | 162 | 1040 | 456 | 0 | 0 | 905 | **2669** | **381** |
| Literacy DE | 213 | 0 | 0 | 706 | 530 | 867 | 371 | **2687** | **384** |
| Maths | 583 | 401 | 304 | 1772 | 666 | 1175 | 3009 | **7910** | **1130** |
| Misc. 1 | 1899 | 0 | 24 | 4679 | 0 | 0 | 2508 | **9110** | **1300** |
| Misc. 2 | 1463 | 0 | 129 | 2245 | 0 | 3503 | 0 | **7340** | **660** |
| Science | 0 | 0 | 1368 | 731 | 0 | 0 | 0 | **2099** | **300** |
| Symbols | 0 | 0 | 207 | 317 | 418 | 391 | 1182 | **2515** | **360** |
| **Total** | **8528** | **1671** | **6159** | **21786** | **2965** | **12204** | **15482** | **66126** | |
| **Mean** | **1218** | **239** | **880** | **3112** | **424** | **1743** | **2200** | | |

Given the wide variation in contribution size and contribution patterns, and the fact that the groups used the wiki mainly as a repository for documents created in face-to-face meetings and by individuals, a closer look at the patterns of wiki use and the content generated makes sense only for the three teams that worked comparatively regularly with the wiki: Literacy for Distance Education (LDE), Maths Stage 1 (Maths), and Symbols, referred to henceforth as the 'lighthouse' teams.

### *Wiki use in three 'lighthouse' teams*

*Quantitative: team level*

The average weekly contributions by the three lighthouse teams together are shown in Figure 10, and the contributions of each team in Figure 11. In all three teams we see a trend of higher levels of contribution over time, and a clear difference between the Maths team and the other two teams. The Maths team used the wiki more regularly over the six-week period, and contributed the highest number of words overall.

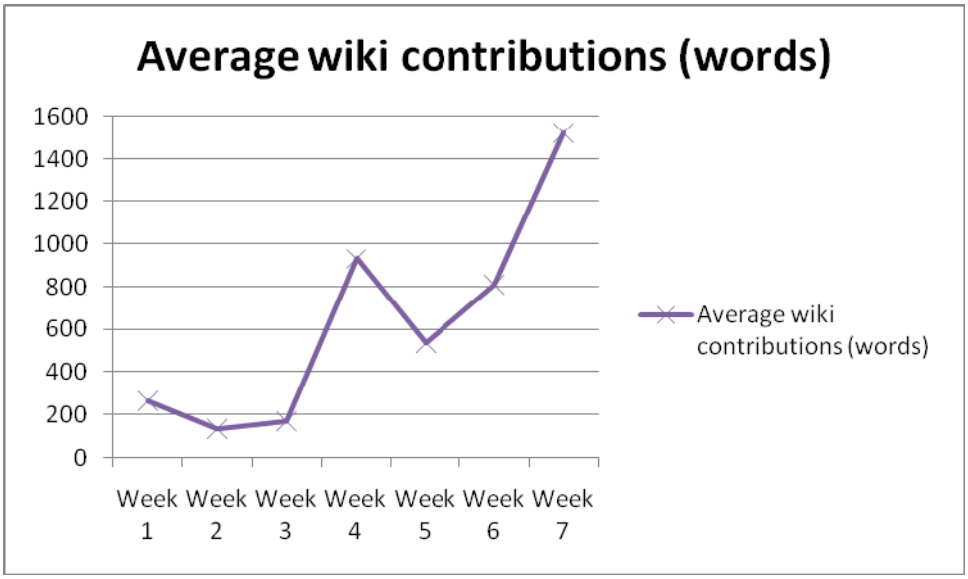


**Figure 10: Average wiki contributions by three lighthouse teams**

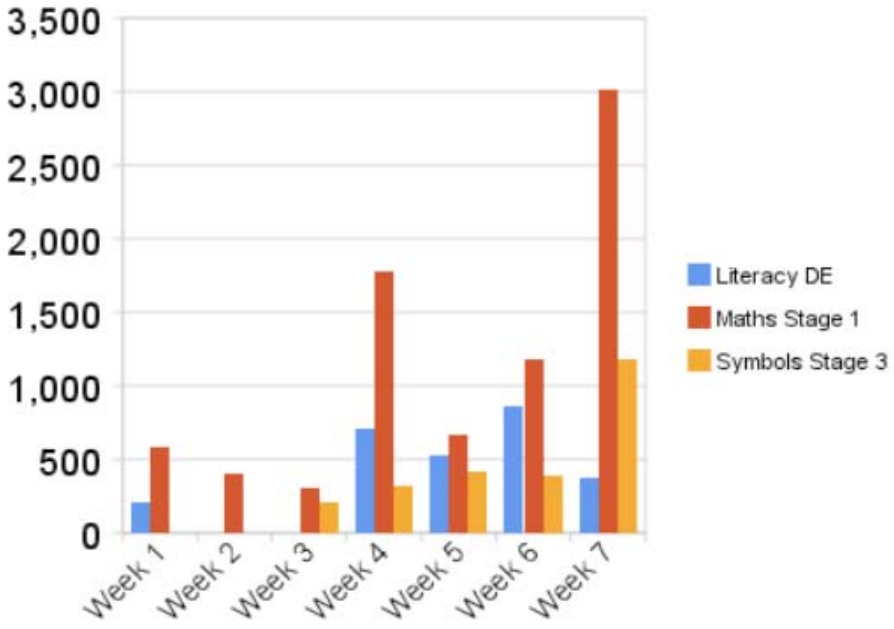


**Figure 11: Weekly contributions per lighthouse team**

*Quantitative: individual level*

As was the case in the other teams, there is substantial variation in the contributions of individual members of the lighthouse teams (see Table 10). This is not to be interpreted as non-participation or free-riding by some members; but rather as reflecting the fact that the main work was done in face-to-face meetings and that 'uploading' of documents was done by a specific person who was not necessarily the sole writer. We know, for instance, that due to the browser settings on Department of Education and Training computers, wiki usage was hindered by sessions being time-limited; and that consequently many participants would complete their writing before copying and pasting it into the wiki.

**Table 10: Individual contributions in lighthouse teams**

***Literacy for distance education***

| Member | Wk 1 | Wk2 | Wk3 | Wk4 | Wk5 | Wk6 | Wk7 | Mean |
|---|---|---|---|---|---|---|---|---|
| LDE1 | 213 | 0 | 0 | 181 | 530 | 244 | 0 | 166.86 |
| LDE2 | 0 | 0 | 0 | 525 | 0 | 0 | 371 | 128 |
| LDE3 | 0 | 0 | 0 | | 0 | 623 | 0 | 103.83 |
| LDE4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LDE5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | 42.6 | 0 | 0 | 176.5 | 106 | 173.4 | 74.2 | 79.738 |

***Maths***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| M1 | 0 | 545 | 222 | 291 | 151 | 723 | 714 | 378.00 |
| M2 | 0 | 0 | 0 | 61 | 0 | 0 | 12 | 10.43 |
| M3 | 583 | 0 | 0 | 1256 | 0 | 399 | 0 | 319.71 |
| M4 | 0 | 401 | 304 | 455 | 666 | 0 | 2820 | 663.71 |
| M5 | 0 | 0 | 0 | 0 | 0 | 776 | 177 | 136.14 |
| **Mean** | **117** | **189.2** | **105.20** | **412.6** | **163.4** | **379.6** | **744.60** | **301.6** |

***Symbols***

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SY1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0.43 | 1.13 |
| SY2 | 0 | 0 | 6 | 317 | 418 | 391 | 1182 | 330.57 | 420.38 |
| SY3 | 0 | 0 | 198 | 0 | 0 | 0 | 0 | 28.29 | 74.84 |
| **Mean** | **0.0** | **0.0** | **69.0** | **105.7** | **139.3** | **130.3** | **394.0** | **119.7** | **133.6** |

*Qualitative: kinds of contributions*

Table 11 sheds more light on the qualitative differences in the documents (including attachments) produced by the lighthouse teams. One difference between Maths and the other two is that, in addition to the jointly authored Design and the Research Document, the Maths team members also developed substantial individual research reports.

**Table 11: Pages (wiki and word attachments) created in the lighthouse teams**

| Team | Pages | Page word count | Description |
|---|---|---|---|
| LDE | LiteracyDesignDocument | 1280 | The focus for the research involves student interaction with ICT and its usefulness in teaching literacy skills, specifically related to descriptive text. The learning environment for research has centered upon three different scenarios. |
| | MY Project.doc | 360 | Description of her MY Grammar project |
| | Dubbo Public School Literacy Project.doc | 671 | Project description |
| | Lit_Review.doc | 548 | Literature review |
| | LiteracyResearchDocument | 2720 | Using the research template, the document presents their findings of whether ICT can improve students' descriptive writing skills |
| | ICT in Schools.pdf | | Digital resource |
| | TeamLiteracy/Minutes | | Links to weekly minutes documents |
| | Literacy Meeting Minutes.doc | 207 | Week 1 minutes |
| | Literacy Meeting Minutes Week 2.doc | 179 | Week 2 minutes |
| | Literacy Meeting Minutes Week 3.doc | 288 | Week 3 minutes |
| | Literacy_Meeting_Minutes_Week_4.doc | 370 | Week 4 minutes |
| | Literacy_Meeting_Minutes_Week_5.doc | 1001 | Week 5 minutes |
| Maths | Meeting Minutes etc | 5043 | Minutes from weeks 1–7 |
| | MathDesignDocument AND planning | 1258 | The group seems to explore different approaches to learning, assessment, and types of technology. |
| | MathsStageOneProject.doc | 527 | A formatted version of the design document. |
| | MathResearchDocument | 231 | This document is incomplete, seems to be a draft of a research report. |

| | | | |
|---|---|---|---|
| | Research_Report_Team_Maths_Stage_One.docx | 2818 | This document is a draft description of their research, methods, findings, etc. |
| | Final TRAC report.docx | 5437 | This is the final research report. |
| | graph.xlsx | | Charts and graphs showing results from the student surveys |
| | Graphs.docx | 12 | Charts and graphs showing students' responses to survey questions |
| | SURVEY_students.doc | 143 | Scootle survey of home use and games |
| | Learning objects used for project.doc | 1705 | List of TLF learning objects used in their study, with identification numbers and descriptions |
| | TRAC letter to parents.doc | 143 | Letter to parents describing the project. |
| | Trac parent survey.doc | 175 | Survey for parents asking about their child's Internet use |
| | TRAC Staff_Survey_for_Project[1].doc | 135 | Survey asking other staff how they use learning objects in their teaching |
| | Scootle logon cards.pub | | Logon cards for students (to take home?) |
| | NNNNResearchNotes | 2530 | Sharnon's research notes |
| | NNNNResearchNotes | 2495 | Sue's research notes |
| | NNNNResearchNotes | 2017 | Helen's research notes |
| | Example of Scootle Use Recording.notebook | | Digital resource |
| | NNNNResearchNotes | 1122 | Sharni's research notes |
| | NNNNResearchNotes.doc | 849 | A more organised version of her notes |
| | CIMG1827.AVI | | Digital resource |
| Symbols | FirstMeeting | 751 | Minutes from their first meeting |
| | PlanningMeetingFriWeekTwo | 239 | Minutes from Week 2 |
| | SecondMeeting | 213 | Minutes from 2nd meeting |
| | WeekFiveMeeting | 443 | Seems to be minutes from one participant who was not able to make the meeting |
| | WeekSevenMeeting | 114 | Minutes from Week 7 |
| | WeekEightMeeting | 276 | Minutes from Week 8 |
| | WeekNineMeeting | 597 | Minutes from Week 9 |
| | SymbolsDesignDocument | 803 | The document examines pedagogy and learning assets |
| | SymbolsResearchDocument | 997 | Final research report |

Regarding the quality of the products, we performed a summative analysis of important features of the documents produced. The Design document for instance we would expect to contain information on the *design rationale*, that is, the reasons for selecting a certain alternative and rejecting others. In the Research document, we would expect rationales concerning research decisions, such as using an observation method or an interview. We would expect the use of particular *rhetorical* means in the documents (for example, highlighting lessons learned) because these are useful for communicating with an audience external to the team. To complement the picture, we included in this analysis the final presentation (delivered during the second – final – workshop). The results are displayed in Table 12. While we find evidence of the key elements we would expect to see in the documents, rhetorical devices aimed at driving home a main point or recommendation are largely absent.

**Table 12: Aspects contained in the key outcome documents**

| Team/document | Template used | Rational (+/-) | Informative | Persuasive/critical analysis |
|---|---|---|---|---|
| ***Literacy*** | | | | |
| Design document | Yes | Yes | yes | no |
| Research document | Yes | No | yes | no |
| Presentation | NA | No | yes | no |
| | | | | |
| ***Maths*** | | | | |
| Design document | Yes | Yes | yes | yes |
| Research document | Yes | Yes | yes | no |
| Presentation | NA | | yes | no |
| | | | | |
| ***Symbols*** | | | | |
| Design document | Yes | Yes | yes | no |
| Research document | Yes | No | no | no |
| Presentation | NA | No | No | no |

The statistics on the versioning and authoring of the key wiki documents (see Table 13) are strongly supportive of the conclusion that, in two of the three lighthouse teams, the wiki engine was used as a place for joint writing and knowledge creation. At least in the Literacy for distance education and Symbols teams, the number of versions created is substantial and the documents are multi-authored. The Symbols team seems to have used the wiki more as a repository rather than a 'living' document. The Maths team's research document is a special case as the shared document is short (231 words, see Table 11), but each team member produced an individual research report of substantial length and with continuous contributions (versions) throughout the project phase.

**Table 13: Statistics concerning the key documents**

| | Design documents | | | Research documents | | |
|---|---|---|---|---|---|---|
| | ***Length*** | ***Versions*** | ***Authors*** | ***Length*** | ***Versions*** | ***Authors*** |
| LDE | 1280 | 45 | 2 | 2720 | 58 | 2 |
| Maths | 1258 | 13 | 3 | 8395 | 110 | 5 |
| Symbols | 803 | 24 | 1 | 997 | 12 | 1 |

### *Team research presentations (all teams)*

Each team presented their research during the second workshop. We report the summary of these presentations and provide a short analysis regarding the research quality and the potential impact of the presentation artefacts (mostly MS PowerPoint files).

#### *Being Aussie*

Due to time and scheduling constraints, as well as the affordances of physical proximity, the team conducted its research as two sub-teams.

#### *Sub-team A*

Research question: Does modeling increase students' confidence when approaching new technology?

Research design: They used a survey, anecdotal records and observations of students' ability to use new software; some design rationale was reported.

Analysis: Not discussed in the presentation.

Results: The presentation did not report research outcomes.

The unit was based on lesson design, inquiry-based learning, technology, and classroom communication, each of which the team members felt was a classroom priority at this time. The teachers felt that students were pretty confident on the computer (100 per cent of them had computers at home; 95 per cent had access to the Internet). Two students involved in the project had, in the past, used a MUVE (Club Penguin). The teachers felt that the students had 'used it' and were 'over it' fairly quickly.

The sub-team had students look at specific Australian inventors. Although the sub-team wanted to use Whyville, they did not have a lot of content to put there. They had older students help the younger students to complete WebQuests and other online activities.

The presentation took the form of a basic MS PowerPoint presentation. Overall, the research as conducted and reported satisfied the needs of the sub-team, but did not employ elements (beyond reporting on the specific experience) that would influence teachers outside the team.

#### *Sub-team B*

Research question: How does Smartboard use of TLF content by individual students in the lab compare with its use in the classroom?

They compared the use of TLF content on the Smartboard when individually used by individual students in the lab and when used in the classroom.

Research design: Very little design rationale was reported.

Analysis: Not discussed in the presentation.

Results: The presentation did not report research outcomes.

The sub-team felt that they had difficulty with the project and that they lacked direction. They originally thought that the research was to be directed to helping students, and then thought that it was for improving students' knowledge. They felt that nothing they tried had worked. They couldn't get the online survey (using SurveyMonkey) 'to work' but they were able to use the digital whiteboard and TLF content. When downloading the learning objects, the students had difficulty with passwords and with the Department of Education and Training's portal. They were unable to use Whyville in the way they wanted because of the costs involved.

Fewer than half of the students in the school had a computer to use at home. The teachers felt that their students were not interested in computers. As one of the sub-team's goals was to work on students' socialisation skills, they had them work in pairs, rather than one-to-one, during the project.

In one of the classes, where emotionally disturbed students needed special attention, behaviour problems seriously affected technology use. A couple of new students did not know how to use the technology, while others were not willing to try anything new. If they were asked to attempt to use technology they would become verbally abusive in order to get out of the situation and avoid use. The sub-team brought in casually employed teachers to assist them.

After six weeks, the students were using computer language that they did not possess at the beginning of the period. At the end, the students were asking to use the computer, which they had not done earlier.

The presentation took the form of a basic MS PowerPoint show. As the presentation provided information on the learning content, but little on students' experience and learning in a research-oriented format, the presentation was not likely to influence others' practices or any decision making outside the team.

*Literacy for distance education*

Research question: Can ICT help students improve their skills in descriptive writing?

Research design: Control group design with three groups:

- Distance education using Moodle, TLF content, Paint and wikis (Stages 4 and 5)
- Face-to-face, outside the normal class, using paper-based materials (Stages 4 and 5)
- Face-to-face in the regular classroom, using Moodle, TLF content (Hot Potato) and wikis (Stage 2).

Analysis: Quantitative analysis of learning gains assessed in terms of a rubric; and use of data graphics and correlations.

This team chose to use Moodle with embedded TLF content, wikis and discussion forums. The students using distance education were already using Moodle, which the teachers considered to be safe, and which they felt contained tools that teachers and students could both use. The teachers also liked the fact that TLF learning objects could be added to Moodle, and that it was possible to see when students used an object or interacted with it. They found brainstorming using the wikis difficult to use because only one student at a time could edit the wiki. It is easier in distance education than in the face-to-face classroom (especially with Stage 2), as it took a lot of time. Brainstorming in the regular classroom (Group 3), using the whiteboard, was very easy, but the discussion forum did not really develop in the intended way, due to time limitations. The face-to-face students used screen shots of the TLF content. They looked at it, and then had a discussion on how to improve the description.

On the assessment rubric an average of 5.2 points was gained. Six students did not participate, which needs to be considered in the research. The face-to-face students of Group 2 gained 2.4 points on the rubric, but they had time constraints. The students using distance education were able to work at home. The in-class group (Group 3) did not complete the tasks.

The team felt that the class sessions were not long enough for gaining enough data. They felt it was better to use the wikis with individual students, rather than with a whole class group. In relation to Paint and other ICT, they felt it was important to consider the time to teach it. They recommended a combination of teaching and self-directed learning. They considered that Moodle needs to be supplemented with interaction to ‘help kids along the way’.

The (MS PowerPoint) presentation was well designed and took the form of a research study report. The team ‘let the data speak’, supporting their conclusions with evidence from their study. Such a presentation could be an effective means to affect pedagogical decision making beyond the team itself.

*Maths*

Research questions:

1. Do students enjoy using the computer?
2. Do students have access to computers at home?
3. Are students able to access the Internet from home?
4. How will we teach students to access the Internet and Scootle from within the Department of Education and Training network?
5. Would students be engaged with learning objects from Scootle?
6. Is Scootle a suitable educational tool to help students with their learning?
7. Is an immersive learning environment a valid tool for Stage 1 students?
8. What can an immersive learning environment offer the students in our class?

Research design:

The research was conducted in three phases.

Phase 1:

- Survey parents at home to see what students had access to.
- Become familiarised with Whyville.
- Use video conferencing, including teach students etiquette.

Phase 2:

- Introduce project to students and parents.
- Have video conferencing between the two schools to connect the classrooms.
- Give parents Scootle access card, focus on numeracy.
- Obtain access to Whyville.

Phase 3:

- Practise logging on to the Internet/intranet (lots of visual assistance, for example, posters, worksheets.

Difficulties

Analysis: Not discussed in the presentation.

Results:

The team determined that while Scootle was suitable for students, Whyville was not appropriate, and that Poptropica was appropriate for Stage 1 students. With management, students are able to access Scootle from inside the portal. The students enjoyed using the computers and were motivated in the lessons. Students chose learning objects in free time and used them at home. Their engagement was maintained if there were new tools.

The team felt that students have more control over their learning in MUVE environments. The students told them about Poptropica, which can be accessed through the portal. The team felt that merging Poptropica with learning objects would create a good immersive environment. They also used the TLF content for progressing or for a reward. Teachers would use Stage 1 objects, and have students go up to Stage 2 if it was appropriate. One of the teachers used a fraction game that the students loved, but she was unsure how much they were learning.

The team felt that their group worked well together. They took the initiative to use video conferencing between the two schools, which they felt worked very well. At the same time, they would think carefully before taking on a project of this size again. They would like to maintain access to computer information that students can reach at home. Parents gave positive feedback about accessing materials at home. There was a poor rate of return for the surveys of both parents and staff, for which there could have been many reasons, but the team did not follow up on it.

The presentation took the form of a carefully designed movie. The way research was conducted and reported had the potential to inform others outside the team, and to influence decision making regarding pedagogy and technology.

*Symbols*

Research questions:

- Does the use of MUVEs make a collaborative environment and can students use their content?
- Does the incorporation of design projects into immersive environments assist in the development of deep knowledge and deep understanding of concepts?

Research design: Some discussion of survey design.

Analysis: No discussion of analysis.

Results: No discussion of results.

The team had difficultly finding symbol systems in the TLF content. They used ‘Fish market’ and ‘Fashion design marketing’. ‘Fish market’ was a good learning object, but it didn’t work as they wanted it to.

Some of the students were ‘intellectually aggressive’, and needed a different space from what is provided in Second Life. The boys, who had overtly preferred learning styles, were given open-ended tasks that would allow them to learn in their preferred way. The team gave students a group project: to design a company logo and a product, and to show their process in a group presentation. One group of boys came to the workshop to show their product.

The project took a lot longer than they expected. As one of the teachers was already going to use the design project, it could be adapted fairly quickly. The students were confident and competent in using technology, and they worked well together. The teachers were experimenting with how MUVEs would help students work together better.

The teachers felt that it was difficult to work together, given other obligations. They found it difficult to complete goals because of network restrictions and inappropriate content in the immersive environments. The teachers wanted to know how to make the MUVEs safe for the students. Teachers found design-based research a bit confusing.

The report took the form of a graphically very well-designed MS PowerPoint presentation. While content and pedagogy was well covered, the classroom research was less so. Its strengths in presenting the pedagogical ideas gave this presentation the potential to influence peers, but its influence on decision makers would be weaker, given the lack of evidence.

*Miscellaneous*

The team split into two groups because they felt they had different emphases.

*Sub-team 1*

Research questions:

- How does an immersive learning environment affect the engagement of students in a classroom situation?
- Do some types of immersion have more of a positive impact on student learning than do others?

Research design: The group used a quasi-experimental design (surveys before and after the intervention).

Analysis: No discussion of analysis.

Results: Some discussion of results.

The teachers had the students complete online surveys about mobile phones. They found that the students showed the highest engagement in learning when they were using the learning objects. Students liked using the forums and creating avatars, but mostly for the social aspects of the tasks. The teachers were surprised that the students had difficulty filling in form fields as they had assumed that students would know what they were doing on the computer. However, students could not navigate through windows, and also had difficulties with typing and translating from the whiteboard. Eighty-five per cent of the students said that they put more effort into these tasks than they would have done for a worksheet. The teachers felt that they needed to spend time teaching these skills as it can't be assumed that students have the skills.

The two teachers in this group felt that they worked really well together. They both felt they had learnt much from the experience. They are now learning how to use Moodle, and one is making her own wiki. She is going to try to get Maths teachers to create a resource wiki for use with the new laptops. This is a direct result of being involved in this project. She is interested in this kind of collaboration in the future.

The report took the form of a MS PowerPoint presentation. The team's interest in immersive learning, combined with reporting sufficient detail on students' experience, led to a presentation that had the potential to influence peers, but its influence on decision makers would be limited, given the lack of method and data.

*Sub-team 2*

Research question: Would students be more engaged in 2D (TLF) or 3D (immersive) learning objects?

Research design: Survey (questionnaire and observation), some discussion of design.

Analysis: The team did not know how to analyse the survey data.

Results: The team did not discuss results.

This sub-team was highly motivated to use Second Life. One of the teachers found Second Life frustrating. He also felt that his students were not engaged with it, and that immersive environments (in this case, Whyville) were better suited to primary school classes. The other teacher was highly motivated and made Second Life work in the classroom. They compared

2D and 3D learning tools. The 2D environment was a McDonald's learning tool that one of the teachers received in a 'Happy meal'. The second teacher found a safe place in Second Life for students to go.

They used the tasks in class only once, so they did not collect data over more than one class lesson. They said it would have been better if they had used it for more lessons. They both felt a lack of competence in designing surveys.

The report took the form of a basic MS PowerPoint presentation. The use of immersive learning with students who have special needs has potential to hold the interest of other teachers with similar students, but the lack of any systematic research limits the potential influence on decision makers.

*Science*

Research questions:

- Does an interactive unit have a positive impact on student engagement during learning experiences?
- Does an interactive unit assist students' development of scientific literacy?

Research design: Minimal research design.

Analysis: They did not present any analysis.

Results: They did not discuss results.

The team felt that Shoe Print was better used offline than online, and that Identikit was better online. They had some technical issues with the 'switch' between the two activities. They did not use Whyville, because they felt its immersive environments were inappropriate. They liked some of aspects of Whyville, such as the 'spin center' and the bank, but overall they felt it was not appropriate. At the same time, they would have also liked to undertake more investigation before choosing their MUVE. They felt that immersive environments had some value, but that 'just because you could, did not mean you should'.

They liked the wiki, thought it was a good way to share information, and were keen to develop their own wikis. They thought the project was a good opportunity to meet other teachers, but they would have liked a bigger group, and contact with other schools. They felt 'in the dark' in the research portion of the project. They found the lack of solid direction to be frustrating.

The report took the form of a well-designed MS PowerPoint presentation. While pedagogy and content were described in sufficient detail to have the potential to raise the interest of other teachers, the lack of research method and data limited the potential influence on decision makers.

## 4. Interviews

After the second (one-day) workshop, semi-structured interviews were conducted with some of the participants (see Appendix 7: Interview guidelines, which had been circulated in advance). The following analysis of those interviews captures teachers' comments on TLF and Scootle.

Scootle is a repository developed by TLF that provides access to more than 8,000 digital curriculum resources from The Le@rning Federation. Teachers can find interactive learning objects, images, audio files and movie clips via browse, search and filter technology. Scootle also allows the creation of learning paths – collections of learning content interwoven with teachers' comments and descriptions that can be made available to students either online or offline. These learning paths can be shared with colleagues.

While Scootle is currently not being used by the Department of Education and Training in New South Wales, it is used by more than 1,000 other schools, including:

- Australian independent schools
- Australian Catholic schools
- Australian Capital Territory government schools
- Northern Territory government schools
- South Australian government schools.

Participants, who had been introduced to Scootle during the first workshop of the project, expressed their overwhelming support for it after using it with their students in classrooms.

About half of the participants who participated in the project had used TLF content prior to participating in the project:

> *I have used TLF content in the past. Because I'm in the library, it is good because there is a wide range of things. I have used material dealing with earth formation (Down to Earth series) in Geography with Stage 3. This time because I was doing Literacy and descriptive writing … I used 'Wonderful words, creative stories: pets'* [a learning object in which students add appropriate adjectives to make sentences more interesting] … *the kids loved it. Teachers … worked with the [students] further on that, because I work cooperatively with the teachers in the library ...*

Others had no previous experience of TLF resources but, as a result of the project, became enthusiasts:

> *I love TLF. I find it so helpful.*

This comment from a secondary teacher arose from using a range of images, audio files and video clips about World War 1 to build field knowledge to enable students in a Year 10 English class to compare the ways in which two poets communicated their view of that war ('The Soldier' by Rupert Brooke and 'In Flanders Field' by John McCrae).

The teaching context and purpose are also relevant to use of Scootle, as testified by the following participant who works in distance education:

> *I used Scootle initially, but found that it didn't suit our purposes. I wanted to download the object into the Moodle course, and it didn't allow you to download, only create the learning path … I need to explore Scootle a bit more [to see] how we would use it here … As a teacher it's the way you are going to use those resources. For our purposes we encourage [students] to embed [the TLF resources] in the Moodle container. Basically, we know when the kids have interacted with the resource. We have a way in Moodle*

*to identify when a kid has logged on and interacted with the resource you have put up there, whereas, in Scootle, how do we know that our kids out there have gone to that resource?'*

Project participation had a viral effect in many of the participating schools:

*The other year two classes were interested to find out more about [TLF digital curriculum resources].*

*I used a lot of it for whole-class demonstration on the whiteboard, and then once they got familiar with it they were working in little pairs in my computer lab just off to the side there. I had a couple of kids who were quite keen and they wrote down the pass codes and took them home and used them at home to use it. I never pushed that aspect of it … when they started to get a bit bored with the ones I had, I went to see if there was something at this level, but it would be Year 4. Most of the time they kept okay with it … I only used Maths. But I'll start looking at more of the other stuff to see what I can pull.*

*[The emotionally disturned students] are all on individual education programs, and it is very hard considering that the behaviour has taken over a lot of their learning. So, we have some Year 5 kids that are only working at Year 1 level, so it's very hard to … I can use Scootle to set up individual pathways, yes, that will be very good for that … if their behaviours are OK that day, than I can try coming to the computer room.*

*They loved 'Citizen's arch'. I'll certainly research the learning objects and see what is there to fit any further.*

*I've now created a wiki space for my class. In the holidays I intend to get it up and running a bit more, research learning objects that are at the level they are at and the topics, and give them access, so they can go onto it at home. I intend to put photos and those things up so they can go home and … logon at home and show Mum. I've also created a wiki space for the staff at school, which I intend to use as a common resource that we can go to, to put things up as we come across them, [including] learning objects, so that we are sharing. You know, you spend all your time searching, and someone else already knows about something, and you could have saved all that time. This also helps, because … I don't see Tina. I won't see Tina now that the project is finished, except at staff meetings.*

In summary, while mixed on some counts, participants were generally positive about the materials and tools, and were able to pass on some specific examples and anecdotes relating to them.

# Summary and conclusions

The teachers participating in this study represented a variety of primary and secondary curricular specialisations. They were generally younger than the average public school teacher in New South Wales, a function of their regional posting (Dubbo), which meant that their qualifications were generally more recent than would be found in a random sample of New South Wales teachers.

The study took place in a region that had recently invested high levels of time and other resources in the use of ICTs, an investment that had largely but not exclusively taken place in the town in which the study took placed. The teachers participating in the study were therefore familiar with ICTs, in particular digital whiteboards, and were used to facing challenges associated with innovation in their classroom practices.

Our survey responses indicated that a cluster of about 28 per cent of participants described themselves as confident with ICT uses in classrooms, knowledgeable about their use and value, and as having sought professional development in this area. The remainder of the group was less confident with ICTs, with a few describing themselves as anxious in relation to using ICTs in their teaching.

There was a tendency in this sample for higher academic and professional qualifications to be positively associated with higher levels of familiarity with ICT uses, and for general familiarity with ICTs to be associated with familiarity with TLF materials specifically.

In the light of the substantial differences among participants in this study regarding their motivation and capacity to work and innovate with ICTs so as to foster their students' learning, the availability of technology is evidently not a sufficient factor to promote its (pedagogically interesting) use. Strategic initiatives such as supplying digital whiteboards in classrooms or 'connected classrooms' do not become widely implemented unless teachers are brought 'on board'. However, professional development that aims at individual competencies is not the only way or the best way to bring teachers 'on board'. Instead, or in addition, capacity can be developed in teams and groups. Very few teachers in our study decided to do things on their own; and most of them found the collaboration with (trusted) colleagues a rewarding experience.

Given the requirements of changing labour markets and informational environments for enhanced learning, knowledge building and problem solving for both teachers and students, our focus on teachers as creators of knowledge (new designs, new insights into students' learning) seems appropriate. However, seeing oneself as an innovator is not yet part of the professional identity of most of the teachers in our study, for whom 'duty of care' is the predominant aspect of their professional identity. Providing a 'safe' environment for their students seems a primary concern, combined with a kind of risk avoidance, in which elements of technology that are not explicitly endorsed by the institution are seen as more of a risk than an opportunity. Risk avoidance by teachers is a completely understandable orientation in the light of the prevalent organisational culture. However, there is an obvious tension, which needs to be addressed, between (a) a risk-aversive organisational culture and (b) expectations of teachers' willingness to engage in innovation – even innovation that is organisationally endorsed. Teachers cannot develop as 'adaptive experts' if they are not given the space and time to try new things, and reflect on their experience, including problems and mistakes.

‘Documentary practices’, which researchers (for example, Lounsbury & Crumley 2007) have identified as prerequisite for take-up of changes and innovations in practice within institutions, were by and large only weakly developed in the teams of teachers participating in this study – both in documenting the design rationale for their pedagogical and technical decisions and in documenting their research process and its outcomes. Furthermore, we found little evidence of inquiry into existing knowledge: the resources provided to teachers as part of the ‘seed’ wiki were not referred to, nor are there references, with the odd exception, to other professional or scholarly resources. This weakened any case that the teams could make regarding the quality and relevance of their work. Pedagogical and technical decisions regarding the use of digital content in classrooms would ideally be grounded in an awareness of research findings (as part of the design rationale).

The finding that research methods were discussed and systematically used in only one of the teams that performed some form of inquiry into students’ learning experiences, leads to the conclusion that teachers in our study are by and large ill-prepared at this stage to engage actively in evidence-based decision making (or do not see the point of it). If teachers want to make claims that their innovations work, they will have to provide the kind of evidence that is accepted by decision makers, if they are to enter effectively into organisational decision-making processes.

Finally, while some of the final presentations were quite effectively designed to communicate the respective team’s planning and inquiry process, others did not serve well as a means of communicating to anyone beyond those directly involved. Although our study was not designed to track the organisational take-up or dissemination of the teams’ work, we can with some certainty state that only a few of the presentations have the potential to ‘travel’, to be effective independently of the original authors.

Having said this, it needs to be kept in mind that the teachers received no formal education in relation to these matters, whether as part of our initial workshop or as part of their pre-service education and in-service professional development. Until now, their job has been to teach, not to innovate, conduct research and communicate effectively across organisational levels and boundaries. Our results are actually quite encouraging in the light of the minimal information they received on how to conduct research into innovation, the little time made available to them to engage with such methods (compared to what is available to full-time instructional designers or researchers), and the many practical difficulties they faced, such as those related to technology use (whether for pedagogical purposes or for project collaboration). When small-scale educational and organisational support can instigate the kinds of dynamics and activities we observed in some of the teams, we have reason to believe that teachers will engage in large-scale innovation and active inquiry – become adaptive experts –if they are provided with the mission and the means, particularly the time.

## Conclusions

### Use of TLF materials

Generally participants were unfamiliar with TLF materials. As they attempted to use them, some found them useful and engaging, but the strongest and most consistent finding with regard to TLF materials was that participants generally found Scootle a useful tool. In the interviews it became clear that the findings from earlier evaluations of TLF content (for example, Freebody 2005; Freebody, McRae & Freebody 2006; Freebody, Muspratt & McRae 2008) also applied in the present setting, and specifically that:

- TLF resources are under-used;
- teachers and school leaders tend to be unfamiliar with them and with the research evaluating their use;
- use of TLF materials and the value accorded them are enhanced when school leadership supports their use;
- use of TLF materials is encouraged when there is a local ‘champion’ who disseminates use and offers general support in accessing and applying the materials;
- the pedagogical activities into which TLF resources are inserted vary from traditional teacher-centred activities to free-range use by students in free time or breaks.

There are some indications that, for more confident and experienced classroom users of ICTs, a teacher-designed research project is a suitable way of becoming acquainted with TLF materials. It is encouraging that teachers generally appreciate TLF materials if they are in a position to access TLF content via Scootle and, driven by their own interest in finding engaging learning resources, to become familiar with some of the learning objects in more detail. However, while the alignment of TLF materials with the school curriculum has been assured, alignment with teaching practices is much harder to achieve. In presenting detail on how teachers integrate TLF materials into their classroom work and their students’ learning, and on the obstacles faced, studies such as this one can help to bring about improved alignment of TLF materials with teaching practice.

### Innovation by teachers

The participating teams varied in terms of their use of the intervention setting as a platform for innovation. Some worked in circumstances that made such high levels of demand on management and basic support for students’ attendance and engagement that it was difficult for them to collaborate on a potentially unfamiliar set of possibilities. Over a relatively short time frame, the work of ‘clearing the ground’ for an ICT innovation that required the planning and execution of data collection and analysis presented special difficulties.

Also evident was the wide variability in the group on knowledge about basic research, data collection and analysis. Some groups reported little knowledge and no confidence in these matters and their reports reflected that fact. In the light of more frequent and urgent demands for teachers to become innovators in their classrooms and to engage in an increasing number of layers of evidence-based accountability, it will be necessary to develop in teachers the capacity for systematic inquiry into students' learning. This requires effort in pre-service and in-service phases. Looking, for instance, at the components of teacher-led design research identified by Bannan-Ritland (2008b), it is obvious that substantial knowledge and skills are required to do this kind of research well.

It was clear from the teachers’ presentations and uses of the wiki that relational agency was a crucial component in the success or otherwise of the intervention reported here. It will be recalled that relational agency involves the capacity to offer, and also ask for, support from others so as thereby to expand the ways in which participants interpret and respond to the problem at hand. Teachers in the lighthouse teams tended to know one another quite well from collaborations before the onset of this intervention. The varying levels of observable and reported success and comfort in this project speak directly to the significance of relational agency in innovative work in classrooms.

Relational agency also relates directly to the degree of use and efficacy of the artefact – in this case, the wiki – used as the intended platform for the collaborative work. The wiki itself had

the potential to become, and in effect did become, both a problem and a resource for the various groups in this project. Contributions to the wiki appeared to vary dramatically both between and within the groups. It was evident, however, that some groups, in particular those nominated as ‘lighthouse’ groups, collaborated *in order to manage* the entries to the wiki, not just through the wiki.

In the case of the lighthouse groups we can see from the wiki contents, the presentations, and the interview data, that *activities* were beginning to become *practices*, and several of the participants indicated that they intended to persist in using some aspects of their teaching and collaboration that they first encountered in this intervention. The group, as a coordinated unit, had begun to develop a distinctive form of epistemic agency. What cannot be overstated, however, are the challenges and obstacles that even these volunteer teachers, in a region comparatively well supported in terms of human and material resources relating to using ICTs in their day to day work, find so difficult to overcome in a sustainable way. If there is to be transformation in the context of digital education, then it seems that it needs to be built on the combination of freedom for local innovative collaborations and system-wide support for infrastructure and digital professional learning. One without the other will lead to an intensification of the frustration experienced by some of these committed and capable teachers, as well as a more predictable failure to bring about real change.

## Further research

One conclusion that can be drawn from this study is that any methodology that smoothes out individual differences (between teachers, teams) would miss important differences between the cases. While the extent of participation and innovation across all cases is quite modest, there are (teams of) teachers who accomplish quite interesting and substantial things even under conditions that make local innovations and the study of the effects of these innovations sometimes difficult, particularly because of lack of time. To the extent that our participants were not all that atypical, there must be many other teachers and groups of teachers in Australia and around the world who are much more actively engaged in using ICTs in their teaching, and doing interesting things with them, than is portrayed in the average findings (slow, incremental change) coming out of large-scale studies. More research in understanding these local dynamics is needed to complement the population-oriented research.

An interesting question concerns the changing role of teachers as 'gate keepers' for content. While in pre-Internet days 'age appropriate' content was defined through textbooks, nowadays teachers who direct their students to content on the Internet are much more actively and frequently involved in deciding the content that is appropriate for their students. While there is some visible debate on whether or not Wikipedia is an acceptable source for established knowledge, and hence for citation by students as reference, the issue goes well beyond Wikipedia: How are teachers to decide which content is (age) appropriate, and which is not? More research is clearly needed.

We learnt comparatively little in this study about the possibilities of linking existing content, such as what is provided through TLF, to emerging educational technologies such as (serious) games and immersive online environments. This is partly due to insufficient readiness on the organisational side, expressed in a lack of access to existing game-like and immersive environments, and a lack of ‘safe’ alternatives. It is also due to a lack of interest on the part of a good number of our participants, whose pre-service education did not prepare them for these new forms of (potential) learning, and nor did any professional development so far. It is left to

other studies to find out more about the value of game-based and immersive learning in Australian public schools.

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# Appendices

## Appendix 1: Agenda for Workshop 1

### Introductory workshop held at iTeach 21 Centre, Dubbo, 2–3 February 2009

***Monday morning***

9:00 Introductions

9:15 Introducing the project (PF)

10:00 Inspecting our mental models: Inquiring into participants' understanding of different classroom technologies by means of the Repertory Grid Method.

11:00 Coffee break

11:30 Introduction to the collaboration tool TRAC (PR)

12:30 LUNCH

***Monday afternoon***

1:30 Hands-on TRAC (PR); familiarisation with online resources in the team's trac site

2:30 Introduction to TLF Materials (MH)

3:30 Coffee break

4:00 Scootle demonstration and hands-on (PR)

***Tuesday AM***

09:00 The design task (PR)

09:30 Introduction to Second Life (including some hands-on) (PR)

11:00 Coffee break

11:30 The research task and the innovation task (PF)

12:30 LUNCH

***Tuesday PM***

01:30 Team formation

02:00 Initial team work: Formulating a first set of guiding questions; agreeing on subject matter area(s); questions and answers

03:30 Coffee break

04:00 Wrapping up

## Appendix 2: Agenda for Workshop 2

### ‘Immersive learning environments’ workshop held at iTeach 21 Centre, Dubbo, 30 March 2009

9.00 Welcome

9.10 Introduction by Professor Peter Freebody

9.30 Presentations from teams (approximately 30 minutes per team) followed by questions from participants

Literacy for distance education

Being Aussie

Literacy

11.00 Morning tea

Maths

Symbols

1.00 Lunch

Miscelleneous

Science

3.00 Summary

In this mail, we want to provide you with more information on the workshop. We’ll also give you some suggestions that might prove useful in preparing for the workshop.

### A possible plan for the team presentations on 30 March

**Format:** 30 minute team presentation

**Materials:** Maybe MS PowerPoint slides and/or materials available on the project wiki, shown through a web browser. (Be aware, though, that the version of Internet Explorer used by DET does not seem to obey all Internet standards, for instance it does not allow you to enlarge the font size in the browser window; but Trac obeys the CSS standard.)

Main points for each team to address in the presentation:

- A summary of the pedagogical objectives you agreed on and set yourselves, your approaches to technology use, and the planning outcomes you documented in the team design document;
- Your classroom research objectives, approach, and the outcomes you documented in the team research document;

- How your team worked together, divided the labour, made decisions, documented your work, and so on.

### How to prepare for the 30 March workshop

Suggested actions in final project week:

All teams will need to invest some time to bring the documentation of their work, both process and outcomes, up to expectations. Most of you will have some unused relief time to engage in this. Now is the time to grab that time!

In concrete terms, from each team we need to have access to team and individual documents that relate to the project. That means:

**1.**

The **team design document** needs to be completed, and it needs to give your colleagues a rich picture of your pedagogical and technical considerations and decisions. You can find a template at http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki/DesignDocument

and a link to your team's documents at

http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki#Teamchallengesandprojectoutcomes

**2.**

The **team research report** needs to be completed, and it needs to give your colleagues a rich picture of your research questions and findings. You can find a template at

http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki/ResearchReport

and a link to your team's documents at

http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki#Teamchallengesandprojectoutcomes.

See also http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki/ResearchTask for more information on the research task.

**3.**

**Meeting minutes/protocols** for all meetings you conducted face to face or in other formats need be provided. The documentation should be provided in your respective team page as specified on http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki#Teamchallengesandprojectoutcomes, either directly there or linking from your team page to other wiki pages and/or attachments. [Please note that these meeting protocols need to have some record of the meeting participants so that we can process the relief time support.]

**4.**

In addition to these team documents, you should make accessible the work you did for this project, even if it does not necessarily fit into the above formats 1–3. Please do so by adding

respective files as attachments to wiki pages such as your Personal profile page, as in http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki/ParticipantsProfilePages

or they may fit (topic wise) into one of your team's wiki pages.

Just as a reminder: We need your input to these documents on the project wiki because, as we described on our start-up day, as part of the project we want to see outcomes created that are of potential use for other teachers, not just those participating in the project, but those facing similar challenges or having similar interests.

Furthermore, this is a research project as well as a PD activity, and the analysis of documents as produced by participants will constitute an important part of the research conducted by Profs Freebody and Reimann. So it is important that you do not describe only the outcomes of your discussions and considerations, but also the rationale behind those decisions and outcomes: talk about the Why, not only the What.

How can you contribute to the documentation on the project wiki?

- You can either use **wiki writing** directly, thus modifying/creating wiki pages: Press the {{{Edit this page}}} button at the bottom of any wiki page, and you will get into editing mode. Simply type, and if you want to format your input further see: http://trac.edfac.usyd.edu.au/trac_arc_essay/wiki/WikiFormatting. Save your contribution by clicking on {{{Submit changes}}}.
  AND/OR
- You can contribute in form of **attachments** to a wiki page: Click on {{{Attach file}}} at the bottom of a wiki page, and follow the pretty much standard file-upload dialogue. This is the way to add your MS Word documents, MS PowerPoint documents, pictures, etc. AND/OR
- You can add links to content existing elsewhere as long as this content has a URL. For instance, if you maintain a blog somewhere, or another wiki somewhere, and you want to include this in this project, copy the link to that external content, select the wiki page on Trac you want to link from, go into edit mode, and paste (or type) the link (http://....) into the right place on the wiki page. Save your change with {{{Submit changes}}}.

We have produced a little video that shows these options, see:

http://lrnlab.edfac.usyd.edu.au/resources/Tools/trac/adding-to-trac.mp4/file_view

As a last resort, if you really can't work your way around the Trac wiki for the purpose of adding attachments, please **mail** your documents to s.howard@edfac.usyd.edu.au. Please describe the attachments in the body of the mail, and mention when these documents were produced (the date) for our research records.

We're really looking forward to catching up and seeing how your ideas played out in the team setting. This is a big week coming up, so please use the time provided to develop your materials so that they do your ideas justice, and to work up the presentations for your colleagues.

# Appendix 3: Template for the design document

### The design document ¶

The design document describes the learning environment so that it can be improved and eventually be implemented.

But you have to decide whether to focus on designing for MUVEs or on integrating TLF and MUVE content into your classroom teaching.

## *Pedagogy* ¶

*Curriculum outcomes and audience* ¶

- How does this relate to existing teaching plans and materials?
- What can be learned, and what learner characteristics (for example, prerequisite knowledge)

---

#### Approach to learning: Philosophy and high-level pedagogy ¶

Basic pedagogical approach, e.g. inquiry learning, collaborative learning, dialogic.

---

#### Approach to learning: Pedagogical strategy and tactics ¶

Specific learning goals and how they will be reached.

'Sequencing' decisions

Assessment (formative)

---

## Learning assets ¶

List here (and reference) the learning content, e.g. pictures, videos, sound clips, etc. To the extent that these objects have a URL (and they'd better have one), use Heurist to add annotations to objects, such as Heurist Example.

### TLF online curriculum content ¶

Materials from Scootle (ScootleAccess)

---

### Video, Animation, Sound ¶

From utube etc.

---

### Pictures ¶

Perhaps use Picasa to manage

---

### 3D models ¶

Use Sketchup to construct and Google3DWarehouse to manage

---

### Avatar Design ¶

(Optional in all cases, and definitely optional for design round no. 1)

---

## Environment design ¶

(Optional for design round no. 1)

Sketch and describe the spatial configuration and where the learning objects are located in the spatial configuration.

---

## Activities ¶


Describe what kind of actions (on objects) and interactions (with avatars) students should engage in. Use e.g. Google Doc Presentations for story-boarding, or perhaps better powerpoint slides with basic interactivity. NoteOnStoryBoarding

## Integration/Implementation in the classroom ¶

e.g. Whiteboard, Computer lab, group use pair use single use

## Attachments

- activity-book.jpg (163.6 kB) - added by preimann on 01/31/09 10:40:58.
- SecondLifeEmploymentBuilding.jpg (72.6 kB) - added by preimann on 01/31/09 10:41:32.
- pedagogy-allegory.jpg (15.0 kB) - added by preimann on 01/31/09 10:41:59.

# Appendix 4: Template for the research report

## Research report ¶

### Research questions ¶

Formulate one or more guiding questions in terms of effects of a (your) pedagogical design on students' learning (processes and outcomes).

- Q1:
- Q2:
- (…)

### Conceptual framework and former research ¶

Describe the framework (perspective, stance, theory) you are using to phrase the question(s) and to look for answers.

To the extent known, mention what former research on (similar) questions found.

### Method ¶

#### Study design ¶

With whom was the study conducted? What steps did it involve? Be detailled here,so that other teachers can interpret your findings in the appropriate context.

#### Instrumentation ¶

Mention any tools here, if applicable, that you use to record observations and perform analysis.

### Findings ¶

### Conclusions ¶

What are the answers to your questions? How are they supported by the findings?

What new questions does your study raise?

### Reflections ¶

What are any limitations of your study?

What would you do differently the next time in a similar situation?

Was it worth the effort?

etc.

# Appendix 5: Survey of participants

## Immersive learning environments

Dear teachers

Information in question 1 is sought to enable us to put like schools together and like people from like schools. No information concerning the school or personnel will be divulged.

We appreciate you taking the time to complete the survey.

## About you

**1. What is the name of your school?**

**2. What teaching qualifications do you have?**

☒ 2. What teaching qualifications do you have? 2 year diploma
☒ 3 year diploma
☒ 4 year Bachelor of Education
☒ Undergraduate degree plus Graduate Diploma of Teaching

**3. Which of the following areas did you specialise in during your undergraduate training? (select all that apply)**

☒ 3. Which of the following areas did you specialise in during your undergraduate training? (select all that apply) Language/Literacy/English
☒ Numeracy/Mathematics
☒ Science/Technology
☒ Studies of Society and the Environment/HSIE
☒ Languages other than English (LOTE)
☒ Health and Physical Education
☒ The Arts
☒ Other (please specify)

**4. Do you have any additional qualifications at the graduate certificate/graduate diploma level or at the master's level that specifically relate to Information Communication Technologies in education?**

☒ 4. Do you have any additional qualifications at the graduate certificate/graduate diploma level or at the master's level that specifically relate to Information Communication Technologies in education? Yes
☒ No

**5. Do you have additional higher qualifications?**

☒ 5. Do you have additional higher qualifications? Master of Education
☒ Other masters' degree
☒ Specialised graduate certificate or diploma (e.g. in educational leadership,
☒ curriculum, or other areas of study apart from ICT in education)
Other (please specify)_____

**6. What is your gender?**

☒ 6. What is your gender? Male ☒ Female

**7. How long have you been a teacher?**

☒ 7. How long have you been a teacher? 1st year of teaching
☒ 2–5 years
☒ 6–10 years
☒ 11–15 years
☒ 16–20 years
☒ more than 20 years

**8. How long have you worked as a teacher at this school?**

☒ 8. How long have you worked as a teacher at this school? 1st year of teaching
☒ 2–5 years
☒ 6–10 years
☒ 11–15 years
☒ 16–20 years
☒ more than 20 years

## ICT knowledge and professional development

**1a. To what extent would you say you are familiar with the use of Information Communication Technologies in the classroom as they relate to standard ICT applications such as MS Word and/or MS PowerPoint?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ☒ 1a. To what extent would you say you are familiar with the use of Information Communication Technologies in the classroom as they relate to standard ICT applications such as Word and/or PowerPoint? | **Not at all** | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ **To a great extent** |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**1b. To what extent have you engaged in professional development activities to enhance your familiarity with the use of ICT of this kind in the classroom?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1b. To what extent have you engaged in professional development activities to enhance your familiarity with the use of ICT of this kind in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**2a. To what extent are you familiar with the use of digital online curriculum resources, e.g. digital encyclopedias, websites, in general in the classroom?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2a. To what extent are you familiar with the use of digital online curriculum resources, e.g. digital encyclopedias, websites, in general in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**2b. To what extent have you engaged in professional development activities to enhance your familiarity with the general use of digital content in the classroom?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2b. To what extent have you engaged in professional development activities to enhance your familiarity with the general use of digital content in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**3a. To what extent are you familiar with the use of *learning objects*, such as those produced by The Learning Federation (TLF), in the classroom?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3a. To what extent are you familiar with the use of *learning objects*, such as those produced by The Learning Federation (TLF), in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**3b. To what extent have you engaged in professional development activities to enhance your familiarity with the use of these *learning objects* in the classroom?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3b. To what extent have you engaged in professional development activities to enhance your familiarity with the use of these *learning objects* in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**4a. To what extent are you familiar with the use of *digital resources*, such as those produced by TLF, in the classroom?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4a. To what extent are you familiar with the use of *digital resources*, such as those produced by TLF, in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**4b. To what extent have you engaged in professional development activities to enhance your familiarity with the use of these *digital resources* in the classroom?**

| | | | | | | |
|---|---|---|---|---|---|---|
| 4b. To what extent have you engaged in professional development activities to enhance your familiarity with the use of these *digital resources* in the classroom? | **Not at all** 1 | 2 | 3 | 4 | 5 | 6 | **To a great extent** 7 |

**4c. In the last year, how often have you used an immersive learning environment (e.g. Second Life, Wonderland or Teen Life)?**

| | | | | | | |
|---|---|---|---|---|---|---|
| 4c. In the last year, how often have you used an immersive learning environment (e.g. Second Life, Wonderland or Teen Life)? | 0 **Never** | 1 **Once a year** | 2 **Once a term** | 3 **Once a month** | 4 **Once a week** | 5 **More than once a week** |

## About your school

**1. Where is your school?**

1. Where is your school?
- ACT
- NSW
- NT
- NZ
- QLD
- SA
- TAS
- VIC
- WA

**2. What is the total enrolment of your school?**

2. What is the total enrolment of your school?
- 1-25
- 26-100
- 101-200
- 201-300
- 301-400
- 401-500
- 501-700
- 701-1000
- more than 1000

**3. Does your school include proportions of students who are:**

| | None | 1–10% | 11–20% | 21–30% | 31–40% | 41–50% | 51–60% | 61–70% | 71–80% | 81–90% | 91–100% |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Language backgrounds other than English** | | ☒ 1-10% | ☒ 11-20% | ☒ 21-30% | ☒ 31-40% | ☒ 41-50% | ☒ 51-60% | ☒ 61-70% | ☒ 71-80% | ☒ 81-90% | ☒ 91-100% |
| **Indigenous** | ☒ | ☒ 1-10% | ☒ 11-20% | ☒ 21-30% | ☒ 31-40% | ☒ 41-50% | ☒ 51-60% | ☒ 61-70% | ☒ 71-80% | ☒ 81-90% | ☒ 91-100% |
| **Low socio-economic** | ☒ | ☒ 1-10% | ☒ 11-20% | ☒ 21-30% | ☒ 31-40% | ☒ 41-50% | ☒ 51-60% | ☒ 61-70% | ☒ 71-80% | ☒ 81-90% | ☒ 91-100% |
| **Students with special educational needs** | ☒ | ☒ 1-10% | ☒ 11-20% | ☒ 21-30% | ☒ 31-40% | ☒ 41-50% | ☒ 51-60% | ☒ 61-70% | ☒ 71-80% | ☒ 81-90% | ☒ 91-100% |

Thank you for completing this survey for The Le@rning Federation. The Le@rning Federation is an initiative delivered on behalf of the Australian Education System Officials Committee (AESOC) by Curriculum Corporation.

## Appendix 6: Participants' attitudes towards use of ICT

**The University of Sydney**


*In the following you will find several statements that suggest possible attitudes towards ICT and ICT use in teaching. Please read each of the following statements carefully and indicate which of the specified answers reflects your opinion the best.*

*There are no right or wrong answers. It is your own opinion/evaluation that counts.*

*Please be aware that the specified answers can change between different categories of statements.*

Imagine that you are given new software for your job that you have never used before. The following questions ask you to indicate whether you could use this unfamiliar software under various conditions.

Please read each scenario. If you think that you would not be able to use the software to complete the job under the condition described, then tick the 'I couldn't do that' (0) box. If you believe that you would be able to use it, then try to estimate how confident you are with your capability to learn enough to complete the job and tick the most appropriate response between 'Not at all confident' (1) and 'Totally confident' (5).

| I believe that I could complete the job using the new software… | *Couldn't do that* | *Not at all confident* | *Not very confident* | *Moderately confident* | *Quite confident* | *Totally confident* |
|---|---|---|---|---|---|---|
| … even if I had never used a package like it before | 0 | 1 | 2 | 3 | 4 | 5 |
| … if someone else helped me get started | 0 | 1 | 2 | 3 | 4 | 5 |
| … if I had used similar software before this to do the same job | 0 | 1 | 2 | 3 | 4 | 5 |

The questions in the next section ask you about your attitude towards computer use. Please read each statement carefully and indicate to what extent you agree with the statement.

| | *Strongly disagree* | *Disagree* | *Neutral* | *Agree* | *Strongly agree* |
|---|---|---|---|---|---|
| I hesitate to use a computer for fear of making mistakes I can't correct | 1 | 2 | 3 | 4 | 5 |
| I don't feel apprehensive about using a computer | 1 | 2 | 3 | 4 | 5 |
| Using a computer does not scare me at all | 1 | 2 | 3 | 4 | 5 |
| Computers make it possible to work more productively | 1 | 2 | 3 | 4 | 5 |
| Most things that a computer can be used for I can do just as well myself | 1 | 2 | 3 | 4 | 5 |
| I can make the computer do what I want it to | 1 | 2 | 3 | 4 | 5 |
| I am not in complete control when I use a computer | 1 | 2 | 3 | 4 | 5 |
| I need an experienced person nearby when I use a computer | 1 | 2 | 3 | 4 | 5 |
| I avoid coming into contact with computers in school | 1 | 2 | 3 | 4 | 5 |
| I will use computers regularly throughout school. | 1 | 2 | 3 | 4 | 5 |

The questions in this section ask you about your experience with digital materials.

Please read each statement carefully and indicate the extent of your experience with different digital materials.

| | *No experience* | *Novice* | *Competent* | *Highly competent* |
|---|---|---|---|---|
| I know how to create a web page (with text). | 1 | 2 | 3 | 4 |
| I know how to import graphics into a web page. | 1 | 2 | 3 | 4 |
| | *None* | *One* | *Two* | *More than two* |
| I know of web sites with information for preparing my teaching. | 1 | 2 | 3 | 4 |
| I know of web sites that demonstrate experiments. | 1 | 2 | 3 | 4 |
| I can name topics that would be suitable for research projects using the web. | 1 | 2 | 3 | 4 |
| I can name ways in which I could assess students' web-based work | 1 | 2 | 3 | 4 |
| I can name criteria on how to judge if interactive web resources would be good for learning. | 1 | 2 | 3 | 4 |
| I can name reasons why computer learning may not suit some students. | 1 | 2 | 3 | 4 |

# Appendix 7: Interview guidelines

| | Understanding: Knowledge (What was their initial understanding, what was it at the end? What changed their understanding?) | Engagement (What was their level of engagement?) | Understanding: motivation | Impact (What impact did it have on their understanding of teaching?) | Innovation (How were they able to innovate? What was your capacity to innovate in the project? In the future?) | Change (What do you see as long lasting changes in your teaching, as a result of using the tools?) |
|---|---|---|---|---|---|---|
| **TLF content (what they selected)** | Had you used content from the Learning Federation before? Did you have any knowledge of the content before this project? | Were you motivated to use the TLF content in your teaching? Could you give an example of content you were motivated or discouraged to use? | Which TLF content did you choose to use? Why? | Did the experience using TLF content have any impact on how you understand teaching? Could you give an example of how you might think differently about teaching? | Did you feel able to use TLF content to innovate in your teaching? Can you give a specific example of why or why not? | Do you foresee any long-lasting changes in your teaching, as a result of using TLF content? Could you give an example of changes you might be planning in your teaching, or why you do not feel you would be making changes? |
| **Immersive environment (Second Life, Whyville)** | What was your initial understanding of immersive environments? Can you give a specific example illustrating this understanding? | Were you motivated to use Second Life or Whyville in your teaching? Could you give an example illustrating why or why you were not motivated? | What was the motivation behind choosing the immersive environment used in your project? Would you do it differently if given the chance? | Did the experience of using the immersive environment have an impact on your understanding of teaching? Could you give an example of how you might think differently about teaching? | Did you feel you were able to use immersive environments to innovate in your teaching? Could you give a specific example of why or why not? | Do you foresee any long-lasting changes in your teaching, as a result of using the immersive environment? Could you give an example of changes you might be planning in your teaching, or why you do not feel you would be making changes? |
| **Design-based research** | Did you have an understanding of design-based research before participating in this project? Are you familiar with any other types of research? | Did you find using Design-based research motivating or discouraging in the project? Could you give an example illustrating why you felt this way? | Did you find participating in design-based research motivating? Why or why not? | Did the experience of participating in design-based research have an impact on your understanding of teaching? Could you give an example of how you might think differently about teaching or research? | Did you feel that design-based research helped you to innovate in the project and/or in your teaching? Could you give a specific example of why or why not? | Do you foresee any long-lasting changes in your teaching, as a result of having participated in Design-based research? Could you give an example of changes you might be planning in your teaching, or why you do not feel you would be making changes? |
| **Cooperating with other teachers** | Had you worked in cooperative groups before? What was your understanding of working cooperatively with other teachers? | Did you find cooperating with other teachers motivating or discouraging in the project? Could you give an example illustrating why you felt this way? | Were you motivated to take a leadership role in your group? Why or why not? | Did the experience of cooperating with other teachers have an impact on your understanding of teaching? Could you give an example of how you might think differently about teaching or research? | Did you feel that cooperating with other teachers helped you to innovate in the project and/or in your teaching? Could you give a specific example of why or why not? | Do you foresee any long-lasting changes in your teaching, as a result of having cooperated with other teachers in this project? Could you give an example of changes you might be planning in your teaching, or why you do not feel you would be making changes? |
| **Developing wiki contributions to share knowledge** | Had you used wikis to share content and information before this project? | Did you find using wikis to share knowledge and content motivating or discouraging in the project? Could you give an example illustrating why you felt this way? | How did you use the wiki? Could you give an example of your typical use? | Did the experience of using wikis to share knowledge and content have an impact on your understanding of teaching? Could you give an example of how you might think | Did you feel that using wikis helped you to innovate in the project and/or in your teaching? Could you give a specific example of why or | Do you foresee any long-lasting changes in your teaching, as a result of having used wikis to share knowledge and content? Could you give an example of changes you might be planning in your teaching, or why you do not feel you would be |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | differently about teaching or research? | why not? | making changes? |