

**Towards a disruptive pedagogy:  
Classroom practices that  
combine interactive whiteboards  
with TLF digital content**

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## Contents

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Executive summary	3
Introduction	5
Research approach	5
Review of related research	7
Use of information and communication technologies in classrooms	7
Classroom use of interactive whiteboards	8
Classroom use of digital learning objects	9
Levels of use of an innovation	10
Surveys of teachers and students	12
Findings	12
Experience of innovation in the schools	18
Canning Vale College, Perth, Western Australia	18
Centralian Senior College, Alice Springs, Northern Territory	21
Footscray North Primary School, Melbourne, Victoria	23
Gray Primary School, Darwin, Northern Territory	28
Mona Vale Public School, Sydney, New South Wales	32
Northern Beaches Secondary College (Cromer campus), Sydney, New South Wales	35
Changes in levels of use of the innovation in the schools	38
Conclusions	42
References	43
Appendix A: Materials distributed at the first workshop	44
Appendix B: Classroom use of whiteboards – annotated references	46

## Executive summary

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This study examines levels of use of an innovation, namely the combination of interactive whiteboards (to present ideas and concepts to students visually and interactively) and use of digital content produced by The Learning Federation. The digital content includes 'learning objects' (interactive learning materials) and 'digital resources' such as pictures, movie clips, sound files.

Coordinated through the Australian National Schools Network (ANSN), the study was sponsored by The Learning Federation (managed by Curriculum Corporation), the participating government school sectors, ANSN and by Commander Australia, distributors of Promethean ACTIVboard interactive whiteboards. All State and Territory education departments participating in the Australian National Schools Network were asked to nominate one or two schools that were willing to undertake a one-year exploration of the pedagogical impact of the combined use of interactive whiteboards and TLF digital content. A condition of participation was that the department would support the participating teachers in their schools with a curriculum consultant who would work with the teachers over the period of the study.

The six schools that participated in the full duration of this study covered primary and secondary years and inner-city and regional contexts, across three states and the Northern Territory.

Participants were introduced to the innovations, and subsequently supported in their use, through three two-day workshops for all participants, continuing access to a curriculum consultant, visits to their schools by the researchers and, in some cases, through collaboration with teachers in other participating schools.

Data for this report were obtained from surveys of participating teachers and their students (in relation to their use of TLF learning objects); interviews with participating teachers and observations of their lessons during visits by the researchers to the participating schools; and presentations by each participating teacher at the final workshop.

By the end of the year-long experience of innovation, almost all 13 participating teachers had moved to higher levels of use of the two innovatory technologies. All were competent users and several were sophisticated users. Major shifts in levels of use occurred for two primary-school teachers in New South Wales, one secondary-school teacher in the Northern Territory and one middle-school teacher in Western Australia. All four teachers at the Victorian primary school had arrived at the further stage of renewing and reconfiguring their use of the technologies.

The teachers reported the importance of the curriculum support officers from their education department in the development of their skills and capacity to experiment with the interactive white boards; and also in locating appropriate TLF digital content and helping them to use it.

Along the way, all participating teachers demonstrated:

- increased personal efficiency
- achievement of stated learning outcomes
- stronger understanding of the relationships between ideas and concepts
- changes in pedagogical practice, based on evidence for adopting new strategies
- a focus on interaction and modes of representation for improving the efficiency of their students' understanding.

The teachers who had most strongly embraced and effectively deployed the technologies claimed that use of the innovations had enabled their students to become more engaged in their learning and to perform at higher levels than before. They also extolled the importance of their year's journey.

In their presentations at the final workshop, it was evident that most participating teachers had an increased level of awareness of the role of the two technologies in achieving desired learning outcomes. Those who had achieved more sophisticated levels of technology use and innovation identified some subtle affordances of the combination of interactive whiteboards and TLF digital content, including:

- an ability to prepare interactive sequences in advance for lessons, and then later for revision and for other learning contexts

- an extension of teaching capability through the creation of recorded sequences that could be replayed by students as required, whether for practice or revision
- direct access to resources through local databases and digital content, and indirect access through web links
- students' faster acquisition of concepts through access to a range of modalities of representation and interactive sequences that can quickly illustrate a concept and also reduce misconceptions and difficulties in interpretation
- capacity to employ of a range of construction tools (for example, the virtual protractor) as part of the rich collection of resources that form part of the interactive whiteboard software.

## **Introduction**

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This study examines levels of use of an innovation, namely the combination of interactive whiteboards (to present ideas and concepts to students visually and interactively) and use of digital content produced by The Le@rning Federation. The digital content includes 'learning objects' (interactive learning materials) and 'digital resources' such as pictures, movie clips, sound files.

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Twenty participants, comprising teachers and curriculum consultants, in the following six schools participated in the full duration of this study. The schools covered primary and secondary years and inner-city and regional contexts, across three states and the Northern Territory:

- Canning Vale College, Perth, Western Australia
- Centralian Senior College, Alice Springs, Northern Territory
- Footscray North Primary School, Melbourne, Victoria
- Gray Primary School, Darwin, Northern Territory
- Mona Vale Public School, Sydney, New South Wales
- Northern Beaches Secondary College (Cromer Campus), Sydney, New South Wales

### ***Research approach***

A review of research related to the study (see next section) indicated that successful classroom use of information and communication technologies requires a careful process of collaboration between teachers and experts, successful experience in teaching with the technologies, and participation in a community that provides continuous support – a combination that is not commonly found in education contexts.

Participants in this study were provided with all three of these requirements. They were introduced to the innovations, and subsequently supported in their use, through three two-day workshops for all participants, continuing access to a curriculum consultant, visits to their schools by the researchers and, in some cases, through collaboration with teachers in other participating schools.

### ***Workshops***

#### **Workshop 1**

The study commenced in June 2006 with a workshop in Melbourne that introduced the participating teachers to the principles behind the development of TLF digital content and to ways of analysing changes in professional practice, especially in relation to and learning activities for students.

During this workshop, participants collaboratively developed a plan for how each school would explore the impact of the use of interactive whiteboards and TLF digital content. As well, sessions were dedicated to developing the teachers' professional skills in using interactive whiteboards, and to discussing how various TLF learning objects could prove engaging for particular groups of students.

#### **Workshop 2**

By the time of this workshop, held October 2006 in Sydney, the research team had visited most participating schools. This second workshop extended the participants' skills with interactive whiteboards and TLF learning objects, and also sought to position each participant's 'stage of concern' and 'level of

use' (see previous section) regarding implementing the combined innovation. By this time the early adopters had reached a 'routine' level of use, while a few participants were still hampered by lack of access to an interactive whiteboard.

This second workshop was followed by visits to those schools where participating teachers were still in the early stages of use of whiteboards and TLF learning objects. At this point one of the small schools ceased to participate, as changes to the teaching staff did not allow for replacement of a participant.

In the following months the researchers visited and collected samples of work from the remaining schools in the study.

### **Workshop 3**

At a final workshop, held in April 2007 in Alice Springs, each participating school presented its learning journey and project outcomes via an "exhibition". Visits were undertaken to Centralian Senior College to explore how their combined use of interactive whiteboards and TLF digital content was being used to support local and Indigenous students in years 10 to 12. During this final workshop, all participants were interviewed in mixed school groups.

### ***Visits to schools by the researchers***

The researchers visited most of the participating schools on two occasions, during which they interviewed all participating teachers and observed their classroom lessons. Further interviews were conducted during the final workshop in Alice Springs.

### ***Surveys of teachers and students***

Each teacher participating in the study was asked to respond to a survey that provided data on their use of interactive whiteboards and TLF digital content. Their students were asked to respond to a survey on their response to using TLF learning objects. Both surveys replicated the items in the surveys conducted by Freebody, Muspratt & McRae (2007) in their major evaluation of TLF digital content.

### ***Calendar of events***

2006

- 4–5 June Workshop 1 in Sunbury, Melbourne
- 23 August Footscray North Primary School, Visit 1
- 20 September Mona Vale Public School, Visit 1
- 21 September Northern Beaches Secondary College (Cromer Campus), Visit 1
- 27 September Gray Primary School, Visit 1
- 30–31 October Workshop 2 in Sydney
- 28 November Canning Vale College, only visit

2007

- 5 March Planned visit to Yuendumu School, but school withdrew from the study on 1 March.
- 6 March Centralian Senior College, only visit
- 28 March Mona Vale Public School, Visit 2 (only to Nicola)
- 29 March Northern Beaches Secondary College (Cromer Campus), Visit 2
- 4 April Gray Primary School, Visit 2
- 19 April Footscray North Primary School, Visit 2
- 26–27 April Workshop 3 in Alice Springs

Teachers' and students' responses to the learning objects (survey data) were collected between February and June 2007.

## Review of related research

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As the study was to examine levels of use of an innovation, namely the combination of interactive whiteboards (to present ideas and concepts to students visually and interactively) and use of digital content produced by The Le@rning Federation, previous research work that provided a basis for the study related to:

- use of information and communication technologies in classrooms
- classroom use of interactive whiteboards
- classroom use of digital 'learning objects'
- levels of use of an innovation.

### ***Use of information and communication technologies in classrooms***

In the employment of information and communication technologies (ICT) in teaching practice, enthusiastic supporters argue for their important role in making learning activities relevant and linked authentically to visual and real-world contexts. However, these arguments have not received teachers' universal support.

Vrasidas and Glass (2005), in compiling views about how to prepare teachers to use technologies in the classroom, found it easy to identify significant obstacles to integrating their use (see Table 1). However, their limited prescriptions for overcoming these obstacles suggest that integrating ICT use into classroom practice requires more than just providing access to the technologies; that it requires a careful process of collaboration between teachers and experts, successful experience in teaching with the technologies, and participation in a community that provides continuous support. In many education contexts some of these elements are missing. Many teachers have never used ICT-based learning strategies as learners themselves, nor had training in, or previous experience of, teaching with such technologies. The rapidly changing technological context in which classroom learning activities are occurring makes the challenge for these teachers even more difficult.

**Table 1: Obstacles to integrating ICT in the classroom**

- 
- The conservative nature of the traditional culture of schooling and classroom instruction
  - Teachers' resistance to changing their traditional teaching approaches
  - Lack of time for teachers to learn how to use and integrate ICT into their teaching
  - Lack of technology infrastructure
  - Lack of specific technologies that address the specific needs of teachers and students
  - Lack of ongoing support
  - Lack of released time and incentives for teacher innovators
  - Incompatibility of traditional teaching with the constructivist framework fostered by ICT
  - Need for teachers to unlearn traditional teaching beliefs and practices
  - Need to prepare teachers to integrate ICT by integrating ICT in teacher-preparation programs
  - Need for policy, curriculum, and assessment reform
- 

(Vrasidas & Glass 2005, p 8)

Russell, Bebell & O'Dwyer (2005) state that while schools have invested in the technologies, studies show that teachers are making little use of the technologies and students have limited access to them. However, they also point to the coarseness of the design and discussion of these studies, suggesting the need to collect multiple measures that reflect the multifaceted nature of teachers' use of information and communication technology. Nevertheless, there is so far little evidence of any radical shifts in teaching and learning arising from classroom use of ICT.

Which information and communication technologies *could* make a major difference in teaching and learning contexts? Perhaps Clayton Christensen's (1997) idea of 'disruptive innovation' is relevant.

Christensen defines a disruptive innovation or technology as one that eventually takes over an existing dominant technology, despite its being radically different from that dominant technology and often initially performing less successfully according to existing measures of performance. However, over time, the functionality or attributes of the new way of doing things enable it to replace the older technology. A recent example of a disruptive technology is in the field of photography. For many decades acetate film provided the visual record of everyday experiences. In the second half of last century the Polaroid film process provided a potentially disruptive technology in that recorded images could be viewed within seconds, a facility for which some important uses emerged. However, once recording processes moved from analogue to digital, there was no longer a need to store recorded images in any material form; and the digital images could be deconstructed, manipulated and retrieved as required and, in high-quality form, transmitted anywhere in the world to be reconstructed to that same quality. Digital photographic technologies were the disruptive innovation that replaced the previously dominant photographic film and Polaroid processes.

No such disruptive technological innovation seems yet to have challenged traditional pedagogies. However, while students still meet in formal classes, the combined use of the interactive whiteboard and TLF digital content *could* develop into a disruptive technology as each of them changes how ideas are represented and how concepts can be presented and shared, especially among those having difficulties in learning them (Hedberg 2006).

### ***Classroom use of interactive whiteboards***

During the past five years a number of studies, particularly within the United Kingdom, have pointed to the capacity of interactive whiteboards to illustrate and demonstrate key concepts in multimodal and engaging ways. In other studies (which generally made little use of the sort of school-based curriculum support and skills development workshops that were a feature of the current study), researchers are more guarded about the effectiveness of the investment. For example, Moss et al (2007), in their evaluation of schools' use of interactive whiteboards, reported the following:

1. Interactive whiteboards *are* used by most teachers who have ready access to one.
2. Interactive whiteboards are mainly used as 'a data projector which can navigate to multiple screens; as a surface which can generate a dynamic rather than static form of display; to enhance presentation in front of the class'. (p 5)
3. Many teachers struggle with the design principles for establishing clear reading paths for students.
4. 'The literature suggests a continuum in which new technologies initially support, then extend and finally transform pedagogy as teachers gradually find out what the technology can do ... Familiarity, confidence and time are assumed to be the keys that unlock this gradual process of transformation ... But the introduction of an interactive whiteboard does not in and of itself transform existing pedagogies. The main emphasis needs to rest with the appropriateness of the pedagogy, not the use of the technology per se.' (p 6)
5. The use of interactive whiteboards does not automatically alter students' levels of achievement.
6. The change fostered by interactive whiteboards depends on what the teachers see as the purpose of the interactive whiteboard, for example, increased pace of delivery, increased use of multimodal resources or more interactive styles of whole-class teaching.
7. Teachers implemented the interactive whiteboard more frequently and in more varied ways in some curriculum areas more than others, according to the curriculum demands such as visually representing Science concepts.

Unsurprisingly, Moss et al call for more research, more time to understand the impact of interactive whiteboards, more training for teachers, and more collaboration among colleagues.

BECTA (2005) outlines three 'stages' that are followed by teachers in their use of interactive whiteboards: 'supported didactic', in which the teacher uses the interactive whiteboard only as visual support for the lesson; 'interactive', in which the teacher makes some use of the interactive whiteboard for a variety of verbal, visual and aesthetic stimuli; and 'enhanced interactive', considered best practice, in which the

teacher exploits the interactive capacity of interactive whiteboards and uses them as a means to prompt discussion, explain processes, develop and test hypotheses and employ a wide variety of materials. These stages mirror earlier, more general, findings of Hall and Loucks (1978), who provided a framework for examining teachers' 'stages of concern' in approaching innovation (see below, within 'Levels of use of an innovation').

### ***Signs of a related disruptive pedagogy?***

Shuck and Kearney (2007), who used case studies to explore the role of interactive white boards in six classrooms in New South Wales, summarised the major benefits of interactive whiteboards, as reported by teachers and students, to be:

- facilitation of reflective practice
- ease of use
- learning of new skills
- visual interest
- immediacy, flexibility, and convenience
- interactivity
- a matching of the students' digital culture.

It is important to note that these benefits all pertain to any computer-projected image rather than to the interactive nature of the whiteboard. This study, however, by combining TLF learning objects with use of the whiteboard, presented scope for interactivity.

Shuck and Kearny (2007) reported that the interactive whiteboards were used mainly to support and facilitate:

- whole-class work in front of the interactive whiteboard
- mainly authoritative dialogue and initiation–response–evaluation (IRE) sequences in which the teacher repeatedly asks a question, obtains a response from a student and evaluates that response
- planned lessons.

All the above studies have indicated support for the use of interactive whiteboards in a variety of contexts but most researchers have not worked with sufficient resources to ensure that teachers are supported to develop their skills in using interactive whiteboards, nor for a sufficient length of time to observe how teachers reflect on their experiences and change their practices.

### ***Classroom use of digital learning objects***

Digital learning objects represent the increasing modularisation of individual elements that can be retrieved from databases and employed in a number of different learning contexts. The digital learning objects that are most commonly used in classrooms are those that are linked closely to topics within a syllabus. Such learning objects tend to be a direct substitute for traditional texts and other non-interactive forms of presentation.

While repositories of learning objects have been developed, the use of learning objects is not as common as might be expected. One significant reason for the low level of use appears to be that most learning objects deal with specific content that can be used to teach only specific topics within specific contexts.

### ***Signs of a related disruptive pedagogy?***

Modularisation and development of reusable learning objects can provide considerable support for changes in teaching approaches because they encourage new ways of teaching and learning that could bring about the following shifts:

- from content management systems to digital repositories

- from learning objects (with content embedded) to learning activities that are generic pedagogical sequences that can be applied across curriculum areas.
- from information delivery to interaction that enables the social construction of meaningful knowledge
- from assessment of the end product to assessment of the learning journey (through keeping running portfolios of products that reflect changes in understanding and reflection)
- from an emphasis on teaching facts and principles to an emphasis on benchmarking learning performance against other groups or other classes.

As TLF's learning objects incorporate these kinds of shifts, their use might be expected to shift current classroom learning activity (which is driven by the teacher) towards potentially disruptive pedagogical options in which the learner not only experiences views of the world that are multimodal but requires a range of literacies to understand the different representative descriptions and to construct and communicate their ideas with others. To support such a shift from the learner as a passive participant towards the learner as an active engaged constructor of their own experiences, requires that attention be given to the nature of learning activities, an exploration of how interactions are managed and facilitated, and a choice of the right tool for the pedagogical task (Hedberg 2006).

### ***Levels of use of an innovation***

As any change can be intimidating, and as classroom use of ICT has a history of being less than successful, it was important to have a framework for describing and discussing changes in levels of use of the innovation being examined in the study: the combination of interactive whiteboard and TLF digital content (learning objects and resources). It was important that the researchers would be able to explore with each participant the extent of change in their use of this *combination*, not just the hardware or the software. Such exploration would benefit from a capacity to discuss both the *affective* and *behavioural* dimensions of the change.

### ***The affective dimension of change***

In describing the *affective* dimension of change (how teachers feel about doing something new or different, and their concerns as they engage with a new program or practice), discussion of the 'stages of concern' has proved to be most helpful for professional development purposes.

The concerns-based adoption model (Horsley & Loucks-Horsley 1998; Hall & Loucks 1978) provides a model for describing the extent of changed practices among teachers taking part in an innovation. This model uses seven 'stages of concern', grouped into four categories shown below in bold, which correlate with increasingly sophisticated levels of use of an innovation.

Discussion of these stages took place at the workshops conducted as part of the study. At the second workshop the teachers identified their own current stage of concern.

Stages of concern

#### **Awareness**

- Stage 0: A teacher is either unaware of the proposed innovation or not interested in learning about it.

#### **Self**

- Stage 1 (Informational): A teacher asks questions on hearing about something new.
- Stage 2 (Personal): A teacher asks how it might affect them.

#### **Task**

- Stage 3 (Management): A teacher engages with new skills, time demands, materials, etc.

#### **Impact**

Stage 4 (Consequence): A teacher considers how to make the innovation work better for learners.

Stage 5 (Collaboration): A teacher works with colleagues to make the innovation work better.

Stage 6 (Refocusing): Having been successful with the innovation, a teacher seeks a further challenge.

### ***The behavioural dimension of change***

The behavioural dimension of change – what teachers actually do in the classroom when making the transition from one teaching practice to another – can be measured using the following levels of use.

The first three levels of use apply to those who are yet to actually make use of the innovation:

- Level 0 (Non-use): A teacher takes no action in relation to the program or practice.
- Level 1 (Orientation): A teacher seeks information about the program or practice.
- Level 2 (Preparation): A teacher decides to adopt the new practice and prepares to implement it.

Until the formulation of the concerns-based adoption model, the literature on innovation implied that once people had decided to use a new practice and were trained in its use, they would establish a suitable routine fairly quickly. However, the concerns-based research revealed the following five further significant levels of mastery among users:

- Level 3 (Mechanical): In early attempts to use new classroom strategies, techniques and materials, teachers often feel inadequate and awkward.  
When using interactive whiteboards or learning objects for the first time, teachers would constantly refer to the index or teachers' notes for guidance and reassurance. Teachers at this level of use often focus on teacher-centred pedagogies.
- Level 4a (Routine): Teachers establish a satisfactory pattern of behaviours and use the innovation with a view to improving learning outcomes rather than to reducing classroom management concerns.  
When using interactive whiteboards or learning objects, teachers would begin to use more student-led sessions and facilitate small-group use of the two technologies.
- Level 4b (Refinement): Teachers move beyond routine patterns to assess the impact of their efforts and make changes to increase that impact.
- Level 5 (Integration): In using the innovation teachers actively coordinate their efforts with those of their colleagues.  
When using interactive whiteboards or learning objects, teachers would share information with other teachers, regarding their effective use of the two technologies.
- Level 6 (Renewal): Teachers seek more effective alternatives to the established use of the innovation. (This is essentially the beginning of a new cycle of stages of concern and levels of use.)

## Surveys of teachers and students

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Each teacher participating in the study was asked to respond to a survey that provided data on their use of interactive whiteboards and TLF learning objects. Their students were also surveyed regarding their response to using TLF learning objects. Both surveys replicated items in the surveys conducted by Freebody, Muspratt & McRae (2007) in their major evaluation of TLF learning objects. Each user of a learning object also submitted a short evaluation of the object.

### **Findings**

While the sample size is much smaller than that of Freebody, Muspratt & McRae (2007) in their major evaluation of TLF digital content, the distribution of responses is similar.

#### **Use of TLF learning objects reported in the surveys**

The list of objects used by the participants is shown in Table 2.

**Table 2: Frequency of use of learning objects by participants**

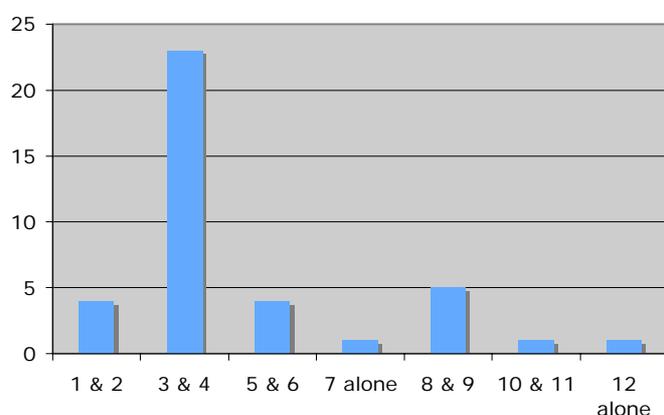
Learning object	Teachers	Students
Anti-bullying campaign	2	32
Area of triangles	1	50
Cassowary fractions	1	
Creativity: Fifi Colston	1	
Decimaster	3	2
Energy from the Sun	1	16
Epilepsy	1	14
Eyeball challenge	1	18
Indigestion	2	18
Kakadu	2	66
Letters to the editor	1	
Meet a scientist	1	29
Monster choir	1	9
Musical number patterns	1	20
Number trains	1	20
Playground rules	1	2
Point of view: witness reports	1	
Respiratory system	1	
Scale matters	2	19
Shaping the land	1	20
Space rescue – Planet Thor	1	12
Take a deep breath	3	33
The digestive system	1	
The rainforest	1	
To catch a thief	2	2
Wishball (in different forms)	5	17
Other responses	0	31
	39	430

The distribution of these learning objects across six curriculum areas is summarised in Table 3, where the final column presents the roughly similar distribution found in the larger Freebody et al (2007) study. In each case, the strongest use is in the area of mathematics and numeracy.

**Table 3: Use of learning objects by curriculum area**

Curriculum Area	No of learning objects	This study	Freebody 2007
		%	%
English/Literacy	6	15	14
Mathematics/Numeracy	15	38	29
Science	6	15	27
SOSE/HSIE	5	13	12
Other	6	15	13
The Arts	1	3	5
	39	100	100

In this study, the most frequent use of learning objects was at years 3 and 4 (TLF Stage 2), as shown in Figure 1. Many of the classes in the study were of composite year levels, such as years 3–4 and years 8–9, a structure that was popular in both the primary and secondary schools participating in the study.



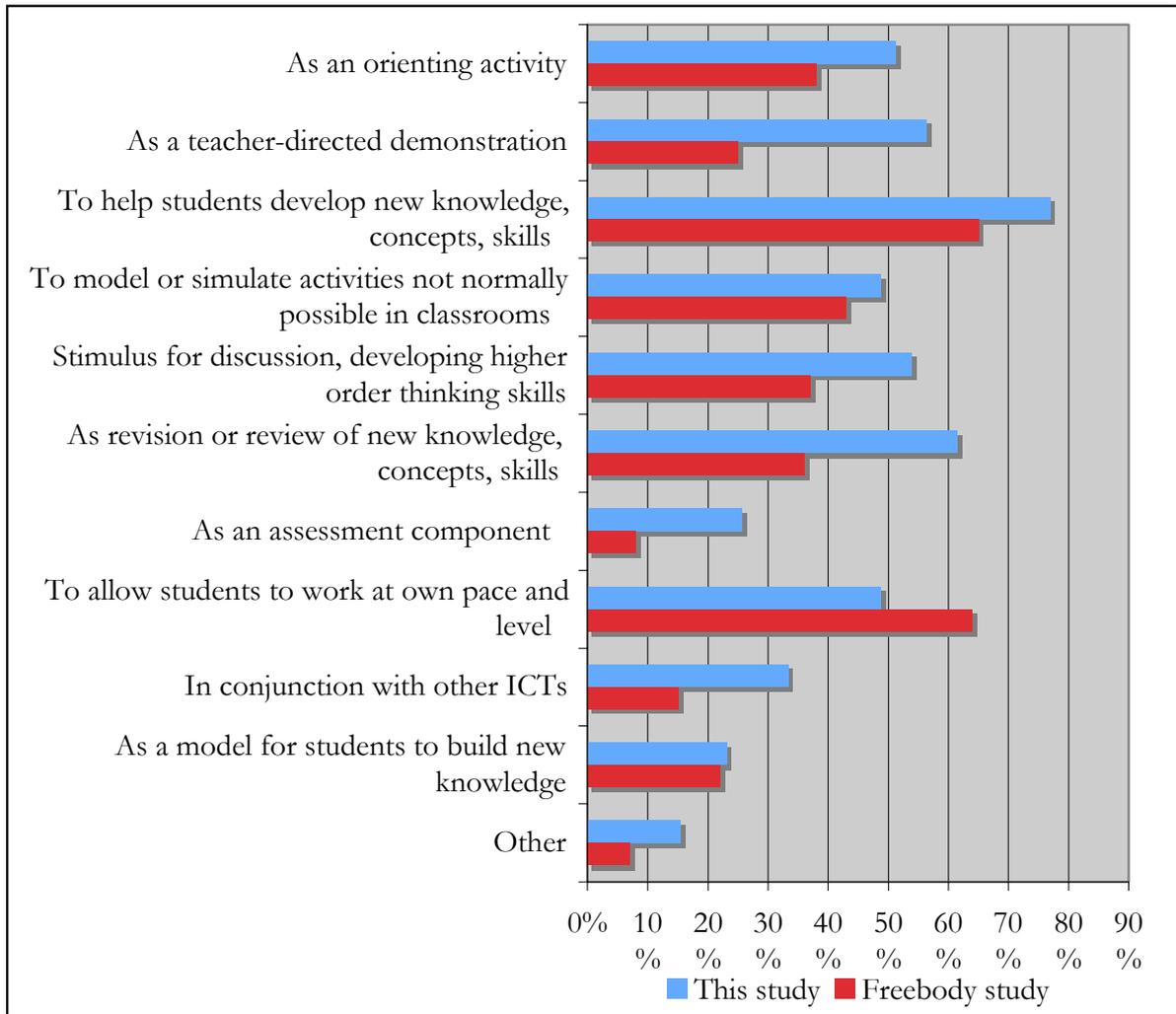
**Figure 1: Number of learning objects used by teachers, by year level**

### ***Teachers' responses to the learning objects***

#### **Teachers' uses for learning objects**

Each teacher was asked to indicate the purposes for which they used each learning object. In responding to 11 items, they could choose any or all of them. Figure 2 summarises the responses of the teachers in this study and also the responses of teachers to the same items, in the larger study by Freebody et al (2007). For every purpose other than 'to allow students to work at own pace and level', teachers in this study recorded higher levels of use than did the teachers in the larger study. This difference may well have arisen from the bias in this study towards use of more learning objects in the lower years of schooling.

It was evident from the researchers' interviews with teachers and their lesson observations that, in the primary schools, learning objects were more often used for whole-class or small-group instruction than for individual use, and mostly to help generate new knowledge, concepts or skills, or to revise them. Teachers also employed the recorded and retrievable nature of the objects for repeated practice and for assessment of learning outcomes. Learning objects such as 'Wishball' and 'To catch a thief' lend themselves to development of knowledge and also to a form of engaging and challenging assessment.

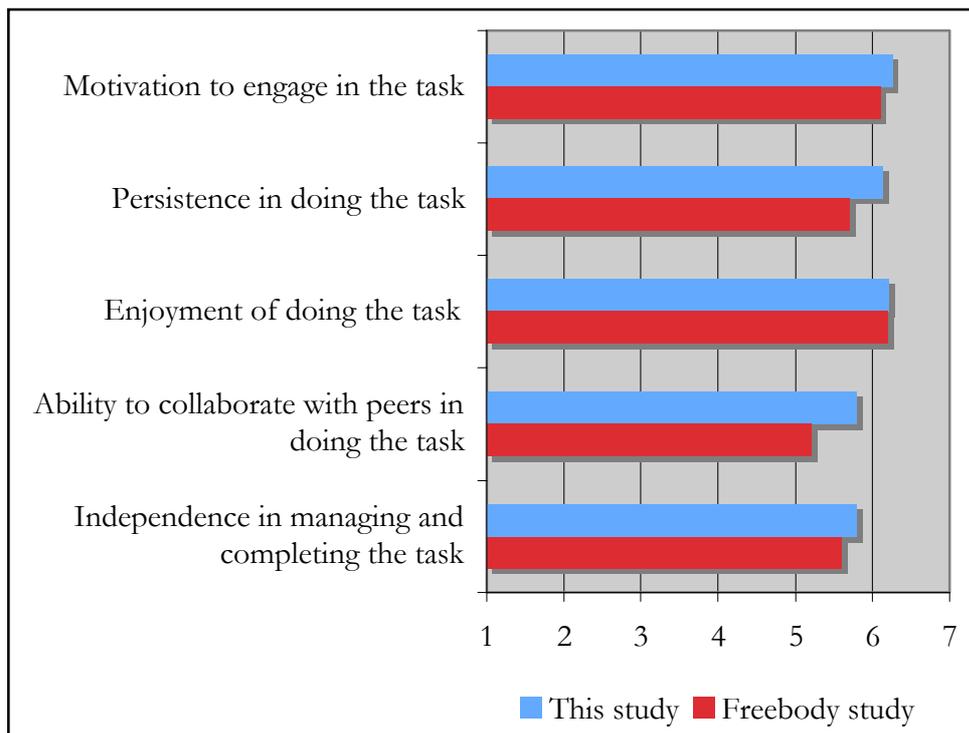


**Figure 2: Uses of learning objects reported by teachers**

Teacher’s views of the effect of learning objects on students

*Students’ motivation to learn*

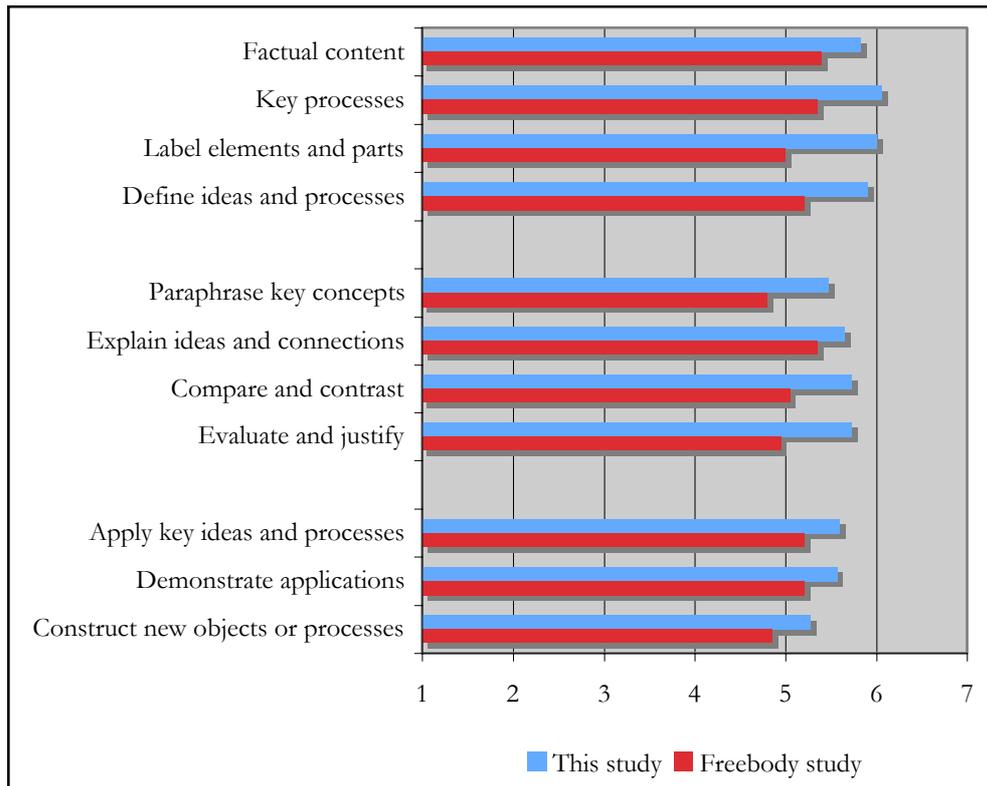
As in the earlier Freebody et al (2007) study, the participating teachers were asked to use a seven-point scale to record their perceptions of the motivational effects of the learning objects on students. The results are shown in Figure 3, where they are compared with responses to the same list in the Freebody et al (2007) study. The mean ratings are slightly higher in this study than in the larger study.



**Figure 3: Teachers' perceptions of the motivational outcomes of using the learning objects (1=low, 7=high)**

*Students' learning outcomes*

When the teachers rated the usefulness of the learning objects in achieving specific types of learning, the participants in this study were again most enthusiastic about the helpfulness of the learning objects in achieving various types of learning (see Figure 4).

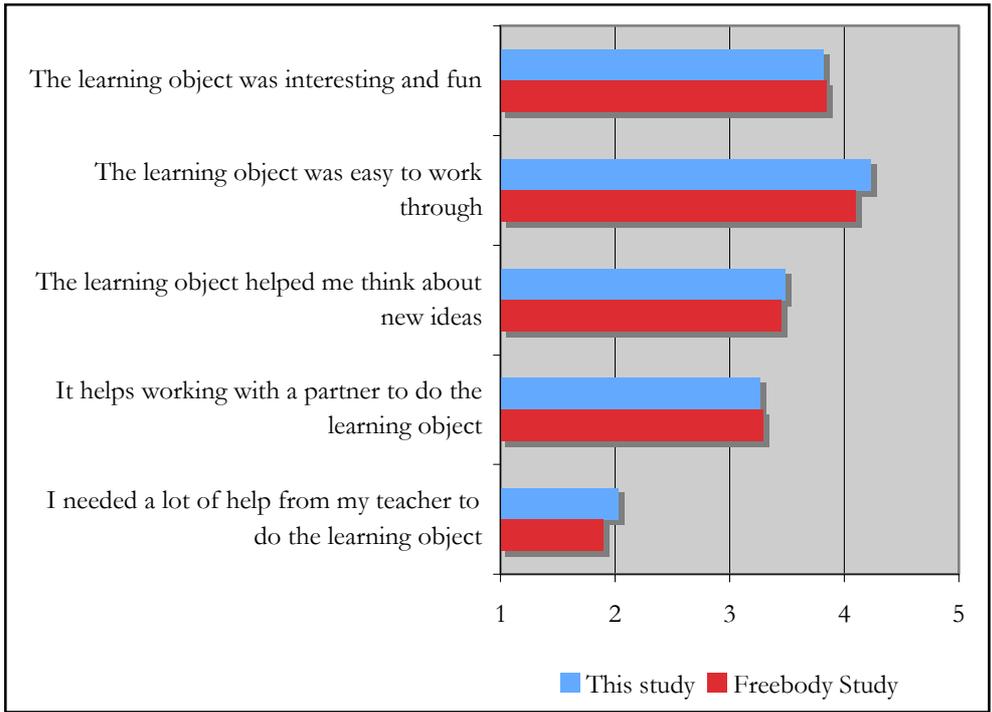


**Figure 4: Teachers' perception of the learning outcomes of using the learning objects**

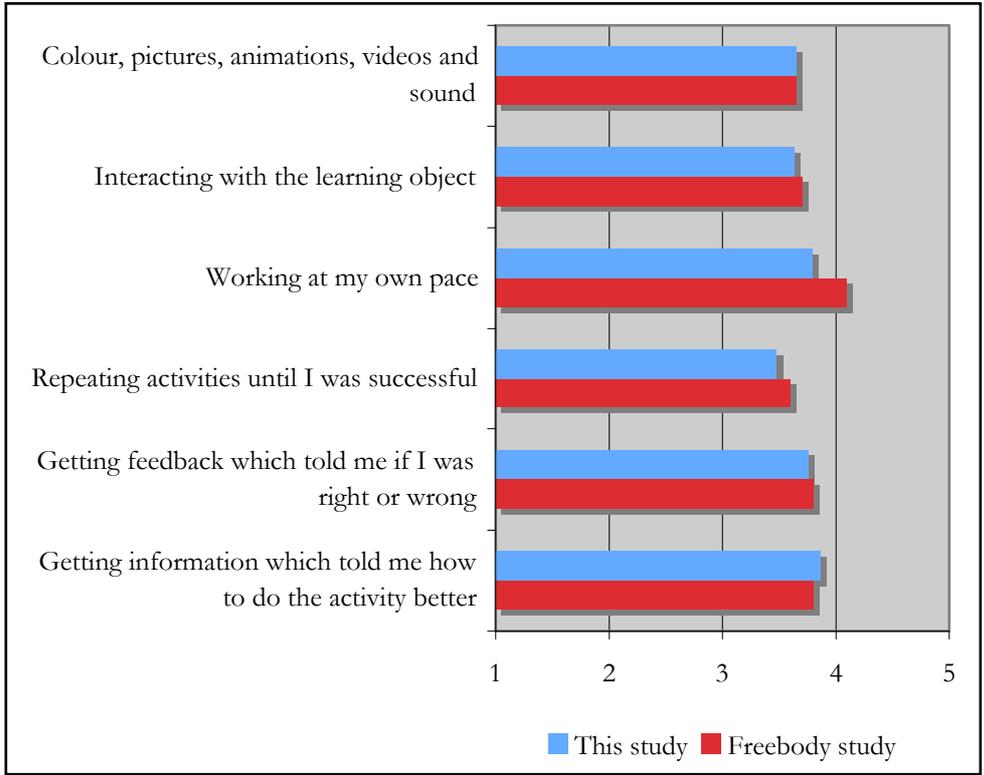
***Students' responses to the learning objects***

Each participating teacher encouraged their students to respond to an online questionnaire about the learning objects that the students used as part of their learning activities. This achieved a reasonable response in all schools. Figure 5 shows that the responses mirrored very closely the general response pattern from the Freebody et al (2007) study. The only school not well represented in the student evaluations was Gray Primary School where, because one teacher used the objects solely as a teacher-directed strategy, students were given little direct access to the learning objects. Overall, the students claimed they liked the learning objects and could use them without help from their teacher.

Students rated positively all the items about using the learning objects to learn. The overall result closely matched the result for the same questionnaire in the study by Freebody et al (see Figure 6).



**Figure 5: Students' evaluation of the learning objects** (1=strongly disagree, 5=strongly agree)



**Figure 6: Students' views of the helpfulness of various features of learning objects** (1=not at all helpful, 5=extremely helpful)

## **Experience of innovation in the schools**

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The researchers visited most of the participating schools on two occasions, during which they interviewed all participating teachers and observed their classroom lessons. This section reports the results of those interviews and observations. It also incorporates the results of interviews held with the participating teachers during the final workshop.

### ***Canning Vale College, Perth, Western Australia***

#### ***The school and its students***

Canning Vale College is a middle school situated in the Perth suburb of Canning Vale. The school works in four 'neighbourhoods', which are large spaces shared by about 100 students and four teachers of Maths, English and Integrated studies. Students leave the 'neighbourhood' for specialist subjects.

Before the arrival of the first whiteboards at the commencement of the project, each neighbourhood already had about 15 desktop computers and a mobile laptop lab. The two Promethean whiteboards were placed in two of the neighbourhood spaces. However, because of difficulties with installing them, the teachers did not obtain access to them until three months after the commencement of the project; and all the teachers commented on problems with the location of the whiteboards, stating that the space was too open, or too hot in summer, for effective working with whiteboards.

#### ***Participating teacher – Trevor Beanland***

Head of neighbourhood; Maths teacher

At the beginning of the project Trevor knew nothing of interactive whiteboards. He agreed to take part in the project because his principal asked him to do so. While excited about the project, Trevor was concerned that his lack of confidence with technology in general, combined with his being a self-confessed 'traditional Maths teacher', would make using the interactive whiteboard very challenging for him.

*From observations and interviews during the school visit in November 2006*

For the observed Maths lesson, which dealt with calculating the area of a triangle, Trevor used a learning object on the interactive whiteboard to demonstrate to the whole class the formula they needed to use. He then allowed students who were confident with the process to move to another area to complete a worksheet, and continued to use the learning object on the whiteboard with the remaining small group of students. These students all took turns with the stylus, with the others helping the student with the stylus if there was a need. This seemed to work well, with all students grasping the concept by the end of the lesson. At any point students in the whiteboard group could move to the worksheet group (and vice versa).

Trevor commented that this type of lesson was quite new for him as he was used to a more traditional style of always teaching the whole class. He said that as a result of learning how to use the interactive whiteboard and learning objects:

I'm thinking of different ways of doing things, I'm thinking of individual kids ... my initial lessons [with the whiteboard and learning objects] were basically aimed at the masses, and they would just listen to me and watch me use it, whereas now I'm using [them] to target particular groups within the lesson.

At the time of the visit, Trevor's increasing experience with the interactive whiteboard saw him planning flipcharts and finding learning objects to use. He thinks that if he were to 'compare a good lesson on the whiteboard with a good lesson without the whiteboard, [there's] probably not a huge difference, but I am more conscious of having a good lesson'. Trevor was also finding that in planning to use the interactive whiteboard, he was thinking more carefully about what he was hoping to accomplish in the lesson.

*From the interview at the Alice Springs workshop*

Trevor reported that he hardly touches the interactive whiteboard anymore, as the minute he walks in with his laptop on a trolley, a student grabs it, sets it up, grabs the stylus and asks Trevor what the lesson is saved as. After attempts at using the interactive whiteboard for traditional lecture-style lessons (with some success and some failure) Trevor now has all his teaching units set up in three stations, with up to ten in each, with one group working at the interactive whiteboard while the others do other types of tasks. Trevor moves between the stations asking questions, and finding that he can ask much deeper questions based on his observations of how students are working – rather than spending all his time trying to keep all 30 students engaged on one task.

Trevor has just finished some professional development on collaborative learning but still finds change difficult, particularly because he shares a space with three other teachers and classes, so everything needs to be very well managed or it has a negative effect on the others. Trevor had commenced teaching other teachers how to use the interactive whiteboard, particularly the other Maths teachers in the school.

Trevor commented on the benefits of the whiteboard for his students' motivation to learn. Interestingly, Trevor found that while student engagement with the interactive whiteboard itself wore off quite quickly, he has found that its use has increased students' (especially boys') engagement in their learning in various ways. Trevor thinks that boys are very kinaesthetic learners and their being allowed to get out of their seat as part of their learning has made a powerful difference.

With regard to learning objects, Trevor often uses them to introduce topics and ensure understanding. However, he is concerned that when he is not supervising them, his students don't read the instructions and use just trial and error until they get the right answers.

### ***Participating teacher – Henning Holtzheuer***

English teacher

Henning works in the same 'neighbourhood' as Trevor and so shares the same interactive whiteboard. Henning was quite resistant to using learning objects or experimenting with the interactive whiteboard, blaming poor positioning of the interactive whiteboard and the inappropriateness of the learning objects for his students as the reasons for his lack of participation in many of the required tasks of the project. Although he completed the bare minimum of tasks, his tasks were always completed late and begrudgingly.

*From observations and interviews during the school visit in November 2006*

For his observed lesson Henning used a learning object that deals with answering questions in job interviews. He started the lesson by discussing with students what they already knew about job interviews. The plan was for students to do a version of the learning object on their laptops, and then come together as a whole class to do a version on the interactive whiteboard and to discuss their answers. However, technical problems with the laptops meant that Henning had to revise the plan and do the learning object as a whole class on the interactive whiteboard first, and then get students to complete it in pairs on laptops. This disruption did not help the behaviour of the students, which at times was quite rowdy. Nor did it do anything to change Henning's opinion about the usefulness of learning objects. He reasserted that potential technical problems were a reason for the infrequency of his use TLF content in classes.

Despite Henning's often negative view of the new technologies, he conceded that it was getting easier to use the interactive whiteboard as he became more used to planning for it and more competent with the programs. He also saw benefits in being able to recall past lessons or to save work if the class ran out of time to finish a lesson. He said that although he often uses the interactive whiteboard for whole-class instruction, he has also found it to work well with smaller target groups.

*From the interview at the Alice Springs workshop*

When looking for appropriate resources the questions that Henning asks are: Is it too easy for my students? Will it engage them? Will it only take a minute or two? With regard to the learning objects, Henning remained unsure of their value to him but intended to make more use of TLF content in the

next semester. He, too, is concerned that students use simple trial and error to arrive at the right answers, which would render their achievements somewhat hollow.

Despite his often negative views, Henning was glad to have access to an interactive whiteboard and has started to work with colleagues to skill them in use of the interactive whiteboard. He hopes that, as a result, the English teachers will plan units together so that their use of the interactive whiteboard can be more effective.

### ***Participating teacher – Kylie Marsh***

Teacher of Studies of society and environment in 2006, and of Technology and enterprise in 2007

Kylie was the only person in her 'neighbourhood' to be involved in the project and therefore had exclusive use of the interactive whiteboard, but little or no collegial support. At the beginning of the project Kylie discussed being very nervous:

... after all, I'm not just [teaching] in front of 30 students, but 100 students, because they're all interested and looking, as well as three colleagues.

Extra tension was created because at the commencement of the project, Kylie was not teaching in her main subject area (Technology and enterprise) but in Studies of society and environment, in which she was not very confident.

*From observations and interviews during the school visit in November 2006*

For her observed lesson Kylie did not use TLF content (a requirement) but instead used the interactive whiteboard to introduce the concept of comic strips, after which she asked students to complete a worksheet. The class was very poorly behaved, with students often getting up to play with the interactive whiteboard and even fighting over the stylus when they should have been working at their desks.

In her interview, Kylie expressed how difficult she had found the process. She spoke of having had lots of ideas that she thought would work well and wanted to try, but of her difficulty in figuring out how to do it, and in having the confidence to try it in front of the class. She also found that students were engaged with the process only in that they wanted to play with the whiteboard; and that they 'switched off' when she tried to use it as a teaching tool. When asked what her plans were with the interactive whiteboard, she replied, 'I'd like to live here so I have time to learn to use it'.

*From the interview at the Alice Springs workshop*

Kylie reported that she felt she had made little progress with the interactive whiteboard. However, because the interactive whiteboard makes group work easier, she was doing more group work, which has resulted in a more differentiated curriculum and a stronger focus on the needs of particular students and small groups.

Kylie felt that two main factors had hindered her progress in using the interactive whiteboard. The first is that, with her return to teaching Technology and enterprise in 2007, she no longer teaches in the room that has the interactive whiteboard. The second is the lack of time to plan effectively or to learn and grow in confidence in using the interactive whiteboard, even when the board was in her room. There is now a new teacher interested in using the board, with whom Kylie is sharing her resources and knowledge.

## ***Centralian Senior College, Alice Springs, Northern Territory***

### ***The school and its students***

Centralian Senior College shares its grounds with Charles Darwin University and Alice Springs Institute of TAFE. Indigenous students comprise 45 per cent of the school's enrolment, and the school recently won an award for its Indigenous education program. The school has an alternative program (Gateways) for students who have difficulty with regular classes, a well-equipped special education centre and a strong apprenticeship program. Classes at years 11 and 12 are scheduled at various times between 8 am and 5 pm, as in tertiary education. During the periods when students are not attending a class they can work in open learning spaces that are all equipped with computers. The focus is on individual responsibility for learning. There is no restriction on students' bringing items such as iPods or even food and coffee to class.

At the beginning of 2007, the school extended its enrolment from years 10 to 12 to take year 10 as well. The new enrolment of year 10 students coincided with the IT coordinator obtaining a grant to purchase nine interactive whiteboards, all of which were placed in the year 10 area (seven of them in classrooms, including one in the special education room, and two of them in shared areas). The senior school already had four interactive whiteboards, all in shared areas.

At the beginning of the project, the IT coordinator decided to donate one of the new boards to Yuendumu, a community school, so that it could be part of the project and benefit from the associated networking. However, due to unforeseen circumstances, Yuendumu had to withdraw soon afterwards, and the interactive whiteboard was returned to Centralian Senior College where it was placed in the alternative education program.

### ***Participating teacher – Olivjia Komandina***

IT Coordinator 2006, Deputy principal 2007, ESL teacher

At the beginning of the project, as IT coordinator for the school, Olivjia's main concern was how to embed IT into teaching and learning and move away from lecture-style teaching. While many of the teachers knew how to use interactive whiteboards, they were still at the stage where they believed that the interactivity lay between *themselves* and the board, rather than between the *students* and the board. Olivjia found it much easier to create an interactive classroom with the year 10 groups because the year 10 curriculum is not as constraining as that of years 11 and 12.

*From observations and interviews during the school visit in March 2007*

Not only was Olivjia herself observed teaching TLF content on the interactive whiteboard but, by arrangement, so were other teachers that she had been working with, as Olivjia saw her role in the project as a facilitator for other teachers as much as an individual teacher herself. The following observations were made on each of four lessons.

#### ***Year 10 Psychology***

At the beginning of the lesson the teacher used the learning object 'Filling glasses' for revision purposes. The students did not get to touch the stylus until over 30 minutes into the lesson. The teacher says that he loves using the interactive whiteboard but finds its location in an open learning area frustrating, as there are too many distractions. He regards the whiteboard as more difficult to use with a large class because it is harder to achieve interactivity and students often cannot hear the audio element. This teacher likes to use the interactive whiteboard for a part of each lesson as otherwise he thinks the lesson might become too passive (like watching TV); which is why it would suit him better to have the whiteboard in a classroom.

#### ***Year 10 Science***

The lesson began with the teacher retrieving old flipcharts and quickly reviewing the past week's lessons, using an initiation–response–evaluation style of questioning to keep the students engaged. Then they

started the learning object ‘Where’s the smoke?’. The students used the stylus almost all the time, directed by the teacher. The students discussed the learning object in great depth, repeating its activities continually after each time discussing why certain things happened. It took almost 20 minutes for the class to get past the first two screens. As a whole class they worked on the learning object for an hour before taking a break and starting on a new activity.

#### Years 11–12 ESL

In this combined class, Olivjia often has to spend more time with the year 11 students whose language levels are lower than those of the year 12 students, so she has arranged to take the year 12 students for an extra hour, before the main class, so that she can stretch their abilities further.

With the year 12 group that was observed, Olivjia used the learning object ‘Nhu Minh’s story’, connecting it to the students’ preparation of oral (autobiographical) presentations, which were almost due. The students had complete control of the interactive whiteboard, with Olivjia standing at the side suggesting what to look for and asking questions to check students’ understanding.

When the year 11 students joined the group for the main lesson, they brought the class website onto the interactive whiteboard to check homework (students submit their homework online). Next they used the learning object ‘A new bridge’ because Olivjia wanted them to connect what they were talking about with images, and also because the character responses were perfectly set up for Olivjia to discuss sentence structure, which she did on a traditional whiteboard.

In her interview, Olivjia discussed levels of uptake of whiteboard use in the school. While she considers that most teachers are still at ‘data projection’ stage, she is not worried by that because:

- ... some things are just time – no matter how IT savvy or enthusiastic you are
- it takes time to learn how to use them efficiently and properly.

#### Year 12 Art

The teacher began the lesson on the interactive whiteboard using an online ‘artist’s toolkit’ program where students could experiment with lines, shapes and colours. The teacher ran the logistics of the interactive whiteboard but invited students to come up to complete activities. She then introduced the learning object ‘Creativity: Fifi Colston’, using the stylus herself to demonstrate how it should be completed and then sending the students off to individual computers. However, as a technical problem resulted in the students not being able to complete it, the teacher brought all students back to the interactive whiteboard to complete the learning object as a whole-class group; but found that a programmed word limit prevented her submitting everyone’s answers. Because the learning object required typing, the teacher stayed at the computer and used the interactive whiteboard basically as a projector.

#### *From the interview at the Alice Springs workshop*

Olivjia enjoyed being part of this project because she found the networking so valuable, particularly because it came from all over Australia, a rare experience for Northern Territory teachers. Olivjia has been doing a lot of work with her teachers to get students more involved in the whiteboard lessons and to make their teaching more interactive.

With regard to TLF content, she thinks that digital resources, which she often uses as stimulus for students’ writing, give teachers further freedom. She has found the learning objects to be very popular with the year 10 teachers and students. She thinks this is because, at year 10, there is more freedom to focus on skills and processes rather than on knowledge content, which is the focus in the senior school. She thinks having sound in learning objects is great for senior ESL. Olivjia commented very positively on TLF content being available all the time through NT Explorer, as it allows students to take risks and make mistakes, to go over a learning object again in their own time at their own pace. She also commented that looking for learning objects is time consuming but once it’s established and you know what you’re looking for, the result is highly rewarding.

Olivjia is of the opinion that it doesn’t matter if interactive whiteboards make things better or not. Like computers, she thinks that now they are here, they will stay. So it’s no longer a matter of ‘should we have them?’ it’s now about ‘how should we use them?’.

## ***Footscray North Primary School, Melbourne, Victoria***

### ***The school and its students***

Footscray North Primary School is in Footscray, an inner-western Melbourne suburb. The school has a high refugee population, and a large percentage of students with language backgrounds other than English. The school has four interactive whiteboards, two in years 3–4 classrooms, one in a year 1–2 classroom, and one in the library. Each classroom also has two to four computers and there is a computer lab attached to the library. As the school employs a technician for only one or two days a week, the teachers may need to wait some days for help with technical problems.

The school has quite a few older, experienced staff who have been quite timid about using ICT. According to one participating teacher, before the interactive whiteboards arrived, a tour of the 14 classrooms, all of which have computers, would reveal only two or three with computers in use. Participation in the project has been associated with the school's embrace of ICT, and all classrooms now have new computers. The participants organised weekly 'techie brekkies', open to the entire staff, at which ideas, problems and skills could be discussed and shared. Staff meetings are now held in the library so that use of the interactive whiteboard is seen to be part of everyday school events.

If they wished to take part in the project, staff members were invited to make a written request, in which they were to state why they and their students would be suitable participants and how they would benefit from access to the new technology.

At the end of the Alice Springs workshop, this school's participants spent some extra days visiting two schools in Indigenous communities of the Northern Territory. The decision was sparked by Sharon, one of the Footscray participants, who had a friend working at Yulara, an Indigenous community near Uluru, who had never worked with interactive whiteboards. As well, the Footscray participants were interested in the Yuendumu community school, which had initially participated in the project but had needed to withdraw. The Footscray North staff decided to visit these two schools to share and demonstrate how they were using the interactive whiteboards in their classrooms. These were very successful visits, as none of the Footscray North staff had ever been to an Indigenous community; and at Yuendumu, the year-old interactive whiteboard had never been properly connected to a computer or even switched on, because of lack of technical support in this community. The Footscray North staff showed the Yuendumu teacher how to turn it on and use the basic programs, and also demonstrated its use in a lesson, which was very successful.

### ***Participating teacher – Ruth Moodie***

Assistant principal

At the beginning of the project, Ruth's main concern was with the technology itself because she knew little about it. As Ruth does not have her own class, her role in the study was to train teachers in use of the interactive whiteboards by taking their classes into the library and using the interactive whiteboard there. Typically, two teachers (at the same year level), would bring their classes to the library, where the combined group would be split into three groups. One group, supervised by the librarian, would work quietly with books, the second group, supervised by one of the class teachers, would work on the computers, and the third group would work at the interactive whiteboard where Ruth would do the teaching and the other class teacher would observe the lesson.

The groups would then rotate, with the teacher who had been observing Ruth taking on teaching the lesson on the interactive whiteboard, and the other class teacher observing. On the next rotation that observing teacher would teach on the interactive whiteboard. Ruth believes this arrangement has worked most effectively, as the prep and years 5–6 teachers are now very comfortable with the interactive whiteboard and are ready for the two further boards due to arrive later in 2007.

*From observations and interviews during the school visit in August 2006*

During the observed lesson Ruth worked with a prep class in the library, using the learning object 'Is it a fish?' Although the students had worked through this learning object previously, they were still all engaged with the task. For each answer, a different student would use the stylus, with the students themselves choosing who would have the next turn. Throughout the course of the lesson each student had about three turns. At the end of the learning object, Ruth used prepared flipcharts, a type of 'interactive book' that used the questions from the learning object, to determine whether different sea creatures were fish or not.

Ruth thinks that use of the interactive whiteboard is a powerful way of teaching, having been surprised by how much students remember what was done on the interactive whiteboard. For example, when she returned from almost six weeks' leave, the year 5 class could remember what they had done in the lesson just before she left. In relation to learning objects, Ruth tends to go slower when using them with the prep classes, and often repeats them. However, with her year 5 classes she just shows them what to do and lets them continue on their own. In these cases she often uses the interactive whiteboard as an introduction to the lesson, after which students proceed to work on computers.

*From observations and interviews during the school visit in April 2007*

Ruth was working with a years 5–6 group and a years 3–4 group during the observed lessons. With her years 5–6 group, Ruth used the learning object 'Make a movie'. Because the students are now so familiar with learning objects and the interactive whiteboard, Ruth had to do very little in the lesson, as the students took over and performed the lesson themselves. There was a lot of on-task whole-group discussion as the students worked through the learning object and every student had at least two turns on the interactive whiteboard, all facilitated by the students rather than Ruth, who was available to answer questions if the students could not figure something out themselves.

*From the interview at the Alice Springs workshop*

Ruth believes that the interactive whiteboards have greatly enhanced the use of learning objects in the school. When the Victorian TLF Contact Liaison Officer came to visit the school at the beginning of 2006 to show the staff how to access and use learning objects, the teachers didn't really pick up on it or get involved with using them. However, this has changed since the advent of the interactive whiteboards and subsequent introduction of 'techie brekkies'. Ruth is concerned, however, that learning objects can be used more as a babysitting tool than as a tool for purposeful pedagogy.

Ruth believes that students are more engaged when using the interactive whiteboard, that they remember the lessons more, and that they are more willing to take risks and get things wrong because they are not afraid of the technology.

### ***Participating teacher – Ursula Shephard***

Years 3–4 teacher

Ursula received her interactive whiteboard at the beginning of the project. She remembers being enthusiastic and desperate to get her interactive whiteboard and start the project, while also realising that it was going to be a steep learning curve. Initial technical problems with Ursula's board were overcome quite quickly.

*From observations and interviews during the school visit in August 2006*

Ursula admitted to being quite nervous about giving her prepared lesson and was anxious that there be no problems with the technology. The lesson, using the learning object 'To catch a thief' was organised so that students worked in three rotating groups: one at the interactive whiteboard, one with the four computers in the classroom, and one completing a worksheet 'identikit' at their desks. As Ursula had used only a couple of TLF learning objects at this point, she had not yet reached the stage of integrating the learning object into her planning. She found that planning lessons for the interactive whiteboard was highly time consuming, but recognised that flipcharts and lessons, once prepared, will reduce her planning time in the future. Despite having had the board for only three months, Ursula was using it everyday, for most lessons, and was comfortable with the students taking control of the stylus.

I say: 'Is this what you want me to do? ... Did you follow that? ... No worries, go and try ... Did you get it? ... Yes? Good! Now teach someone else!' – and so the whole class is being skilled to do that particular thing.

*From observations and interviews during the school visit in April 2007*

Ursula had planned to work with a particular learning object but had some technical problems, so quickly found a different one to work with. It is notable that, unlike the first observation when Ursula was so nervous, she was now quite unfazed by any problems that were encountered. She had not even planned a 'special lesson' for the occasion. Indeed, the response on ringing the school to organise the second observation was to come any time at all, as long as the school was informed the day before.

Ursula has become so accustomed to planning lessons on the interactive whiteboard that she now finds it quicker than planning lessons without it. She claims:

If you want to do something new [such as] a flipchart, that takes time, but so does ruling up a sheet. I mean you'd have to do that [on paper] anyway. But once you've got that done on the board, you can go back to it, you know where to locate it, so [it's] easier.

Ursula's students are now so accustomed to using the interactive whiteboard that she plans all her lessons for relief teachers on the interactive whiteboard, and relies on the students to guide the new teacher through it. Ursula and her students are now also so used to using learning objects in the classroom that Ursula sometimes gets particular students to research different areas and find appropriate learning objects for the class to use.

*From the interview at the Alice Springs workshop*

Ursula believes that initially she and the students were learning together, but at some point the students took over a lot of the teaching in the classroom. With the interactive whiteboard being 'larger than life', students have found it easy to pick up IT skills because they can see others making things work. One of the benefits for Ursula is that it's logistically easy to begin and end activities, in that you can display things, check the Internet or other resources, and get on with an activity quickly and without losing student engagement. It's also good for revision because she can retrieve past work at any time.

In relation to the anecdotal nature of teachers' views regarding the increased level of students' engagement in learning that flows from use of the interactive whiteboard, Ursula referred to the visit by the Footscray North group to Yuendumu. After setting up the interactive whiteboard, they used it in a demonstration lesson during which students' engagement was so high that there was absolute silence during the activity.

In relation to learning objects, Ursula's students love them and happily explore new objects without being shy or worried they won't understand them. When they are working with a learning object as a whole class, if they are not meant to be helping each other they have to be told so, or they will yell out the answers to the person at the board. Ursula particularly likes the capacity of learning objects to provide immediate assessment for students.

### ***Participating teacher – Mary Dowling***

Years 3–4 teacher

At the commencement of the project Mary didn't know what an interactive whiteboard was and was quite nervous as she did not consider herself IT-savvy. Like Ursula, Mary received her interactive whiteboard at the beginning of the project. Because she and Ursula taught the same grades, they decided to do their planning together. As a result they used many of the same learning objects. According to Mary, one of the first things she learnt was that her students could contribute a lot to her learning and to the success of the project.

*From observations and interviews during the school visit in August 2006*

Like Ursula, Mary also worked with 'To catch a thief' for her observed lesson, but used it for a whole-class activity. At no stage of the lesson did Mary use the interactive whiteboard herself; rather, her students each had a turn, after which they would choose a member of the opposite gender to have the stylus next.

The student at the interactive whiteboard was guided by the students on the mat in front of the whiteboard, while Mary sat at the back of the classroom and gave organisational directions ('Sit up', 'Pass the stylus on now', etc). This lesson structure suits both Mary and the students because:

They love it. They love the stylus. They love getting up there and trying different things, which is good because I'm not a computer person. It is this huge challenge for me.

Like Ursula, Mary has found the planning task to be challenging and time consuming; but she uses her students' ability to transfer their knowledge and skills from elsewhere to help with her planning:

Some nights I have had to sit there for four hours to figure this thing out ... so this thing has been a huge challenge. But when we're working with the whiteboard it's good because the kids are so comfortable with it ... and it's nice to see them transferring their knowledge ... [Although] they haven't used the whiteboard before either, [they bring] knowledge ... [from] other programs and other sources so they're able to say 'well what about if we try this?'.

*From observations and interviews during the school visit in April 2007*

At the beginning of the observed lesson, students were finishing off some Maths revision using 'Wishball'. The students wanted to go to the next level, and Mary let them do so, but then pulled them back when she noticed that they were starting to make decisions that seemed based more on guessing than on learning. The lesson then moved to Science where Mary used the learning object 'The digestive system' for students to learn about the human body. Mary chose a few of her struggling students to use the learning object on the interactive whiteboard while the rest of the class watched and offered help when needed.

At the beginning of 2007, Mary became the welfare officer for the school. As a result, she is in the classroom only on a part-time basis and she co-teaches with another teacher. Mary has found this challenging because she cannot seem to find the time to plan together with her co-teacher. Also, the co-teacher is new to the interactive whiteboard so Mary is trying to offer support and give her some training. The students help with this, but the two teachers need to plan for their teaching styles to complement each other. The upshot is that Mary tends to use learning objects mostly when she is in the classroom where students can work responsibly and in smaller groups. She often uses the same object more than once and she encourages students to teach each other.

*From the interview at the Alice Springs workshop*

What Mary likes about the interactive whiteboard is that it provides for spontaneous and incidental teaching as well as for learning through planned activities. As Mary plans for learning she thinks about how to use the interactive whiteboard in association with a learning object, digital resources, flipchart, modelling a worksheet or using the Internet. Because Mary also uses the interactive whiteboard quite spontaneously if an issue needs to be addressed, she has come to know where all the resources are located and can readily find them as she needs them. On reflection, she realises that the networking with her colleagues was paramount, and that sharing resources, planning, and providing support for each other made a big difference. Mary believes that with tools such as the interactive whiteboard, schools are finally moving to embrace the sorts of levels of technology that students experience outside the classroom.

### ***Participating teacher – Sharon Smith***

Years 1-2 teacher

Sharon, the only early years teacher participating in the project, has also had her interactive whiteboard since the middle of 2006. Prior to that, Sharon had seen an interactive whiteboard only once before – at a professional development activity where it was used only to display an item. Sharon had no understanding of the kind of interactivity that could be achieved through whiteboards. Sharon applied to be part of the project because she likes to 'tinker with computers' so thought it might be something she found interesting. However, when the interactive whiteboard was installed she realised it was going to be a 'steep learning curve'.

*From observations and interviews during the school visit in August 2006*

For her observed lesson, Sharon used the learning object 'Music maker', which is designed to develop Maths concepts. She used it for a whole-class activity in which students, who were sitting in front of the interactive whiteboard on the mat, had to make notes in their books. For the most part, Sharon did not use the interactive whiteboard herself but instead directed the students' use of it.

By the time of the observed lesson, students had been using the interactive whiteboard everyday for spelling, and they were making a class book in which they used Adobe Photoshop to insert their faces onto fish bodies as part of creating an 'under the sea' story. Sharon has noticed that the interactive whiteboard has cut down paper use quite dramatically, particularly as she is able to use CDs or the Internet for reading instead of having to photocopy sheets for individual use by students. Among other benefits of the whiteboard raised by Sharon were the opportunities for spontaneous teaching, particularly being able to access the Internet easily in a way that all students can see, without their having to move. For example, when students ask questions or are curious about what things look like, Sharon uses the Internet to find answers or pictures.

*From observations and interviews during the school visit in April 2007*

For her observed lesson Sharon used a learning object on shapes, with her students sitting on the mat in front of the interactive whiteboard and each having a turn finding the shapes in pictures. Unlike her practice earlier in the project, Sharon no longer needs to plan explicitly for the interactive whiteboard, finding instead that:

... it just happens. And because I know what's available and what I can use, I don't have to think too much about it.

When looking for resources, Sharon notes if she finds something appropriate for her students, even if it is not exactly what she's looking for at the time, so that she keeps developing a bank of resources she knows are worthwhile. She still uses the whiteboard every day for spelling, and has started to use it for Maths too. Like Ursula, she finds it easier to plan for relief teachers on her interactive whiteboard. This is a big change for her because:

... when we first got them I used to cover them and put a sign saying 'Interactive whiteboard. Don't touch!', while now it's more like 'Interactive whiteboard. Please touch!'.

*From the interview at the Alice Springs workshop*

In relation to learning objects, Sharon restricts her use mainly to Maths learning objects because her years 1–2 students are not advanced readers. To choose Maths learning objects she examines the ones that are appropriate to the age of her students. Sometimes she uses them even without reviewing them, but in such cases she tells the students she hasn't checked it yet. She is sufficiently confident with her students to be able to use something that might not work.

Sharon reported that she had to introduce a rule that students on the mat can help the student at the interactive whiteboard *only* if they ask for help, as otherwise students get too excited. She appreciates the way in which students get congratulated when they reach the right answers in the learning objects, believing that this is particularly important for very young students. Sharon has noticed a considerable development in her students' IT skills since they have had access to the interactive whiteboard. She thinks this leads to other skills such as students knowing about capital letters for names, because they have to use the shift key when they type their name.

Sharon is now so comfortable with her interactive whiteboard that in looking to employment in another school, she will not consider applying for a job if there was not an interactive whiteboard, or the possibility of an interactive whiteboard, available for her use.

## ***Gray Primary School, Darwin, Northern Territory***

### ***The school and its students***

Gray Primary School is located in the suburb of Gray in Palmerston, Darwin. About half of its students are Indigenous Australians. The school population is fairly transient as students from nearby Indigenous communities and those from the nearby Defence base move in and out of the school.

The school has eight interactive whiteboards (two Prometheans and six Smartboards), a computer lab in the library, and up to four computers in each classroom. At the beginning of the project a fortnightly meeting was organised so that all teachers using the boards, the deputy principal and the departmental IT coordinator for the Northern Territory would meet to discuss strategies and problems and share resources. These meetings were considered successful by the participating teachers, one of whom commented, 'It made us get on with it. If we were doing it by ourselves nothing would have happened'.

### ***Participating consultant – Libby Smith***

IT coordinator for Northern Territory (Northern Territory Department of Employment, Education and Training)

At the beginning of this project, while Libby had only seen interactive whiteboards at conferences, she was keen to introduce them to Northern Territory schools. She developed an online professional community for all teachers who were using or planning to use interactive whiteboards.

Libby has been surprised by the positive response to the boards from experienced teachers who are normally not attracted to classroom use of ICT, many of whom have told her that use of the boards has brought them new enthusiasm for their job and enjoyment in learning new skills and using a new classroom tool. Libby has arranged for Gray Primary teachers to go to other schools to introduce teachers to the use of interactive whiteboards.

When discussing the purchase of interactive whiteboards with schools, Libby is adamant that schools should purchase more than one interactive whiteboard because its use requires a learning community where staff can share related resources and skills.

In relation to learning objects, Libby's enthusiasm for them is based on their capacity to take students into an interactive environment that is not possible when using paper-based or video-based materials. At Gray Primary School she has seen learning objects being used to help teachers address issues such as bullying and playground rules without making it personal or blaming particular students.

Although Libby now works with DEET's Accelerated Literacy program, in her new role she still promotes the use of interactive whiteboards. Libby believes that interactive whiteboards provide strong motivation for students to write because their work is displayed and seen by other students, in contrast to a sheet of paper that is seen only by the teacher.

### ***Participating teacher – Eric Smith***

Deputy principal

Gray Primary School's successful trial of one interactive whiteboard, ahead of the commencement of the project, led to their purchasing another three. When participation in the project brought the interactive whiteboard count to six, participating teachers were already using the interactive whiteboards and meeting once a fortnight to share their experiences. Over the course of 2006, teachers who had not yet used interactive whiteboards joined the meetings. Two more boards were bought in 2007.

Eric recommends that school leaders ensure that any purchase of interactive whiteboards be associated with building a good network of users (because, otherwise, frustration can set in, with negative consequences) and with professional development activity that helps teachers acquire the new skills and feel comfortable using them.

Eric thinks that the school's uptake of digital content has been a slow process that started with one learning object that was highly appealing to students. Eric said that learning objects are now built into the school's planned units of work. He commented that a common procedure is to introduce the learning object to a group or the whole class, using the interactive whiteboard, after which students use the desktop computers to work individually with the learning object. 'Underwater discovery' and 'Fish market' have become favourites, with students coming back again and again to have a big competition based on them.

### ***Participating teacher – Nick Kokkinomagoulos***

Senior teacher

Nick received his interactive whiteboard at the beginning of the project. Although he knew little about them, he took the view that the interactive whiteboard would be 'just another tool' in his fairly technology-rich classroom, and that successful use would arise from 'how you plan for it and use it'. However, it took him many hours to do so, a matter not helped by there being no support in Darwin for Promethean interactive whiteboards.

*From observations and interviews during the school visit in September 2006*

Nick admitted to hating the interactive whiteboard at first. He found making and finding resources time consuming and that 'if things didn't work, they just didn't work, and it disrupted everything!' By the time of the visit, however, he was much more comfortable with the basic operations of the interactive whiteboard and had started to enjoy it. He also noted that his students enjoyed it and that 'the interest levels are certainly there'.

Nick was still spending considerable time familiarising himself with whiteboard requirements and ensuring that his lessons would work. For the first six months, Nick had set himself the goal of becoming comfortable and proficient using the interactive whiteboard in one curriculum area, Maths. He deviated from this plan rarely. He once used the whiteboard in combination with the learning object 'To catch a thief' for a language lesson that was so successful that he used it again in a display lesson for the school's 'multicultural day', during which all classes in the school got to have a turn.

Although much more comfortable with the interactive whiteboard, Nick still maintained personal control, only rarely allowing students to work on the board. In the observed lesson on revising shapes, students did not get to use the stylus until close to the end. Nick would ask for an answer and move the shapes himself. Nick appeared to be aware of this issue, commenting in his interview that:

... the more comfortable that I get, the more I allow the kids to be part of the lesson as well. So for me to get to the point where I have the kids up there using it and fixing things, I spend quite a lot of time trying to familiarise myself with the software and the actual package. And the kids are a lot braver than we are!

*From observations and interviews during the school visit in April 2007*

In 2007 Nick was teaching a year 4 class. His senior teacher duties were taking him out of his classroom for about an hour each day, during which time another teacher took his class; and also often involved interruptions to his classroom role and having misbehaved students from other classes in his classroom.

Nick makes sure he is in class for Maths and English, the two subjects for which he was using the interactive whiteboard that term. Nick had used a number of learning objects, particularly 'To catch a thief' to explore fact and opinion, 'Picture this' to help with imaginative writing and 'Wishball' for Maths. Nick has also found himself using the board beyond these two curriculum areas and more spontaneously compared with his use on the previous visit. He may use the interactive whiteboard for 'anything that comes up if it lends itself'.

In the observed lesson Nick used the learning object 'Anti-bullying campaign' to introduce students to the elements of an effective information leaflet, having noticed that many students had experienced difficulty when preparing information leaflets for their Friendly Schools Friendly Families program. Nick

commented that the learning object explained what was needed in a 'more visual, more concrete' way, noting this as a reason for his use of the whiteboard, too – 'particularly with things I cannot show them'.

Nick still has not yet allowed the students to use the stylus, but he plans to turn his Maths classroom into more of a learning centre with groups rotating for different activities and students using the interactive whiteboard with Nick facilitating. Nick does not take long to plan his lessons because he modifies prepared lessons from mainly United Kingdom websites.

*From the interview at the Alice Springs workshop*

Nick regards the interactive whiteboard as a tool that supports his planning, whether it be annotating student work, using a learning object or using the Internet. He believes that the interactive and visual nature of the interactive whiteboard can make the abstract more concrete for his students, and that one of the biggest benefits is that slow learners can demonstrate their understanding of a concept without having to do the traditional book work with which they often have trouble.

When it comes to changes in his pedagogy, Nick said that the main change for him had been to more collaborative learning for his students and more collaborative planning and sharing of resources with his colleagues, each of which had become more routine for him. He sees himself as more open to incidental learning and more spontaneous in his use of his resources as they are all now so accessible, particularly through the Internet. He is aiming for improvement in creating his own flipcharts, which require time and the availability of suitable resources. He is enjoying his journey.

### ***Participating teacher – Emma Lew Fatt***

Early years teacher

Prior to the commencement of the project, Emma was sharing an interactive whiteboard with another early years teacher. When she was chosen to participate in the project, she was given exclusive use of the board. Emma seemed concerned about the implications of that decision for her collegial relationships and while she did what the researchers asked of her, indicated that her involvement had become too time consuming. In October 2006 Emma decided that her family commitments did not allow her time to participate as fully as she would like. At that point, participation in the project changed from Emma to Natasha Ryan.

*From observations and interviews during the school visit in September 2006*

Emma considered the interactive whiteboard 'just a gimmick' initially, but her reliance on the board had already progressed to her having her entire planned Maths program there. While she had needed to commit considerable time in order to make it usable and accessible, she saw it as a big step in her development. Her students could now use the interactive whiteboard to follow what was happening week by week within their Maths program. In six weeks out of the 10 for the term Emma had incorporated learning objects into the program. She commented, however, that her students could not use the TLF content unaided, given their age and ability levels, and she could not adapt it to suit her class.

Emma uses the interactive whiteboard every day, for which she spends a lot more time planning than she used to. She feels that her low level of IT skills lets her down in that it takes her so much longer to figure out how to do things that other people already know because they use computers more regularly.

According to Emma, her students love the interactive whiteboard. She notes, in particular, that one of her students with learning difficulties and behaviour problems is enjoying using the interactive whiteboard:

He'll sit there for a lot longer. For accelerated literacy, for which ... I now [use the whiteboard], he can stay focused for an hour and a half, which is just great.

### ***Participating teacher – Natasha Ryan (Tash)***

Years 3–4 teacher

Natasha took over from Emma in October 2006. She had been using an interactive whiteboard in her classroom since April 2006 and was chosen to participate in the project because Eric, the deputy principal,

considered that she was a particularly enthusiastic and innovative user of the whiteboard. At the beginning of 2007 it was decided that Emma and Natasha would share Natasha's interactive whiteboard, swapping classrooms every week so that the two classes each had the opportunity to use it. This lasted for about seven weeks before both teachers decided that the arrangement was not working well, and Natasha was given exclusive use of the interactive whiteboard.

Natasha recalls the first few weeks of having the interactive whiteboard as a 'wow' time when she would turn the board on just for the sake of it. At first she was not ready for making flipcharts so she used the whiteboard mainly for Internet access, including finding resources that could be fairly easily used on the interactive whiteboard. This also helped Natasha and the students become used to the students' touching the board, about which Natasha was initially anxious.

*From observations and interviews during the school visit in April 2007*

A major breakthrough for Natasha in her use of the interactive whiteboard was to learn to take a step back, to let the students take control, and to realise that they were not going to break the board.

There are still things that I do on it but, really, they use it ... they set it up, they arrive in the morning and it's a fight as to who gets to my laptop. They set it all up and get it all ready, and I'm comfortable with that now.

She noted how IT-savvy her students had become in the last two years compared to the years when she didn't have the interactive whiteboard.

In the observed lesson, Natasha was revising some previous work, using the learning object 'Playground rules'. Natasha did not touch the interactive whiteboard or the computer during the lesson, even having her students type in the names of the learning objects in the search engine on the laptop. Apart from occasional spelling mistakes, which were corrected by Natasha, students had no problem with this.

Natasha does not use many learning objects because searching for suitable ones is so time consuming. When Natasha found that her planning time was increasing significantly when trying to locate suitable online resources, she decided that she would spend no longer than 15 minutes searching for a suitable online resource, after which she would instead develop her own using flipcharts. It is worth noting that Natasha, who has always been quite meticulous with her planning, now spends no longer time developing resources for the interactive whiteboard than she would spend on developing non-electronic resources. Planning time is now about the same as it used to be.

For the next term Natasha has arranged with her colleague Sylvia for Sylvia's students, who have just finished doing PowerPoint presentations, to teach Natasha's students how to produce their own presentations about their families.

*From the interview at the Alice Springs workshop*

In relation to learning objects, Natasha usually uses them as first port of call when planning units of work, and has just chosen one to use as an assessment item. She said that her students are very enthusiastic about them, with even those who are not strong readers choosing learning objects that are designed for years 5–7, because they see them as games. Natasha is happy with this and believes that her students do learn from them. She notices the students will refer to them in classroom discussion.

So I use them in lessons, I use them as lessons, but [my students] see them as games and are happy to use them in their own time.

One of Natasha's goals for next term is to be more patient when planning to use TLF content. She wants to take the time to find good resources so as to develop a bank of resources she knows will work for certain topics. Natasha also plans to use the interactive whiteboard across the entire curriculum, not just for the specific curriculum areas for which she now uses it.

## ***Mona Vale Public School, Sydney, New South Wales***

### ***The school and its students***

Mona Vale Public School is a primary school located in the northern beaches suburb of Mona Vale, Sydney. During the course of its participation in the project, the school saw a change of principal at the commencement of 2007. The school has interactive whiteboards in most classrooms, the computer laboratory, and the library. They are mainly Smartboards, but two Prometheans were bought specifically for their participation in the study. Access to the single computer lab is highly competitive given the size of the school. Most classrooms have one computer but the two classrooms in this study each had three or four additional computers so that students could work at them in small groups.

Mona Vale Public School had already had experience with TLF content prior to its participation in this study.

### ***Participating teacher – Nicola Skey***

Year 5 teacher 2006, Year 4 teacher 2007

Nicola taught a year 5 lower-streamed class alongside the other year 5 teacher who took part in the project, Christine Painter. At the commencement of the project, although having had her interactive whiteboard for a while, Nicola and her students were still getting used to it.

*From observations and interviews during the school visit in September 2006*

As Nicola's students had some attention problems, the interactive whiteboard worked well for whole-class activities only for the demonstration or introduction section of the lesson. When Nicola split the class into groups that rotated through a cycle of simultaneous activities, the students would actively manipulate the interactive whiteboard because 'if they're not in control of the pen they get distracted and it's not worth it'. Nicola uses the interactive whiteboard for most lessons, in some way, every day. Most days she also used it spontaneously for purposes such as searching the web or displaying an item.

The observed lesson consisted of mathematics revision during which Nicola used the interactive whiteboard to demonstrate a few examples of addition, and later to display the worksheet that she asked the students to go away and complete. While most students returned to their desks to fill out the worksheet, a small group of students who had been struggling with the Maths concept stayed at the interactive whiteboard with Nicola to work through a learning object on angles.

For a few weeks prior to the visit, Nicola had experienced technical problems with the stylus not working correctly and so had not been able to use the interactive whiteboard for a few weeks. Nicola commented on her students' response to its working again:

Just their engagement, just having them on-task a lot more ... that's what I'm noticing. They're enthused, they want to learn more and they take ownership. They're discovering things for themselves.

*From observations and interviews during the school visit in March 2007*

Nicola, who was now completing her Certificate in Gifted Education, was teaching a year 4 extension-stream class in 2007. She had become the driving force behind the year 4 teaching team's planning for combined use of interactive whiteboards and TLF content in as many units as possible – but time was defeating them. At the time of the visit, they had completed one newly planned unit on national parks, focusing on the 'Kakadu' learning object, but using others such as 'Anti-bullying campaign' to teach pamphlet writing. Nicola was still using the interactive whiteboard every day and for most lessons, and finding that the novelty had not worn off. Students still going 'yeah!' when they got to use it, and the 2007 class is noticeably most engaged. However, Nicola consciously offers more traditional activities to them every now and then.

At a recent training day on whiteboards, Nicola placed herself in the advanced class, but found it too difficult. She feels confident, however, of teaching with an interactive whiteboard, even a model that she has not used before. She is planning to use the microphones for assessing students in areas such as oral reading, and to make a movie on the interactive whiteboard with her class later in the year.

*From the interview at the Alice Springs workshop*

Nicola felt that relinquishing control to the students and allowing them to be interactive with the interactive whiteboard was a big challenge for her. She now uses the whiteboard in this way with small groups much more than using it in whole-class teacher-controlled settings. Surprised at the high level of ICT skills already possessed by her new class, she feels she now has to take her teaching to the next level. Nicola found that planning for her new grade is enormously time consuming, even with the help obtained from team planning and sharing resources.

In relation to learning objects, Nicola commented on how often she uses a learning object for her own purposes, such as using the learning object 'Kakadu' to introduce an information report as an assessment item in testing the students understanding.

### ***Participating teacher – Christine Painter***

Year 5 teacher 2006

Chris was a senior teacher at Mona Vale at the commencement of the project, and had been the driving force behind the school's involvement in previous TLF projects. She taught the year 5 gifted and talented class and, along with the other year 5 teachers (Karen and Nicola), planned units incorporating extensive use of their interactive whiteboards and a variety of TLF content. According to Chris, having the three teachers plan together was extremely successful because

... sifting through the learning objects is very time consuming. That's why when I spoke to the others on my team I said, '... we've got this huge job to sift through, put these things where relevant, and trial them. How about we all take a different area?'

I took the resources and we looked at Studies in Australia. We divided it up ... the others looked at them and they trialled them in their classrooms and worked out how we could best incorporate them. That worked for us because we had decided to focus on creating a unit of work on 'Gold'.

*From observations and interviews during the school visit in September 2006*

Because the school visit occurred in the last week of term, Chris decided to get her students to recap the entire unit for the researchers. Students 'walked through' the key points and learning activities they had done for the unit, including demonstrating the learning objects they had used, and recalling the class discussions about some of the digital resources. Chris handed the stylus to the students, who managed the resources of the unit and used the interactive whiteboard for various purposes including retrieving their own PowerPoint presentations.

Chris asked her students to compare how they went about learning before they had the interactive whiteboard with how they feel about their lessons now. The students believed that having the interactive whiteboard made the concepts behind the unit more meaningful to them and thought that being able to display their work on the interactive whiteboard promoted discussion. Chris believed her students' writing was also enhanced because they could

... work through an idea on a huge scale instead of looking at a small picture or doing a chalk-and-talk thing on the board. I'm getting much better quality writing from them.

Class members, including Chris, were all highly comfortable with the interactive whiteboard and used it every day, for almost every lesson. Students were also accustomed to using learning objects, usually at least one each week.

In her interview Chris discussed one such lesson:

They (the class) drove that lesson, their skills were such that they could use the interactive whiteboard and I was overseeing the whole lot. One of my top groups decided that they could actually go on and calculate the area of a triangle. No way could that group have understood the area of a triangle without having the learning object to explain it to them.

In December 2006, Chris left Mona Vale Public School (and therefore the project) to work as a curriculum trainer and facilitator for teachers in northern beaches area of Sydney. Her place in the project was taken by Karen Blundell.

### ***Participating teacher – Karen Blundell***

Year 5 teacher 2007

Karen replaced Chris Painter as a participant in the project. In 2006 Karen had used a Smartboard, but switched to a Promethean board in 2007 when she joined the project. When Karen had first used an interactive whiteboard, most of her students had been using one for the year before and they showed her how to work a lot of the software.

It was not possible to observe a lesson taught by Karen during the researchers' March visit to the school.

*From the interview at the Alice Springs workshop*

Mona Vale Public School has an online site for tutorials in interactive whiteboard software so once she was used to the basic operation of the interactive whiteboard, Karen would stay after school to learn more. Karen reported, however, that she needed to use many websites before becoming comfortable with using the software. When planning what to use on the whiteboard, Karen looked for evidence that her students could *do* something on the interactive whiteboard; as she had found her students' engagement to be higher when they were waiting to be chosen to demonstrate their understanding on the whiteboard.

Chris Painter had introduced Karen to TLF learning objects to be used in the 'Gold' unit and in other HSIE lessons already planned by the year 5 teachers as a result of their catalogue search and subsequent trial of selected learning objects to determine their suitability.

Karen had only begun to explore further English and Maths learning objects, a task that she found to be highly time consuming. She commented that sharing the task with other teachers helps but it doesn't happen frequently enough; and that those teachers who are reluctant to use computers in their classroom do not use the learning objects at all.

At her interview, Karen discussed her plans to make more use of the interactive whiteboard for helping students who are having trouble with basic literacy. She has set a goal to start fortnightly meetings of her grade-level teaching team with a view to developing a bank of resources they can all use. Karen believes development of such a bank would cut down the time it takes to plan and would make teachers more enthusiastic about using their interactive whiteboards. Mona Vale is the perfect place for this sort of team planning because most teachers have an interactive whiteboard in their classroom.

## **Northern Beaches Secondary College (Cromer campus), Sydney, New South Wales**

### ***The school and its students***

The Cromer campus of Northern Beaches Secondary College is situated in Cromer, a northern suburb of Sydney. The existence of several selective schools in the area affects the student population of Cromer, which is open to all. During its participation in the study, Cromer had an acting principal in 2006 before the appointment of David Krust for the 2007 school year.

The school has two interactive whiteboards, one Promethean board set up in the library, and a Smartboard installed in a Science lab. The Promethean was initially installed within the computer lab section of the library but after problems were experienced with its use there, it was moved to a different space in the library proper where it could be used with small groups of students.

### ***Participating teacher – Elyte Blansjaar***

Art and IT teacher

Elyte was an original participant in the project at Cromer. However, she did not manage to use the interactive whiteboard at all during the first six months of the project, blaming the poor location of the interactive whiteboard, and then departed on maternity leave. She attended the first two project workshops but at no stage used the board or any learning objects.

### ***Participating teacher – Elizabeth (Liz) Lewis***

ICT facilitator (part-time staff member)

Liz works with the school's teachers and students to provide learning and planning support. Liz has effectively taken charge of implementing this project at Cromer. Although not teaching herself, Liz has recruited teachers to be involved with the interactive whiteboard and helped with the planning and implementation of their lessons. During the school visits, Liz organised for the researchers to interview and observe the lessons of the teachers with whom she was working at the time.

*From observations and interviews during the school visit in September 2006*

Two lessons were observed (Gill's Science lesson and Geoff's English lesson). Interviews were held with Gill, Geoff and a Maths teacher who did not feel he had enough time to plan a lesson for observation, having recently been absent from the school. The visit was disappointing. No TLF content was being used even though it had been explicitly requested. The teachers with whom Liz was working seemed to be quite resistant to exploring the interactive whiteboard. All lessons were being planned by Liz, who was always in the classroom to provide technical support during the lesson and on whom the teachers relied to fix even the smallest problem.

Gill (Science)

Gill's interactive whiteboard had been installed only a few weeks ahead of the visit, and Gill had been too busy to use it much. Her classroom is not ideal for students' use of the interactive whiteboard as a desk and podium are located right in front of it. When Gill used the interactive whiteboard during the lesson, she had the students bring their chairs in front of the interactive whiteboard, which proved time consuming and disruptive.

The lesson comprised revision of a resource from the United Kingdom, which Gill had found on the Internet. Students were engaged with the lesson, but as they were not keen to come forward to use the interactive whiteboard themselves, Gill had to name a student to do so. Interestingly, when something went technically wrong, the students were ready to offer solutions. Unlike some other teachers, Gill finds it hard when 'something goes wrong and you've got 30 kids in front of you who suddenly are experts'.

Time constraints seem to be Gill's main reason for using the interactive whiteboard so infrequently and TLF content not at all.

It's just been somewhat of a rush for me. Liz has helped in finding me resources but you know when someone is finding resources for you they might not actually fit in with what your idea of it is.

Gill was planning to continue using what Liz finds for her, or what she finds herself on the Internet, rather than developing any of her own resources.

Geoff (English)

Geoff is fairly technophobic. During the observed lesson, Geoff used the interactive whiteboard with a year 9 class that had never seen it before. Geoff and Liz planned the lesson together, but Liz had made all the resources. While there were audible gasps when Geoff turned the first page of the flipchart, the lesson slowed down from there. Because of space difficulties that prevented students from easily coming to the interactive whiteboard, they used the slate. As a result, a task that should have been quickly accomplished took 20 minutes. Geoff was obviously not comfortable with the interactive whiteboard and used the stylus only to change the pages on the flipchart. For everything else he relied on Liz, who was sitting at the computer, opening files when he needed them. At the end of the lesson, which had been successful, Geoff commented:

It still felt like a blackboard with a video machine. The thing is I'm not quite sure of what else to do.

After a few lessons, Geoff decided to withdraw from the project.

The Maths teacher

Like Geoff, after using the interactive whiteboard only a couple of times, the Maths teacher withdrew from the project. During the interview, he told the researchers that he had stopped using the interactive whiteboard and would not consider using it again until it was moved to a more suitable location. He also claimed that the time it took to plan (even though he had Liz finding resources) was too demanding.

To be honest, ... I enjoyed the software, I enjoyed the experience. I think if I had something like this in my classroom all the time I would definitely use it. But there's a big proviso here. As it stands now, the amount of effort that goes into preparing the lesson ... you've got an hour in front of that class and in the background you're probably spending two hours to come up with something good.

*From observations and interviews during the school visit in March 2007*

This visit to Cromer occurred at a time of some timetabling conflicts with two participating teachers and the absence of a further participating teacher. As a result, only one lesson was observed (Gill's Science class). The teachers with timetabling issues, both new recruits to the project in 2007, were Geoff (Music) and Katrina (Hospitality and Integrated studies). They were each interviewed after school. The absent teacher taught Integrated studies.

The visit still provided insight into the progress made at the school since September 2006. The interactive whiteboard had been moved to the library and was now being used for more than 10 lessons per week, often organised by teachers themselves rather than by Liz.

Gill (Science)

Since the previous visit, Gill had used a few learning objects, both on the interactive whiteboard and on the computers. However, she is still not using the interactive whiteboard regularly, reporting that lack of time is responsible for her using it only about 10 times since it was installed in August 2006. Liz and Gill continue to discuss Gill's progress with the interactive whiteboard, but Liz is no longer actively helping Gill to plan. Gill has been trying to get other Science faculty staff to use the interactive whiteboard but has met with resistance.

For Gill's observed lesson, students once again needed to move away from their desks and bring their chairs closer to the interactive whiteboard, which made it difficult for students to approach the interactive

whiteboard easily. While Gill gave students the opportunity to work on the interactive whiteboard, it was more to navigate than to undertake an activity.

#### Geoff (Music)

Geoff appears to be the most enthusiastic user of the interactive whiteboard. He uses it with his year 7 and 9 classes. Geoff claims that if he had one in his classroom he would use it for most, if not all, lessons because:

... it just fits in so well with Music because it's so much easier. Like if I'm in the classroom I've got to run between three boards: one board that I'm writing notes on, one board that I'm writing music on, and then run across and play examples. With the interactive whiteboard I can do it all in one spot, and they have programs where you can demonstrate instantly, you can change the note and they can hear it instantly, rather than having to change it on music paper and run across to the keyboard to play it to hear the difference.

When Geoff uses the interactive whiteboard to introduce a topic or to demonstrate a point, he tends to keep control of it. However, he allows students to take control of the interactive whiteboard for any activity section of the lesson. As his experience with the interactive whiteboard has been for only a short time, Geoff is not yet sure of the extent to which the observed higher levels of students' engagement arise from its novelty value but, regardless, he believes that the interactive whiteboard increases students' understanding of music. Unfortunately, there is no appropriate TLF content for his curriculum area.

#### Katrina (Integrated studies)

At the time of the visit, Katrina was very new to the interactive whiteboard and had used it for only three lessons. Liz had organised training for Katrina, but it was to occur in a few weeks' time. One of the lessons for which Katrina had already used the interactive whiteboard had proved very successful. For a class of students with special needs, Katrina had linked websites and quizzes into the flipchart for a lesson on food groups. She found that these particular students

... were not afraid of the technology. They got up and wrote on the board and it gave them a chance to shine. Even if they got the question wrong, they were mastering the technology and they felt successful.

The lesson was also successful because students who do not usually work on their own very effectively could use technology in a whole-class environment without having to crowd around a computer.

Katrina claims she would use the interactive whiteboard every day if she had better access to it, but as the interactive whiteboard is located in the learning centre and her classroom is on the other side of the school, she finds it difficult to move all her students to the learning centre and then back to the classroom to use the equipment there.

#### *From the interview at the Alice Springs workshop*

Liz is now happy working with the teachers she recruited in 2007, particularly as Katrina's class of students with special needs is so enthusiastic about the learning objects. The interactive whiteboard offers a wonderful opportunity for these students who are not able to undertake a learning object on their own but who can do so as a group.

Liz recommends placing interactive whiteboards in classrooms rather than in common areas such as the library. The new principal is applying for a grant to supply the school with seven interactive whiteboards, which will allow the school to have one per faculty. Liz is helping him decide where to put them.

In relation to learning objects, Liz believes that the time it takes to find the right ones to use would be a major deterrent to use for most teachers. Liz herself can spend considerable time searching for appropriate learning objects because she has more discretionary time than do classroom teachers. She recently shared her search experiences in a professional development activity for Science teachers in which she demonstrated how to find suitable online resources.

## ***Changes in levels of use of the innovation in the schools***

As is evident in the above record of each school's' experiences during the course of the study, each school explored some aspects of the innovation. Many spent considerable time in dealing with just the interactive whiteboard while others moved towards pedagogical changes. Over the year of the study, the teachers who spent sufficient time to move beyond mechanical levels of use soon found that the strength of combining the interactive whiteboard with learning objects lay in the pedagogical support that they provided. In particular, those teachers who explored interactivity and representational modes began to see the potential power of the combination for their students' learning. However, consistent with the innovation and change literature, one or two teachers did not spend enough time in exploring the innovation to realise these gains.

Below is a summary of the change in levels of use of the innovation in each of the six schools.

### ***Canning Vale College***

As the interactive whiteboards took a long time to arrive and be installed at the school the participating teachers at Canning Vale were not able to commence using the boards until three months into the project. At that point, all three teachers were at Level 2 (Orientation) in their use of the innovation.

The frustration arising from the delay had a negative effect on some of the teachers who deferred their exploration and moved back to Level 1 (Non-use). The location of the interactive whiteboards also made them difficult to use, as in the two-storey building with large uncurtained windows there was considerable light spill onto the screen. The organisation of the school into 'neighbourhoods', while useful for many purposes, resulted in having to use the whiteboard in a small corner of a large space in which the presence of other students and activities would often be distracting for all concerned.

**Trevor** By the end of the project, Trevor had moved the furthest in this school in level of use of the innovation. In his final interview, he was able to discuss how using the interactive whiteboard had changed his teaching and how, subsequently, he had altered his use of the interactive whiteboard and learning objects to incorporate different learning styles and levels of achievement among his students. His thinking and actions showed evidence of Level 4b (Refinement) in his level of use. At the final workshop, Trevor discussed his plans to share his knowledge of the interactive whiteboard with other staff members in the school. He was excited that he had tried a variety of ideas and that he was re-examining his pedagogy, which he claimed had been rather traditional.

**Henning** remained at Level 3 (Mechanical) in his use of the innovation. He did not use the interactive whiteboard routinely, mainly because of what he saw as the limited role of learning objects in the English language curriculum that he teaches.

**Kylie** barely reached Level 3 (Mechanical) in her use of the innovation. Although she used the interactive whiteboard at one stage, for the last few months she hardly ever used it, partly because she transferred to another curriculum area, and partly because she never arrived at feeling comfortable with the technologies and how they could be used to underpin her teaching.

### ***Centralian Senior College***

At the beginning of the project, Centralian had already had interactive whiteboards installed for about one year and had participated in a Territory-wide project that had provided staff development in their use. Some teachers at the school, including Olivjia, were therefore already working at Level 4a (Routine) in their level of use of the innovation.

**Olivjia** By the end of the project Olivjia was well and truly working at Level 5 (Integration). Her position in the school (Assistant principal but still teaching) involved her in spending considerable time facilitating the use of the interactive whiteboards with other staff, as well as continually using it in her own teaching.

### ***Footscray North Primary School***

As Footscray North Primary School had just received their interactive whiteboards at the commencement of the project, they began at Level 2 (Orientation) and Level 3 (Preparation).

**Ruth** Ruth's role in the project was to support the professional development of all the teachers on the school staff through demonstrating use of an interactive whiteboard (in the library) and providing additional support for breakout classes, a strategy that enabled those who did not have an interactive whiteboard in their classroom to experiment with its use. Ruth was comfortable with the technology and its effective application. Ruth was operating at Level 5 (Integration), as was evident in her participation in discussions and collaborations about integration and sharing of the ideas.

**Sharon** In her sharing experiences with other teachers and in her organisation of the trips to the remote Central Australian Indigenous communities, Sharon showed evidence of having reached Level 5 (Integration). Her own classroom practice demonstrated Level 4a (Routine) and Level 4b (Refined) of use. Although Sharon maintained that her teaching style was teacher-centred, she encouraged her students to use the interactive whiteboard for practice and exploration of the learning objects.

**Mary** A change in Mary's role within the school resulted in her not moving far in integrating the new technologies in her classroom, even though she became much more comfortable with the interactive whiteboard by the second visit. By the second visit, Mary was using the interactive whiteboard mainly with learning objects, which the students could run themselves. She would manage whole-class discussions of the results as the students worked through them. She was mostly operating at Level 4a (Routine) or Level 4b (Refinement) in her use of the innovation. However, she actively participated in the 'techie brekkies' where staff used interactive whiteboards and learning objects, and shared ideas about their pedagogies.

**Ursula** In many ways Ursula's level of use of the innovation moved the furthest of all participants at the school. Her teaching practice changed more markedly than did that of her colleagues. By the second visit, Ursula was doing all her lesson planning on the interactive whiteboard, she had students finding and researching the effectiveness of resources, and she talked in her interview about the benefits of various approaches for various groups of students. These developments, along with her trips (with all the Footscray North participants) to the central Australian Indigenous communities and the regular meetings held with other staff at the school, would place Ursula at Level 4b (Refinement) and Level 5 (Integration) levels of use of the innovation. Furthermore, Ursula spoke of changes in the way she was preparing for her teaching by the end of the project: she was beginning to rely on the technology to manage and organise her resources, which made it much easier to recall previous lessons and to reuse materials for revision or for other classes.

### ***Gray Primary School***

At the beginning of the project, both teachers were at Level 1 (Orientation) and Level 2 (Preparation).

**Nick** rarely moved beyond Level 3 (Mechanical) in his use of the innovation. He did not use the interactive whiteboard for lesson planning. At the end of the project, he was still using the interactive whiteboard only for pre-made learning objects or modifications of interactive sequences from websites. He had not become familiar with the range of software and was still using the interactive whiteboard only as a display device in a teacher-centred lesson. In his early interview he claimed he would let students use the board once he had become more familiar with its range of functions. As Nick had still not got to that stage by the end of the project, the researchers never saw any of the more participatory practices found in most primary classrooms. Maths was the only curriculum area in which Nick's use of the interactive whiteboard reached Level 4a (Routine), an outcome that was directly due to Nick's involvement in the project and a goal that he had set for himself.

**Natasha** By the end of the project Tash's use of the interactive whiteboard was oscillating between Level 4a (Routine) and Level 4b (Refinement). Tash had become very comfortable with the interactive whiteboard, as had her students, and she used it as a matter of course in her lessons. Usually Tash did not need to touch the interactive whiteboard as her students ran the technology with ease. There was evidence of her approaching Level 4b (Refinement) in her discussion of resources that she'd developed and of her plans to make them better now that she better understood the interactive capacity of the whiteboard, and in her pattern of discussing use of the interactive whiteboard with other colleagues and incorporating their

ideas and suggestions into her practice. By the end of the project, she had not quite reached Level 4b (Refinement) because she had not yet reached the stage of talking about how the interactive whiteboard affects student learning nor about what changes could be made to improve how the students might interact with it differently.

### ***Mona Vale Public School***

As Mona Vale had already installed interactive whiteboards throughout the school and as the teachers participating in the project had already been using their boards for a few months before the commencement of the project, they were already approaching Level 4a (Routine) in their use of the innovation by the time of the researchers' first visit to their school.

**Karen and Nicola** By the end of the project Karen and Nicola had each reached Level 5 (Integration) in their use of the innovation. They were working with colleagues to integrate the combined technologies within a whole-school approach. Nicola was in charge of the year 4 planning team and Karen in charge of year 5 planning. The school had set up an interactive whiteboard intranet where all lessons planned for each curriculum area for each grade were stored on a content server so that all teachers could access the resources. The staff and administration of the school showed a high level of technological know-how in effectively employing the technologies.

### ***Northern Beaches Secondary College (Cromer campus)***

At the beginning of the project Cromer had just received their interactive whiteboard and so were at Level 2 (Orientation). The whiteboard was installed in the library, at one end of the computer laboratory, a space that was not suited to whole-class teaching. Nor was it suited to computer-based lessons, as students needed to move their chairs between the whiteboard and the computers.

**Liz.** Like Ruth at Footscray North, Liz supports the use the interactive whiteboard in the school as part of her role as a learning support teacher. As she doesn't have her own class, she is not in a position to track students' learning associated with the use of the interactive whiteboard and learning objects. While Liz worked hard and tirelessly to raise the level of use at the school, most of the teachers she is working with have not moved past Level 3 (Mechanical) use of the interactive whiteboard and some TLF digital content. Most of the teachers that Liz is working with want to use the whiteboard only for specific topics. The location of the whiteboard in a shared space in the library discourages its use. When teachers *do* use the whiteboard, moving their classes to and from the library is so disruptive that they usually feel obliged to use the board for a complete lesson – which is not always the best strategy.

### ***Notable factors affecting level of use***

#### **Individual versus shared use of whiteboards**

The evidence from this study is that shared use of interactive whiteboards does not seem to work well. All the teachers in the secondary schools in this study had to share their interactive whiteboards whereas the teachers in the primary schools generally had a whiteboard in their own classroom for their sole use.

The secondary schools had a tougher time in working towards effective use of interactive whiteboards, some teachers opting to employ the whiteboards solely as data projectors without any interactive components. Use of a shared interactive whiteboard involved the teacher and class having to move to the location of the shared whiteboard, a location that was often unsuitable for viewing the whiteboard, using it effectively or being able to have the space dedicated to the activity. As well, when a teacher moves their students to where the board is located, they feel a need to use the interactive whiteboard for the whole lesson. For all these reasons, teachers were not attracted to their use and students did not have the chance to become accustomed to using the full functions of the whiteboard.

By contrast, the primary school teachers usually had the interactive whiteboard in their classroom all the time, which allowed teachers to use them readily for short segments and for students to become very familiar with their use by the end of the project. Shared use of a whiteboard in primary schools proved difficult for the same reasons found in the secondary schools: students would be distracted, the location was noisy, access was difficult – giving teachers little reason to engage with the whiteboards.

#### Suitability for the curriculum domain

Some curriculum areas seem to be better suited to the use of these technologies than are others.

#### Age of students

Secondary school students, particularly those in senior secondary classes, are likely to respond less enthusiastically than do primary school students to these new technologies, as they may have less interest in the novelty of the new technologies, being more interested in getting on with learning that they need for passing their exams. As Liz commented, 'they don't want to feel like they're guinea pigs having new things tested on them'.

## Conclusions

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Unlike other studies that have explored how teachers employ interactive whiteboard technology, which are restricted to the affordances of *any* computer-projected resource, this study investigates the combined use of interactive whiteboard technology and digital content.

Participants in this study were provided with all three requirements cited in the research literature for successful classroom implementation of information and communication technologies – collaboration between teachers and experts, successful experience in teaching with the technologies, and participation in a supportive community – in that they were introduced to the innovations, and subsequently supported in their use, through workshops for all participants, continuing access to a curriculum consultant, visits to their schools by the researchers and, in some cases, collaboration with teachers in other schools.

At the end of the year-long study, most of the teachers completing the project were those who had begun in June 2006. One school had left the project, and a change of one participant had occurred in three of the schools. However, continuity was generally maintained.

By the end of the year-long experience of innovation, almost all 13 participating teachers had moved to higher levels of use of the two innovatory technologies. All were competent users and several were sophisticated users. Major shifts in levels of use occurred for two primary-school teachers in New South Wales, one secondary-school teacher in the Northern Territory and one middle-school teacher in Western Australia. All four teachers at the Victorian primary school had arrived at the further stage of renewing and reconfiguring their use of the technologies.

The teachers reported the importance of the curriculum support officers from their education department in the development of their skills and capacity to experiment with the interactive white boards; and also in locating appropriate TLF digital content and helping them to use it.

Along the way, all participating teachers demonstrated:

- increased personal efficiency
- achievement of stated learning outcomes
- stronger understanding of the relationships between ideas and concepts
- changes in pedagogical practice, based on evidence for adopting new strategies
- a focus on interaction and modes of representation for improving the efficiency of their students' understanding.

The teachers who had most strongly embraced and effectively deployed the technologies claimed that use of the innovations had enabled their students to become more engaged in their learning and to perform at higher levels than before. They also extolled the importance of their year's journey.

In their presentations at the final workshop, it was evident that most participating teachers had an increased level of awareness of the role of the two technologies in achieving desired learning outcomes. Those who had achieved more sophisticated levels of technology use and innovation identified some subtle affordances of the combination of interactive whiteboards and TLF digital content, including:

- an ability to prepare interactive sequences in advance for lessons, and then later for revision and for other learning contexts
- an extension of teaching capability through the creation of recorded sequences that could be replayed by students as required, whether for practice or revision
- direct access to resources through local databases and digital content. and indirect access through web links
- students' faster acquisition of concepts through access to a range of modalities of representation and interactive sequences that can quickly illustrate a concept and also reduce misconceptions and difficulties in interpretation
- capacity to employ of a range of construction tools (for example, the virtual protractor) as part of the rich collection of resources that form part of the interactive whiteboard software.

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## **Appendix A: Materials distributed at the first workshop**

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### ***Why use interactive electronic whiteboards?***

#### **Dr Bell gives a 'baker's dozen' reasons for using the interactive electronic whiteboard**

1. It's great for demonstrations.
2. It's colourful.
3. It can accommodate different learning styles.
4. All ages of students respond favourably to using it.
5. It's excellent for using in a distance-learning setting.
6. One-computer classrooms can maximise the use of limited computer access.
7. It's an excellent tool for the constructivist educator.
8. It's clean, mess-free and attractive.
9. Students with limited motor skills can enjoy using it.
10. It's interactive.
11. It interfaces well with other peripherals.
12. It's great for meetings or lessons where participants need printed copies of the proceedings.
13. It's a kid magnet!

For further explanation visit: <http://teachers.net/gazette/JAN02/mabell.html>

#### **Perceived benefits from use of interactive whiteboards**

- Students' heightened motivation, engagement and independence in learning (Horne 2004, Richards 2004, Beeland nd, BECTA 2005)
- Capacity to remotivate teachers ( BECTA 2005)
- Capacity to capture young people's prior experience with technology so as to bring about a different relationship between teachers and students and help create a 'mutual learning environment' (Richards 2004)
- Capacity to save student work and teacher planning so that it can be used over and over again as a resource
- Capacity to use previous lessons and work with students who need extra help or students who were absent ( BECTA 2005)
- Capacity to repeat demonstrations as often as needed
- Potential for enhancing teachers' classroom control through use of the remote function (Richards 2004, BECTA 2005)

#### **Points of contention**

- Are these benefits maintained over long-term use of the interactive whiteboard? (Higgins et al 2005)
- Are interactive whiteboards being used to explore – and to experiment with or generate – new ideas regarding pedagogy, or simply to replace the blackboards of more traditional pedagogy? (Burden 2002)
- Are the secondary-school resources and activities made available through the software for the interactive whiteboard superior to the primary-school resources and activities, which are far more focused on the identification of facts than on the development of thinking skills? (Horne 2004)

***Integrating interactive whiteboards effectively into the classroom: notes on 'best practice' from the research***

Practitioners should:

- exploit the interactive capacity of interactive whiteboards and use them as a means to prompt discussion, explain processes, develop and test hypotheses;
- use a variety of sources for materials;
- develop an understanding of the techniques arising from interactive whiteboard software use and development;
- develop detailed lesson plans that incorporate verbal, visual and kinaesthetic learning styles;
- be daring, try new things, and not be afraid to change their pedagogy to exploit the benefits of having access to an interactive whiteboard!

Schools should:

- make interactive whiteboards accessible to teachers by putting them in classrooms rather than in separate ICT rooms;
- provide ongoing professional development for teachers who are using interactive whiteboards;
- provide a variety of software and multimedia resources for teachers to use with interactive whiteboards;
- be supportive of teachers working with interactive whiteboards!

## **Appendix B:**

### **Classroom use of whiteboards – annotated references**

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BECTA 2005, 'How can the use of an interactive whiteboard enhance the nature of teaching and learning in secondary mathematics and modern foreign languages?', report prepared for BECTA ICT Research Bursaries.

This report outlines the three 'stages' teachers go through when using interactive whiteboards as 'supported didactic', in which the teacher uses the interactive whiteboard as a visual support tool in the lesson; 'interactive', in which the teacher makes some use of the potential of interactive whiteboards and uses a variety of verbal, visual, and aesthetic stimuli; and 'enhanced interactive', which is considered best practice, whereby the teacher exploits the interactive capacity of interactive whiteboards and uses them as a means to prompt discussion, explain processes, develop and test hypotheses and use a wide variety of materials.

Teachers who were involved in this study (13 LOTE teachers and 10 Maths teachers) were considered 'best practice teachers'. They were observed and recorded on videotape in classrooms as well as while participating in a semistructured interview.

Participants discussed the extra time it took to plan for lessons using the whiteboard, but also mentioned that using the board had increased not only the students' motivation to learn, but also the teacher's motivation to teach. They discussed time saved in marking because the students' responses could be immediately assessed by the interactive whiteboard. The 'print and save' capabilities mean that once a lesson is planned, teachers can re-use their planning and also their students' work. This was also something that could be used for students who missed the lesson or needed extra help.

One of the suggestions made at the end of the report was that priority should be given to teacher training, professional development and familiarisation in relation to interactive whiteboards. The authors recommend that a video for training purposes be commissioned and made available to schools.

Teachers felt much more in control because they could walk around the room and look at student progress while using the interactive whiteboard.

One Maths teacher asked herself the following questions before planning for every class: What is my aim? What are my objectives? How can I use the whiteboard? How can my students use the whiteboard? She also tried to incorporate into every lesson a verbal explanation, a visual example and some kinaesthetic learning through movement, and also tried to make it relevant to students' lives.

The researchers found that teachers used interactive whiteboards in lessons in the following ways:

- Drag and-drop: matching a response to a stimulant
- Hide-and-reveal: opening a response when a stimulant is understood, often used in a step-by step feature or when using software with an immediate response (though this might be mediated by the teacher)
- Matching: for example, equivalent terms such as fractions in mathematics or vocabulary in languages
- Using movement: to demonstrate principles, for instance, angles on a line, sentence construction.

In the literature review, they cited the following studies that focus on use of interactive whiteboards within specific subject areas: Glover et al 2003, Edwards et al 2002, Cooper & Brna 2002, Blanton & Helms-Breazeale 2000, Ekhami 2002 and Smith 2001.

Beeland, WD nd, Student engagement, visual learning, and technology: Can interactive whiteboards help?,

[http://chiron.valdosta.edu/are/Artmanscript/vollnol/beeland\\_am.pdf](http://chiron.valdosta.edu/are/Artmanscript/vollnol/beeland_am.pdf) (10 May 2006)

In this action research project 197 students filled out a questionnaire immediately following participating in a lesson using an interactive whiteboard. The purpose of the study was to establish whether interactive whiteboards had an impact on student engagement and motivation during lessons. Teachers also completed a survey and questionnaire. The results of the survey showed that students:

- unequivocally enjoyed using interactive whiteboards
- found that interactive whiteboards facilitated their learning
- were comfortable using interactive whiteboards
- would enjoy school more if more teachers used interactive whiteboards.

An analysis of the surveys showed that not one student did not enjoy working with an interactive whiteboard.

The study also found a correlation between how highly the board was rated by the students and the type of media that was used. However, there was no correlation between how highly the board was rated and how much interaction students had with the board.

Burden, K 2002, 'Learning from the bottom up - The contribution of school-based practice and research in the effective use of interactive whiteboards in the FE/HE sector', discussion paper presented at the Learning and Skills Research - Making an Impact Regionally conference, The Earth Centre, Doncaster, 21 June 2002.

In the introduction, Burden discusses the tendency for new technologies to be 'initially used to replicate rather than transform' and the danger of interactive whiteboards being used simply as a glorified blackboard. In order to combat this danger, Burden suggests we 'develop a theoretically sound and robust conceptual model for the use of this technology in classrooms' as well as the 'need to be able to argue the case for their use cogently and from an empirical standpoint' (p 4).

There is discussion of two research projects involving interactive whiteboards. The first is based on interviews, videoed observations, and follow-up discussions with 200 teachers who were using interactive whiteboards. The second was based on 10 university staff being sent to a training session and being involved in pre-training and post-training questionnaires regarding their pedagogy and if or how it was affected.

Burden refers to Gibson's (1999) model of technology use in schools as having three stages: infusion, integration and transformation. Schools at the *infusion* stage generally display the following pattern in their use of the interactive whiteboard:

- The interactive whiteboard is purchased in isolation from its intended use and is placed in the ICT room rather than in a general classroom.
- Little strategic thought is given to its integration into the curriculum.
- It is used only intermittently.
- It is used mainly for presentational teaching and passive learning.
- It is used little or not at all for interaction with students.

Schools at the *integration* stage generally display the following pattern in their use of the interactive whiteboard:

- The whiteboard is deployed strategically within a context of whole-school learning and placed in a curriculum area rather than the ICT room.
- It is used to integrate software.
- It is used in conjunction with a wider range of tools and hardware, for example, video.

- It is used to encourage students to participate in learning.

Use of interactive whiteboards in a school at the *transformation* stage tends to be characterised by:

- a richer diversity of genuine multimedia resources brought together through one device (such as video, sound, text, images)
- classroom resources being produced and used in ways that relate to the specific context (perhaps making use of the technology in ways not yet thought about)
- genuine interaction with the user through learning activities involving the students
- an emphasis on using the technology as a means of knowledge construction for students, rather than on knowledge accumulation
- students being actively involved and credited, via the board, with the production of resources that demonstrate their deep understanding of the subject
- interdisciplinary learning and projects that combine a range of curriculum areas.

While the transformation stage is seen as the goal, while Burden believes most schools are in the first or second stage of Gibson's model.

Higgins, S, Falzon, C, Hall, I, Moseley, D, Smith, F, Smith, H & Wall, K 2005, Embedding ICT in literacy and numeracy strategies, final report, University of Newcastle, [http://www.becta.org.uk/page\\_documents/research/univ\\_newcastle\\_evaluation\\_whiteboards.pdf](http://www.becta.org.uk/page_documents/research/univ_newcastle_evaluation_whiteboards.pdf) (4 June 2006).

This project ran from the autumn of 2002 to the summer of 2004. It involved installing interactive whiteboards in years 5 and 6 classrooms in 12–15 schools in five areas in the United Kingdom. Data was collected through observations, teacher weekly records of interactive whiteboard work, student and teacher interviews and Key Stage 2 test results.

There was an overwhelmingly positive response to the introduction of interactive whiteboards from teachers and students, both of whom believed that interactive whiteboards improved teaching and learning. Classroom interactions were changed dramatically by the introduction of the technology and observations of these interactions 'suggested that the changes in questions by the teachers and the responses from their pupils were consistent with the kinds of interaction associated with effective teaching'.

In the first year, test data indicated an improvement in students' learning. However, this was not carried through into the second year, suggesting that sustained improvement is harder to achieve.

This is quite a long report (70+ pages), which has quite detailed information.

Horne, L 2004, The use of the interactive whiteboard as a stimulus for generic thinking skills, Teacher Net Best practice Scholarships, <http://www.teachernet.gov.uk/professionaldevelopment/resourcesandresearch/bprs/search/index.cfm?report=2533> (4 June 2006)

Horne noted that there were immediate results in the areas of attention, motivation and enthusiasm when using interactive whiteboards in her early years classroom. However, she noted a concern regarding content in that, unlike interactive whiteboard work for secondary students (which much of the research she had read had focused on), the activities for young students were more focused on the identification of clear facts ('a triangle has three sides') rather than the 'generation and testing of new theories'. This meant that the teaching of thinking skills was left up to the teacher.

Kennewell, S & Morgan A 2003, Student teachers' experiences and attitudes towards using interactive whiteboards in the teaching and learning of young

children, Department of Education, University of Wales Swansea, <http://crpit.com/confpapers/CRPITV34Kennewell1.pdf> (8 May 2006).

In this paper, the researchers discuss student teachers' use of interactive whiteboards during their practice-teaching rounds. While the student teachers involved in the study had varying levels of contact and success with interactive whiteboards, 97 per cent of them declared they would choose to have an interactive whiteboard in their classroom. Effective training was an issue for these student teachers and the authors discuss the need for teachers to be taught how to use interactive whiteboards.

Miller, D, Glover, D & Averis, D 2005, Developing pedagogic skills for the use of the interactive whiteboard in mathematics, Keele University, <http://www.keele.ac.uk/depts/ed/iaw/docs/BERA%20Paper%20Sep%202005.pdf> (4 June 2006).

This research discusses a three-stage developmental process that teachers go through as they become accustomed to using interactive whiteboards in their classroom:

1. Teachers use interactive whiteboards to support their traditional, often didactic, teaching styles.
2. Teachers use a more interactive approach in which the interactive whiteboard is no longer a novelty for the teacher or students and is used more fully. However, teachers still lack confidence in the technology and its teaching power so include more conventional approaches to teaching to ensure cognitive development.
3. Teachers move towards an 'enhanced interactive approach', marked by a change in thinking that leads them to seek to use the interactive whiteboard as an integral part of almost every lesson.

At this third stage (an enhanced interactive approach), the researchers identify the following three elements as associated with teachers' effectively integrating the interactive whiteboard with lesson planning and delivery:

1. They understand the techniques arising from interactive whiteboard software use and development.
2. They use interactive whiteboards to support verbal, visual and kinaesthetic learning styles.
3. They use a variety of sources for materials.

Richards, R 2004, Use of interactive whiteboards for teaching and learning in secondary art and design, Teacher Net Best Practice Scholarships, <http://www.teachernet.gov.uk/professionaldevelopment/resourcesandresearch/bprs/search/index.cfm?report=2457> (4 June 2006)

For this research, Richards used interactive whiteboards within her secondary school art and design classes. She uses both personal observations and feedback from students to outline some benefits of using interactive whiteboards to work on visual literacy. The benefits noted by students were:

- their enthusiasm for learning with interactive whiteboards
- being able to use their prior knowledge of technology to reach a different relationship with the teacher and to create more of a 'mutual learning environment'
- their keenness to explore the learning independently
- being provided with evidence of their understanding and learning outcomes, and being able to re-use it as a resource.

The benefits she notes from personal observations are:

- Use of interactive whiteboards can stimulate discussions with students about content.

- Operating the interactive whiteboard from a remote control device gives the teacher greater freedom and allows for easier classroom control.
- Interactive whiteboards can be used to celebrate and demonstrate student achievements.
- Demonstrations can be easily repeated when necessary.
- Although workload is increased in the early stages of using interactive whiteboards, the fact that resources, once created, can be used repeatedly or easily modified makes lesson preparation easier.

She also noted:

- There is a lack of subject-specific teaching material for art and design.
- Using interactive whiteboards did not compensate for seeing and working with actual art works.

She raises the following questions for further research:

- To what extent does the use of the interactive whiteboard have long-term benefits for teaching and learning, when compared with more established methods?
- What are the necessary factors to ensure good practice in the use of interactive whiteboards in the secondary school?

SMART Technologies Inc 2004, *Interactive whiteboards and learning: A review of classroom case studies and research literature*, white paper, <http://dewey.uab.es/pmarques/pdigital/es/docs/Research%20White%20Paper.pdf> (4 June 2006).

This paper brings together information and findings from research undertaken in the United Kingdom, the United States and Australia. It discusses these findings in five parts:

1. Students' engagement in learning: A series of quotes from teachers and researchers outlines these benefits. One of them is the fact that they can be used in an easily engaging way in whole-class settings, which is often not the case with other technologies. Often student engagement is discussed as 'initial engagement' or 'novelty'. However all the comments are positive, with particular reference to flexibility, enjoyment, interactivity and immediacy.
2. Students' motivation to learn, and their school attendance: Interactive whiteboards appeal to students who require intrinsic motivation, by giving them opportunities to showcase their achievements; and appeal to students who require extrinsic motivation by giving them 'the wow factor' and the opportunity to enjoy learning through technology. Quotes from teachers and researchers discuss improved self-esteem, peer modelling, and more enjoyable lessons. One school noted that using interactive whiteboards had improved their attendance rate.
3. Learning styles and special needs: The visual and tactile nature of interactive whiteboards allows for students with special needs or different learning styles to work differently. Many of the quotes from teachers and researchers focus on engaging those students who were previously difficult to engage. There is also discussion of benefits to students with specific needs, such as those with hearing impairment.
4. Review and retention: Acknowledging that it is difficult to judge why students do or do not retain information, the researchers remark that using interactive whiteboards in the classroom makes the work more memorable, engages students with different learning styles, and can be saved, printed and distributed for easy review.
5. Teacher preparation: Use of interactive whiteboards enables teachers to save their lesson notes for another time and to easily modify those notes to suit another group. It promotes organisation.

This paper, while biased in the information selected, includes information and quotes from a large number of smaller-scale research projects in the United Kingdom, United States and Australia.

