Evaluating The Le@rning Federation’s online curriculum content initiative

Summary of findings from surveys, site visits and a field experiment

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Research team

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Participants in the study

The participation of principals, teachers, parents and students from the schools involved in the research is appreciated.

The Le@rning Federation’s contact liaison officers, in supporting the research team in identifying schools for the site visits and in accessing data, made a significant contribution to the study.
Executive summary

This report of the ongoing evaluation of the implementation of The Le@rning Federation’s online curriculum content initiative presents:

- a summary of the results of the third round of (questionnaire) surveys of the views of teachers and students who are using the online materials;
- a summary of the results of the third round of interviews and observations undertaken on visits to schools that are using the materials;
- a description of the design, conduct and outcomes of a field experiment aimed at gauging the effects on students’ learning of their use of learning objects; and
- an outline of the implications of these findings, especially for further implementation and evaluation of the initiative, and also for the professional development and training of educators.

As indicated in earlier reports of this ongoing evaluation (Freebody 2005, 2006), a review of available research literature is marked by the following features:

- There is now a reasonable body of empirical work on the nature and efficacy of ICT use in school classrooms.
- Much of the data points to generally improved motivational and learning outcomes for students from classroom use of ICT.
- There is some ambiguity regarding the rate and nature of ICT uptake in classrooms in response to the significant material and human investment in classroom use of ICT.
- There is relatively little reliable guidance on conclusions relating to medium- or long-term effects of ICT use, even less on the motivational and learning outcomes of specific kinds of ICT use in classrooms, and even less again on the consequences of the use of ICT-based online curriculum content such as learning objects.
- The research area is characterised by small-scale observation and interview studies. There are very few large- or medium-scale field experiments.

This evaluation comprises three components:

- **Surveys.** Across 109 schools, 2,465 students and 206 teachers completed survey forms. Teachers and students were asked about the helpfulness of the learning objects in supporting teaching and learning in specific curriculum domains, and about the effect of learning objects on students’ motivation, depth of learning, acquisition of higher-order concepts, collaboration with peers, thinking about new ideas and independence in learning. Students were also asked about specific operational aspects of learning objects (such as sound, animation, interactivity, and feedback on performance), the relevance of which had emerged in earlier studies.

- **Site observations.** Interviews with principals and teachers, and lesson observations, were conducted in eight schools. The sample of schools took in urban, rural and remote settings; primary and secondary years; mainstream and ‘at-risk’ students of various kinds; an environmental education centre and a distance education centre.
Field experiment. In 19 schools, students at years 5 and 7 spent six weeks of their Mathematics time assigned (randomly allocated) to one of two classroom conditions. The first was a ‘business-as-usual’ classroom condition, in which selected topics in the areas of ‘basic number skills’ and ‘chance and probability’ were taught and learnt in the accustomed ways of those classrooms. The other was a ‘Learning object use’ classroom condition, in which the same topics were taught and learnt through using learning objects in whatever ways teachers and students were inclined, once they had received basic training in the structure of learning objects and how to access them.

Students’ learning outcomes arising from each of these classroom conditions were measured through testing before and after the experiment, using test items drawn from banks of standardised items appropriate to each of the two year levels.

Multilevel analyses of the data (using MLwiN software) comprised three steps: a single-level analysis to establish base-line estimates; a multilevel analysis with ‘classroom’ as a random factor to determine variation at the classroom level; and treatment (‘business-as-usual’ compared with ‘Learning object use’) to arrive at the relative performances of the two different groups of students.

Findings

1. Teachers, tutors, parents and students generally reported that students using the learning objects were more highly motivated to engage with learning tasks and that, in all curriculum domains, their learning was enhanced.
2. In their assessments of the value of the learning objects, teachers showed fine differentiations between factual, conceptual and applied learning outcomes.
3. There were no correlations between ratings of the learning objects and any of the respondent variables in the survey of teachers or the survey of students.
4. Considerable variations occurred in the pattern of responses by teachers and students within and among learning objects and also curriculum domains.
5. Many teachers reported that the learning objects were of particular benefit to students ‘at-risk’ and those with special needs, especially when the learning objects dealt with concepts that are usually hard to teach.
6. There was evidence of the new digital learning environments being put to ‘old’ pedagogical work.
7. In the field experiment, at both primary and secondary schools, the group of students who used the learning objects were found to have achieved significantly higher scores on Mathematics test items than the group who learnt the same content under a ‘business-as-usual’ classroom condition. There was also evidence that this effect was strongest when the learning objects dealt with difficult-to-teach concepts.
Introduction

In investigating the effects of The Le@rning Federation’s (TLF’s) learning objects on students’ motivation and learning outcomes, a review of the relevant research literature, summarised below, yields ambiguous findings. Disappointingly for many, there is little evidence that the introduction of comparable ICT materials into classrooms has, of itself, brought about changes in the nature or extent of learning that some commentators have described as necessary for participation in new economies and forms of citizenship (see, for example, CEO Forum on Education and Technology 2000).

For classroom use of ICT to be more effective the researchers recommend that further consideration to given to:

- how ICT can be located within the learning sequences of specific curricular domains;
- careful specification of the kinds of learning (factual, conceptual, application and transfer) that new ICT materials are designed to offer; and
- more detailed theoretical and empirical attention to the ways in which pedagogies and uses of ICT adapt to and transform each other.

This report builds on earlier evaluations of TLF’s online content (most recently Freebody 2006) that used extensive surveys of teachers’ and students’ views, along with interviews and classroom observations at school sites, to investigate:

- the effects of use of TLF learning objects on students’ motivation and learning outcomes; and
- the extent to which ICT generally was being incorporated into classrooms.

This time the evaluation also incorporated the first controlled field experiment designed to gauge the effects of exposure to learning objects on standardised learning outcomes in Mathematics.

Background

The Le@rning Federation initiative

In 2001 the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) established The Le@rning Federation to produce online curriculum materials and make them available to education systems in the States and Territories of Australia and New Zealand. More specifically, TLF was charged with:

1. producing a repository of online materials in the following priority curriculum areas:
   - Innovation, enterprise and creativity (years P–10)
   - Languages other than English (specifically Chinese, Japanese and Indonesian across all school year levels)
   - Literacy for students at risk of not achieving national literacy benchmarks (years 5–9)
Mathematics and numeracy (years P–10)
Science (years P–6 and 9–10)
Studies of Australia (years P–10);

2. developing online materials that:

• represent cutting-edge best educational theory and practice;
• engage teachers and students in active learning and in creative and critical thinking;

3. supporting and reinforcing the increasing priority given to innovation, enterprise and knowledge by governments in Australia and New Zealand;
4. supporting teachers in developing enterprise education;
5. engaging students in innovative learning environments;
6. equipping students to live competently and proactively in an environment increasingly characterised by online communication, learning and work; and
7. stimulating the growth of a marketplace for high-quality public and private online curriculum content.

The term ‘online curriculum content’, as it is used here, refers to interactive learning activities (that may include texts and/or graphic, audio or animated materials) that improve students’ motivation and learning outcomes and that capitalise in innovative ways on the particular potential of information and communications technologies to enhance young people’s learning. In this project, the online curriculum content takes the form of ‘learning objects’. These learning objects are:

• one or more files or modules of learning material;
• reusable in multiple settings and for multiple purposes;
• potentially usable in classrooms as components of units of work accompanied by digital and non-digital materials; and
• accessible from digital repositories, as referenced, located and accessed by metadata descriptors.

The Le@rning Federation has undertaken cycles of evaluation designed to monitor and enhance the quality of its educational products and to fulfil its goal of disseminating knowledge about use of information communication technologies (ICT) in educational contexts. This report is of the third evaluation conducted by the same team of independent consultants. It builds on the two previous reports (see Freebody 2005, 2006) in reporting on further surveys of teachers and students, further site visits to observe classroom use of ICT and learning objects in particular, and the results of an initial field experiment aimed at testing the effects of use of TLF learning objects on students’ motivation and learning outcomes.

In specifying its approach to delivering educationally sound learning objects, TLF adopted four principles (drawn from Atkins & Jones 2004, pp 2–7):

1. **Learner focus** that addresses the needs of all students, with particular attention to differences relating to gender, socioeconomic conditions, race, culture, geographic location, physical and mental wellbeing, stage of development, and preferred learning modes and styles;
2. **Content integrity** that assures domain-related accuracy, authenticity and purposefulness;

3. **Usability** that is intuitive, consistent and meaningful for users; and

4. **Accessibility** based on accessibility standards for students with languages other than English, those with a variety of disabilities, and those from rural and remote communities.

With regard to the learning framework that should guide development of educationally sound learning objects, TLF suggests that materials should possess the following features:

- **Problem-based learning** such as puzzles, algorithms, story problems, rule-using problems, decision making, trouble shooting, diagnosis–solution problems (following Jonassen 2004)

- **Inquiry-based and investigative learning** that is marked by framing and focusing questions; locating, organising and analysing information and evidence; and valuating, synthesising and reporting conclusions

- **Authentic, situated contexts for learning** that are based on users’ own direct observations and interpretations of data, thereby enabling them to build on and construct their own new knowledge and understandings (as in Salter 2003)

- **Constructive, scaffolded feedback** – the tailoring of graduated feedback, in anticipation of likely errors and partly correct responses.

The Le@rning Federation is now in its fifth year of operation, with more than 1,700 learning objects available and in use in Australian and New Zealand schools. Each new learning object is subjected to field trialling in classrooms prior to its formal release, as well as to feedback from a number of advisory groups. Because of the need for immediate reactions and modifications to be undertaken early in the life of any new learning object, the outcomes of those less formal evaluations of the materials are generally not systematically documented.

The evaluation reported here, along with those two conducted earlier (Freebody 2005, 2006) represents TLF’s ongoing interest in formally documenting reactions to and effects of its digital materials in schools. It is important to note that, since TLF commenced the production and dissemination of learning objects, changes have occurred in the use of ICT in classrooms, in the theory relating to use of ICT for teaching and learning, and also in the attitudes and practices of teachers and students whether in or out of the classroom. In an important sense, therefore, some aspects of the environment in which the learning objects are to make a beneficial difference, are evolving – a situation that modulates the responses of teachers and students to these successive evaluations, and affects the receptivity of educational systems and policy-makers to the TLF initiative.

**Review of related research**

Investments in ICT by educational systems around the world have grown over the last decade. So too, but less dramatically, has the body of research attempting to evaluate the efficacy of these investments and to explore how to use ICT more creatively and effectively for learning and teaching. Below is a brief summary of this growing body of research work. For more extensive coverage, the reader is directed to the BECTA site,

As an overall observation, it is striking that many research reports, and hence many of the summaries and reviews of research, especially those conducted for or by government agencies, signal their ‘disappointment’ regarding the return (penetration and creative use of ICT in educational settings) on investment (effort and expenditure). Nichol and Watson’s (2003) conclusion following their extensive examination of the educational uses of ICT in the UK captures the flavour:

[In the United Kingdom] the role and nature of ICT in schools is problematic, with minimal involvement of ICT across the curriculum in the everyday teaching of pupils … Rarely in the history of education has so much been spent by so many for so long, with so little to show for the blood, sweat and tears expended. (pp 132–3)

Similarly, Jamieson-Proctor, Burnett, Finger and Watson (2006) conclude their extensive survey study of the nature and extent of ICT usage in classrooms in Queensland, Australia, with this:

… there is evidence of significant resistance to using ICT to align curriculum with new times and new technologies … current initiatives with ICT are having uneven and less than the desired results system wide. (p 511)

Other studies have pointed more optimistically to the gradual increase in ICT usage in schools. In the United Kingdom, Pittard and Bannister (2005), for instance, have drawn together a major review of the educational use and consequences of ICT, including data (summarised in Table 1) describing reported simple rates of uptake of ICT across a range of major curriculum domains. It is clear that reported usage is increasing, but there are also indications that this increase is not occurring consistently across curriculum domains.

<table>
<thead>
<tr>
<th>Curriculum area</th>
<th>2002</th>
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<th></th>
<th>2004</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Substantial %</td>
<td>Some %</td>
<td>None %</td>
<td>Substantial %</td>
<td>Some %</td>
<td>None %</td>
<td>Substantial %</td>
<td>Some %</td>
</tr>
<tr>
<td>English</td>
<td>16</td>
<td>64</td>
<td>19</td>
<td>19</td>
<td>69</td>
<td>12</td>
<td>21</td>
<td>63</td>
</tr>
<tr>
<td>Maths</td>
<td>24</td>
<td>59</td>
<td>17</td>
<td>31</td>
<td>57</td>
<td>11</td>
<td>41</td>
<td>51</td>
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<tr>
<td>Science</td>
<td>33</td>
<td>61</td>
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<td>41</td>
<td>54</td>
<td>4</td>
<td>49</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 1: Reported ICT usage across core curriculum areas in the United Kingdom

While it could be speculated that other curriculum domains would show even more dramatic variation in rates (say, Visual arts compared with History), these data tell nothing of how, if at all, ICT usage is variously integrated into lessons and homework across these curriculum domains, or of the effects on students’ motivation to learn and their learning outcomes.

In relation to the second matter – learning outcomes of ICT usage – Pittard and Bannister (2005) sound three cautionary notes, versions of which recur throughout this report. First they point to the timeframes of the evaluations, noting that some of the
more substantial benefits may appear only after the passage of some considerable time; but they also note that some positive effects may in fact disappear. The research is not yet at a point to offer much guidance as to which kinds of outcomes will be optimally visible over what timeframes. Secondly, Pittard and Bannister note the likelihood of differential effects on learners, according their linguistic, cultural and socioeconomic characteristics. Finally, they pose the question of how to measure the extent to which an observed effect is due to the introduction and use of the technology itself, to the work of the teacher, and to other factors.

Pittard and Banister (2005) proceed to report positive results on a number of counts, including minor learning gains across curriculum areas as assessed by standardised measures, gains that seemed to hold steady across apparently diverse kinds of usage and different school and cultural settings. As well, they found some indication that teachers’ knowledge and practices can have enhancing effects on these basic gains, and that even when teachers’ knowledge and practices had negative influences, the basic gains were not completely erased. The three technology-related features that Pittard and Banister used to account for these gains were:

- the enhanced presentational capabilities available to both teachers and students in lesson and assignment work;
- the enhanced range of resources available through ICT usage to support both students’ and teachers’ research; and
- the immediacy of feedback to students for self-evaluation.

Additional reviews of research evidence relating to the progress of ICT usage in educational settings have been conducted by the British Educational Communicational and Technology Agency (BECTA 2005). One of the conclusions has been that purpose-built online content is the most productive use of ICT in schools. The authors pointed to a trend towards the better supply of content for schools, especially for the core curricular subjects. With respect to outcomes, the BECTA report noted a review by Cox and others (2003) indicating that:

> … high-quality, interactive learning resources are more likely to be related to higher learning gains for pupils than [are] other resources. The reviews point to substantial evidence of the impact of specific uses, for example, using simulations and modelling in Science and Mathematics. However, impact is dependent on teachers’ use and quality of implementation. (p 19)

However, the BECTA (2005) review also draws attention to the urgent need for more targeted, carefully designed, longer-term research:

> On the basis of current data it is difficult to assess the quality of existing educational content and there is a need for a more sophisticated analysis of the dimensions of quality in practice. (p 4)

Similar cautions and recommendations have emanated from studies conducted in Australian educational settings, for example that of Ainley, Bourke, Chatfield, Hillman & Watkins (2000).

Additional studies provide some grounds for drawing firmer conclusions about the effects of classroom use of ICT on students’ motivation and learning outcomes. In these (generally shorter and more focused) studies, researchers have worked closely with small numbers of teachers within particular curricular domains. Marzano (1998, and see also Marzano, Gaddy & Dean 2000) conducted a meta-analysis of more than 100 such
research studies, together covering several thousand experimental comparisons. He
drew together field experiments that demonstrated positive relationships between
instructional variables and students’ learning and, using a strict criterion for genuine
experimental effects, found the following variables to be important:

- Explicit teaching of new knowledge accompanied by students’ application of
  that knowledge in a variety of conditions;
- Regular and systematic testing of hypotheses about new knowledge;
- Representation of new knowledge in multiple modalities (linguistic, graphic,
  visual and auditory); and
- Use of computer-based, interactive activities to explore, discover, and apply new
  knowledge.

Taken as a set, these features point to the potential value of ICT use in classrooms, in
particular to the capacity of ICT to support teachers’ explications of knowledge, to
provide high levels of multimodal representation and interactivity, and to stimulate
problem- and inquiry-based learning.

Further support for the distinctive advantage of ICT use in multimodal teaching and
learning comes from a number of studies examining specific curricular domains and
topics. Dori and Barak (2001), for instance, experimentally compared the use of
computer simulation and realia (physical objects and models) for teaching molecular
structures in Chemistry. The students using computer simulations showed significantly
better understandings and were more capable of defining and implementing new
concepts than was the group using realia. The group using computer simulations were
also better at transforming two-dimensional representations of molecules into three-
dimensional representations. Comparable results have been reported in the teaching and
learning of Mathematics (see Abidin & Hartley 1998).

A further set of research reports adds a variety of facets to the general picture. A few
report positive effects of ICT use. Mann, Shakeshaft, Becker and Kottkamp (1999), for
instance, concluded that general ICT usage has positive effects on basic learning over
10 years’ implementation in a statewide educational jurisdiction. They concluded that
the advantages of ICT use were particularly pronounced in the case of curricular tasks
that are traditionally regarded as difficult to teach and in the case of students who
generally have learning difficulties. Similar results are reported by Passey, Rogers,
Machell, McHugh and Allaway (2003) on the basis of case studies, interviews with
principals, teachers, pupils, parents, social workers and teacher aides, and pupil surveys
on attitudes to learning. Their key findings were:

- ICT use by pupils and teachers led to positive motivational outcomes and higher
  levels of confidence in research skills and in tackling complex learning tasks
  (see also Walton & Archer 2004).

- Positive motivational outcomes were most frequently found in classrooms where
  ICT use was directed to supporting engagement, research, writing and editing,
  and presentation of work. Where ICT use supported cognitive aspects of
  learning, for example in secondary-school Design and technology curriculum,
  there were indicators that the motivation arising from the use of ICT was linked
to gains in subject-specific learning.

- Use of ICT had positive effects on students’ behaviour in school and out of
  school. Among the areas of students’ motivation positively affected by ICT use,
the researchers cited perception of class time as more interesting, students’ completion of homework, and students’ confidence and independence in their learning.

In an extensive evaluation of a project initiated and funded by the European Union, involving 500 schools across six countries, McCormick and Li (2006) reported the effects of learning objects on teaching and learning in schools. As in earlier surveys conducted as part of the two previous evaluations of the TLF initiative (Freebody 2005, 2006), McCormick and Li found teachers to be generally receptive to learning objects, and in some cases enthusiastic about their potential. Interestingly, a recurring issue in the findings of McCormick and Li was the futility of embedding any particular pedagogy within the learning object:

The fact that teachers use learning objects in a variety of contrasting ways means that they are likely to be able to superimpose their own pedagogy on any learning objects, almost whatever the ‘designed’ pedagogy. (p 229)

In concluding this review of the literature, it is worth noting Pittard and Bannister’s (2005) warnings regarding what learning outcomes of ICT are being tested. In particular, they caution against an over-reliance on standardised test gains as the only, or even the leading criterion in pronouncements of success or otherwise for ICT interventions. They draw attention to the potentially growing discrepancy between what these tests assess and two other domains of practice and learning, namely:

- the special learning affordances of ICT use; and
- the skills, understandings, and dispositions young people will need for engaging with emerging forms of globalised economic, civic and cultural life – autonomy, discernment, and the establishment and maintenance of new, digitally-based relationships (Gee, Hull, & Lankshear 1996).

Evaluating new teaching and learning technologies only in terms of whether or not they can be shown to improve performance on standardised tests that reflect 19th and 20th century pedagogies, practices, forms of communication, and social organisations will not deliver new citizens and workers. As Heppell (1994) comments:

Imagine a nation of horse riders with a clearly defined set of riding capabilities. In one short decade the motor car is invented and within that same decade many children become highly competent drivers extending the boundaries of their travel as well as developing highly new leisure pursuits (like stock car racing and hot rodding). At the end of the decade government ministers want to assess the true impact of automobiles on the nation’s capability. They do it by putting everyone back on the horses and checking their dressage, jumping and trotting as before. (p 154)

In the following three-part evaluation of TLF ‘s learning objects initiative, there is reference to many of the issues that have arisen in the above review of the research literature and also in the previous two evaluations conducted (see Freebody 2005, 2006), particularly in relation to the effects of pedagogical variations on students’ motivation to learn and their learning outcomes.
Surveys

Methodology

The surveys designed for teachers and students contained questions about their use of learning objects, whether or not using learning objects in specific curriculum domains helped to support teaching and learning and, more specifically, whether the learning objects had any effect on students’ motivation, depth of learning, acquisition of higher-order concepts, collaboration with peers, thinking about new ideas, and independence in learning. As well, students were asked about specific operational aspects of learning objects (such as sound, animation and interactivity) the relevance of which had emerged in earlier trials of the learning objects.

Survey forms (see Appendix 1a and 1b) were available online to all Australian and New Zealand schools for eight weeks, and in paper form for any schools not able to access the online version.

Findings

Background factors

Participating schools, teachers and students

As surveys were web-administered and voluntary, the distributional pattern of responses from each State and Territory of Australia and from New Zealand is relevant to the interpretation of findings. That distribution is shown in Figure 1. The dark columns show the number of responses received from teachers in each country, State and Territory as a percentage of the total number of teachers in that country, State or Territory; the pale columns show the similar proportions for responses from students; and the mid-grey columns show the similar proportions for responses from schools.
It is clear that the distribution of respondents is far from even across the jurisdictional sites, indicating variable success on the part of TLF’s site-based liaison officers in attracting responses. Notable in particular are the occasionally substantial discrepancies between the column heights, indicating that, in some jurisdictions, response rates from students and teachers were similar, while in other jurisdictions there was considerable variation. Responses from teachers and schools in New Zealand, for instance, represented a substantial proportion of the total sample of teachers and schools, but that was not the case for responses from students. Responses from Tasmania, in contrast, showed a much higher proportion of responses from students, even though rates of responses from schools and teachers were roughly comparable to those from New Zealand. These discrepancies, unavoidable given the data collection procedures, need to be kept in mind when reflecting on the generalisability of the findings.

Regarding the kinds of schools represented in the survey sample, Figure 2 (2a–f) summarises a number of features of the schools participating in the survey, as described in the responses of teachers. The sample shows predictable patterns and indicates a moderate to high level of representativeness, given that:

- about three out of four participating schools are government administered;
- the large majority are coeducational institutions;
- about 80 per cent of the participating schools have less than 25 per cent enrolment of students whose backgrounds are Indigenous, characterised by home languages other than English, or in poverty.
A number of questions to the teachers concerned their own backgrounds and current teaching activities. Female teachers made up 69 per cent of the respondents. Other features, summarised in Figures 3 and 4, include the following.

- In Figure 3a, the distribution of years of teaching experience (pale columns) and years working at the current school (dark columns) indicates that the sample is tending towards high levels of professional experience, and that this experience has been gained from movement across a number of schools.
- Figure 3b shows that the large majority of responding teachers had a four-year qualification, either in the form of a Bachelor of Education or a first degree and a
graduate Diploma in Education. A minority held two- or three-year qualifications.

- Figure 3c shows that about one respondent in six holds a Master’s or doctoral degree, and that the bulk of postgraduate work has been undertaken in the form of specialised diplomas (such as in early childhood education or special needs education). The ‘other’ column represents responses to do with studies ‘in progress’, such as a Diploma in Teaching and Learning or certificate studies in areas such as teaching English as a second or subsequent language.
Figure 3a: Teacher respondents by number of years of teaching experience overall and at current school

Figure 3b: Teacher respondents by years of initial training

Figure 3c: Teacher respondents by nature of postgraduate qualifications

Figure 3: Teaching experience and qualifications of teacher respondents
Figure 4a shows the distribution of teacher respondents according to the year level at which they are currently teaching. (Note that the proportions do not add up to 100 because some teachers taught at two or more year levels.) Clearly a spread of year levels is represented, with most of the sample working between years 3 and 10, and the highest concentration being at the upper-primary level.

In Figure 4b, the bars indicate that most core areas are represented. The substantial number of respondents indicating ‘other’ specialisations indicated that they regarded themselves for the most part as ‘general primary teachers’. Other areas mentioned by a small number of teacher respondents included (from highest to lowest in number) early childhood, ICT, business/commerce and special needs education.

Figure 4c has two y-axes, the left axis showing degrees of familiarity, and the right axis showing frequency of professional development (PD), both referring to the three different kinds of ICT experience shown on the x-axis. These teachers report relatively high levels of familiarity with the three forms of ICT presented, with a predictable decline from standard ICT applications, to digital online resources, to learning objects specifically. These levels, however, are higher than would be predicted from a review of related literature (see, for example, Jamieson-Proctor and others 2006) and would exceed projections based on European and United Kingdom research (such as that of Pittard and Bannister 2005). Similarly, high to moderate levels of professional development are reported by this sample, again less so for professional development related specifically to learning objects. It is likely therefore that the sample choosing to respond to this voluntary, web-administered survey is somewhat more ICT-familiar than others of their colleagues in schools across Australia and New Zealand. A second possibility relates to the calibration of the response scale, in that respondents may be counting as ‘some familiarity’ and ‘some professional development’ levels that are, in absolute terms, quite low in frequency, but that are more favourably judged in light of previous levels of familiarity and the professional support they have been offered in the past.
Figure 4a: Distribution of teacher respondents by year level they are currently teaching

Figure 4b: Teacher respondents by their curriculum specialisation

Figure 4c: Teacher respondents’ level of familiarity with ICT and frequency of their professional development in ICT education

Figure 4: Current teaching responsibilities and ICT familiarity of teacher respondents to the survey
How teachers use the learning objects

Both students and teachers were asked to respond to a number of questions about the learning objects(s) with which they were working at the time of their response to the survey. Table 2 provides a snapshot of the number of learning objects in use within each curriculum domain, as reported by the teacher and student respondents. (There were a further 30 unidentifiable learning objects nominated by these respondents.)

<table>
<thead>
<tr>
<th>TLF curriculum area</th>
<th>Number of learning objects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reported by students</td>
</tr>
<tr>
<td>Literacy for students at risk</td>
<td>26</td>
</tr>
<tr>
<td>Mathematics and numeracy</td>
<td>51</td>
</tr>
<tr>
<td>Science</td>
<td>38</td>
</tr>
<tr>
<td>Studies of Australia</td>
<td>26</td>
</tr>
<tr>
<td>LOTE</td>
<td>18</td>
</tr>
<tr>
<td>Art, Design &amp; Technology and Business &amp; Enterprise</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>185</strong></td>
</tr>
</tbody>
</table>

Table 2: Numbers of learning objects nominated by teachers and students as being in use within each curriculum domain at the time of the survey

As elaborated below, there is substantial variation in the usage rates of individual learning objects and also in their use within particular curriculum domains. According to the survey responses, learning objects are most heavily used in Mathematics, Science and Literacy and least used in Languages other than English (LOTE) and in Innovation, Enterprise and Creativity.

Debate over the value of learning objects is often concerned with the various ways in which teachers use them. As noted above, McCormick and Li (2006) argue that it is crucial to the success of learning objects that they avoid any pedagogical framing that prevents teachers from superimposing their own pedagogy on any learning object. Others, such as Pittard and Bannister (2005), suggest that it is the pedagogical settings and strategies that can radically modulate the success of a learning object. These contrary points of view call for some documentation of the various ways in which teachers currently use learning objects, and for what purposes. Figure 5 summarises the surveyed teachers’ responses to questions about their classroom uses of learning objects.
In relation to Figure 5, it should be noted that teachers could give more than one use. Figure 5 shows that responding teachers very rarely used the learning objects for assessment purposes. This is perhaps not surprising given that the novelty of learning objects in the teaching repertoire would discourage their use as assessment items; that the learning objects are not directly linked to any formal school syllabus content; and that the learning objects are developed for instructional rather than assessment purposes.

Figure 5 also shows that these teachers report frequent use of the learning objects for the development of new knowledge, concepts and skills. This squares not only with one of the prime purposes of TLF’s learning object initiative, but also with observations from site visits reported in earlier evaluations (Freebody 2005, 2006) and as described later in this report. Because this capacity to help students develop new knowledge, concepts and skills is so highly valued by the responding teachers, it needs to be closely scrutinised in all aspects of the TLF initiative.

Another use of learning objects that attracted high levels of response is that of allowing students to work at their own pace and level, an explicitly stated purpose of TLF’s learning objects, which are especially directed to assisting students for whom current arrangements for schooling are not well suited. For some students, the pace of classroom interaction and consequent knowledge development is either too fast or too slow, or classroom materials are too hard or too easy. Learning objects can offer a solution to these situations whereby students can have measured exposure to some core knowledge, concepts and skills, and at the same time achieve a sense of success and progress.

The third most popular use of learning objects reported by this sample of teachers was to model activities not normally possible in classroom settings. This can make the
learning objects highly suitable for teaching knowledge, concepts and skills that are regarded as difficult to teach in standard classroom conditions.

**Respondents’ evaluation of the learning objects**

A series of questions invited students’ responses to the list of items shown in Figure 6. The bars represent mean responses on a five-point scale from ‘strongly disagree’ to ‘strongly agree’.

![Figure 6: Students’ evaluation of the learning objects](image)

Responses to these items from more than three thousand students showed that they clearly distinguished between the five variables under consideration. Students were strongly positive in their support for the learning objects as ‘easy to work through’ and ‘interesting and fun’ (the top two items in Figure 6), thereby offering strong support for the manageability and interest level of the learning objects they had at hand. They supported to some extent the statement that the learning objects stimulated their thinking about new ideas. Their responses were neutral on the value of working on a learning object with a partner or peer. They gave clear signals that they did not need help from their teachers to work through the learning objects.

A series of questions was asked of students concerning the helpfulness or otherwise of certain features of the learning objects. Students’ responses on a five-point scale of helpfulness are summarised in Figure 7.
While all rankings are reliably on the positive side of the neutral point, these students drew particular attention to the opportunity to work at their own pace in the completion of the learning object activity. This feature of the learning objects was also frequently nominated in earlier surveys (Freebody 2005, 2006) and during the site visits discussed later in this report. All five features are consistently nominated as helpful and, critically, students recognise the particular advantages of the use of learning objects over ordinary whole-class or small-group classroom work for improving their learning, feedback on their learning performance, choice of pace and sequence, and interactive content.

Teachers were asked to use a seven-point scale to gauge their perceptions of the motivational effects of the learning objects on students. Responses are summarised in Figure 8.
Each of the means presented in Figure 8 is substantially and reliably above the neutral mid-point of 4. Differences between these means are not such that any highly differentiated response patterns to the various items are evident; that is, teachers strongly endorsed the helpfulness of the learning objects on all the counts offered to them. This finding is compatible with the findings from the site visits, described later in this report.

For purposes of ongoing development and to contribute to the growing field of research in this area, there is interest in what particular aspects of learning the teachers believed were enhanced by the learning objects. To that end a series of questions was asked about the value of the learning objects in general in helping students with various kinds of knowledge and learning. Teachers could nominate the relevance or otherwise of a particular learning object for various types of learning discussed in Freebody (2006). Figure 9 shows the proportion of teachers who nominated each aspect of learning as relevant or not to the learning object they were then using with their students.
Apart from some minor variation, the overall high rates of nominated relevance are striking, especially given that the responses relate to a large number of individual learning objects. The two aspects of learning most frequently nominated as relevant are ‘factual content’ and ‘key processes’; those nominated least often are ‘evaluating and justifying’ and ‘labelling of elements and parts’. It should be noted, however, that even these least frequently nominated aspects were nonetheless regarded as relevant by more than 80 per cent of responding teachers.

A summary of teachers’ ratings of the features found to be important in these different kinds of learning is presented in Figure 10. Note that on the vertical axis the original variables are named in lower case. In addition, factor analysis revealed three reliable factors that directly reflected the conceptually generated variable sets. Upper-case labels on the vertical axis refer to these three factors.
Again, the ratings are substantially above the neutral mid-point for all variables, and the differences in mean ratings are not of sufficient magnitude to be noteworthy. The three composite scores have very close mean values, indicating strong overall and consistent endorsement that the learning objects supported all 11 types of learning listed in the survey.

There was again considerable variation of response, sufficient to warrant exploration of patterns of responses from the teachers as they relate to the particular learning objects to which they were referring (as shown in Figure 11) and the curriculum domains from which the learning objects were drawn (as shown in Figure 12).

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1 The factor solution is shown in Appendix 3. Note that the item entitled ‘Define ideas and processes’ (shown in Figure 10 in parentheses) does not correlate solely with the factor to which it is assigned in Figure 10. It ‘cross-loads’ with the ‘conceptual/understanding’ factor. Therefore, it has not been used in computing the mean composite score for either factor.
Evaluating The Le@rning Federation's online curriculum content initiative

Figure 11: Mean composite factor scores for ‘factual learning’, ‘conceptual understanding’ and ‘transfer and application of knowledge’ for 12 most commonly used learning objects

Figure 11 shows that there are differences in the overall three-factor assessments among these learning objects. In addition, it is clear that the distinction between types of learning, as identified in the analyses of survey responses, relates to differences in the character of the various learning objects. The learning objects in common use tend to be rated more highly for their benefits in facilitating factual learning than in facilitating conceptual understanding and transfer.

Figure 12: Mean composite factor scores for ‘factual learning’, ‘conceptual understanding’, and ‘transfer and application of knowledge’ for five curriculum domains
Figure 12 also shows both overall and factor-related differences among curriculum domains, although at this level of analysis there emerges a distinction in relation to ‘conceptual understanding’. For four of the domains learning objects are rated lower on this factor than on the other two. It should be noted in this regard that there is a clear difference in overall ratings for the two elements of the LOTE domain, called here learning LOTE 1 (in which the ‘Cracking the code’ set of learning objects supports students to learn and use the Chinese and Japanese character-based writing systems) and LOTE 2 (in which the ‘Close encounters’ set of learning objects enables students to use engaging, interactive multimedia scenario-based learning objects that promote intercultural learning and communicative competence in the languages and cultures of China, Japan and Indonesia). We can conclude that differences are not always large but are nonetheless worth noting in the ongoing development of the learning objects. Pertinent differences relate to particular learning objects and to particular curriculum domains, and these differences relate variously to various types of learning. Comparable patterns of variation are found for the engagement items in the survey (motivation, persistence, enjoyment, collaboration, and independence in learning) in relation to individual learning objects and to curriculum domains.
Site visits

Eight site visits were conducted, each involving lesson observations and interviews with principals and teachers. The sample of eight schools took in urban, rural, and remote settings; primary and secondary years; mainstream and at-risk students of various kinds; an environmental education centre and a distance education centre.

The primary focus of the 2006 round of visits was to investigate the factors involved in successful school implementation of digital learning in general and in the use of TLF learning materials in particular.

Seven of the eight schools were selected on the basis on their being successful in this regard, while the eighth (Fitzroy Crossing District High School) was at only a very early stage of introducing TLF materials. While observations and interviews at that school (see Appendix 2) confirmed previous experience of the high applicability of digital materials generally and the use of TLF materials in particular to the learning of Indigenous students, data from that school is not included in the ‘Features in common’ section, below. Those findings relate to the seven schools where implementation was well advanced.

The school contexts

The two schools described below are located in established metropolitan areas. Of the others, which are described in Appendix 2, two are located in areas of new and rapid housing development, where urban fringes are being met by development coming from other directions. Households are reasonably affluent, with both parents in the paid workforce. Parents have high levels of interest in the celebratory or ‘show’ elements of education but trust the school personnel to handle the educational aspects of their children’s schooling.

By contrast, another is a small and comparatively old school in the process of redefining itself, encouraged by systemic support and some members of its staff including its leadership. This school demonstrated not only the attention to detail and precise teaching that can be found in high-quality education for children with special needs, but also the value of learning with ICT in this school’s unit for students with autism.

The Environmental Learning Centre, located within a national park, can be viewed as a one-teacher school or a highly engaged educational service providing hands-on learning experiences (for 8,500 students in 2005). This centre provides a fine illustration of how ideas are spread in that the teacher in charge was previously a long-term Science consultant who was familiar with TLF’s learning objects and is an active agent of disseminating information about them.

Cairns School of Distance Education is another case out of the mainstream. In developing ICT and the use of learning objects, members of staff have found just the tool for their task. How they might improve both the efficiency and effectiveness of their task has driven their interest.
Features in common

All seven sites were well advanced in their adoption and application of ICT. As well, they showed evidence of being well organised, working successfully to a plan, and achieving success in a range of areas. They have a sense of energy and a productive bustle. Successful implementation of ICT appears to be associated with the following factors that make for success in other areas as well:

- Committed leadership
- A champion of the cause
- A working plan
- Well-directed and high-quality resources
- A substantial and effective program of professional learning.

Committed leadership

In all seven schools, changes were vigorously supported by the school leadership, the reasons almost always couched in terms of meeting the needs of young people in today’s society. The commitment to their planned changes often had personal as well as professional dimensions. One principal talked about his son in year 9. Another talked about her youngest daughter. One referred specifically to the changes she had observed in students over the past ten years. In describing this personal commitment, principals referred to the planned changes as ‘unavoidable’, ‘essential’ and ‘necessary’, and as ‘urgent’ rather than ‘desirable’.

The professional dimension of their commitment related to their confidence in the capacity of ICT to improve pedagogy. They all saw the wider introduction of ICT as driving pedagogical change.

Several of the school leaders also viewed ICT use as improving the quality and effectiveness of some existing resources, commenting, for example:

There was a lot of technology hardware around. In fact it had been around for a long time. It was a matter of changing expectations about the ways in which it could and should be used.

Many of these school leaders were emphatic about using technology as a tool, as a servant of learning rather than its master, an attitude that, for the most part, was borne out in action on all seven sites. There was evidence of pragmatism, rather than fixed technological purposes, in these leaders’ strong aspirations.

A champion of the cause

A ‘champion’, as used here, is a staff member who possesses expertise with ICT and also pedagogy, who can encourage colleagues to try new directions and who is motivated to make their ideas work. Provision needs to be made for these experts to operate at a high level in their schools, perhaps at assistant principal or deputy principal level, or with some other remit of authority, as such people are the objects of much poaching, so it is in the interests of schools to find ways to retain them. This relates not only to their conditions of employment but also to the sorts of freedoms with which they are provided to implement their ideas. In all the cases we saw, these ‘champions’ had
been provided considerable liberties, and either had delivered benefits or were in the process of doing so. Each of these people was well aware of a wide range of ICT resources and grateful for the existence of TLF’s materials.

A working plan

In almost all seven schools, ‘going with ICT’ was a conscious and carefully planned decision with regular and serious attention given to its implementation, review and refinement. This was evident in the schools’ operational plans and in other documentary sources. The processes in place at Cairns School of Distance Education are noteworthy in this regard. The school’s principal outlined the processes of investigating and formally defining future directions under way at the time of our visit, but noted:

It's surprising how change is occurring before the need becomes formalised … It will take time, but people will see the results in better teaching and learning. Even in the last two months things have escalated dramatically in the development of online learning materials. We would now have a dozen or more staff active in this regard. It's being driven by the kids’ interest.

Another school had developed and used a comprehensive professional learning guide, which occupied a key role in its operations. This guide included an ICT ‘capabilities chart’ (a section of which is reproduced in the report on Ringwood Secondary College, below). Such documents described not just the school’s intentions but also its activities, and it was clear that such planning activities were evolving rapidly and were becoming increasingly important in schools’ activities.

Well-directed and high-quality resources

As noted above, ICT use can lead to the more efficient and systematic use of existing hardware and software. It was evident from the site visits that the schools that were successfully implementing ICT were also achieving better coordination of resources, a higher level of dispersal and hence accessibility, and more consistent and better-quality hardware. Three of the larger schools visited had instituted a levy for continuous upgrading of hardware, a levy that had been endorsed and, in one case, instigated by parent bodies.

In relation to the more efficient and systematic use of existing hardware and software, a typical comment was:

It was a matter of changing expectations about the ways in which [ICT hardware] could and should be used. [For almost a decade] teachers had laptops as administrative tools, but … they could choose to use them or not … [Our next step] was to stop the haphazard roll-out of hardware and infrastructure.

We developed a three-year plan to ensure that we had the sorts of things we needed to enable us to get where we wanted to go. We also began to redesign our learning spaces. The general principle was to provide greater access to hardware through a higher level of distribution.

We had a number of labs at the time, but we built 11 computer pods connected to classroom areas in various parts of the school, and we significantly upgraded our intranet so that digital resources could be shared much more readily.
Each of the five mainstream schools visited were making use (and in several cases, extensive use) of interactive whiteboards. All three primary schools were making extensive use of them and had built them into standard teaching processes. Although the two secondary schools had interactive whiteboards, we observed them in use on only one occasion and for static display purposes rather than for the sorts of active teaching purposes observed regularly in the primary schools.

Most, but not all, of the five schools had a high level of technical support. In one case the technical support officer was directly involved in the planning and implementation of the school’s initial digital learning project. However, in another school, technical support was provided for only two hours per week.

**A substantial and effective program of professional learning**

At all seven sites it was evident that using ICT to improve students’ learning and the overall effectiveness of the school has been a multi-pronged learning effort that has required the support and the authority of the leader; the availability of someone within the school who can offer practical and effective ideas as well as encouragement and support; peer influence and resource and idea sharing; and last, but not least, the influence of students themselves – what they respond well to, what motivates them and what they want.

The types of professional learning programs varied from ‘infusion’ (strong peer support coupled with access to consultancy for some staff) to voluntary and well-subscribed activities. The two secondary schools had extensive modular programs provided by colleagues within the school and also by external agencies. At the distance education school, teachers worked in teams to construct new units of material for electronic transmission.

Finally, in every case, there was provision to encourage, support and skill staff who possessed only a low level of ICT skills; and no blame was attached to those who were starting from scratch. It seems to be important that teachers be encouraged by school leaders to accurately describe the state of their ICT skills and for schools to provide what teachers need and think they need, (‘just in time, just for me’ is the way one informant and much contemporary literature describes this), rather than what somebody else thinks would be good for them.

The following reports of two of the eight site visits provide illustration of the issues discussed above. Reports of the other six site visits appear as Appendix 2.
Ringwood Secondary College

Ringwood is a long-established town that became an outer-eastern suburb of Melbourne some time ago. Students at Ringwood Secondary College are from economically heterogeneous backgrounds. While some students’ families are very well off, nearly one-third of the school’s students receive support through the government’s Education Maintenance Allowance. It is a very large school of 1,370 students across years 7 to 12, who are predominantly of Anglo-Celtic backgrounds. There are nine classes at each of years 7 to 10 and about 200 students in year 12. Manifestations of the school’s success include, in 2005, 198 of the 200 year 12 students obtaining places at university (55 per cent), TAFE institutes (30 per cent) or employment.

The school has 110 staff whose length of teaching experience is quite diverse. In 2006, 11 of the 110 were in their first year of teaching. The school is well equipped with technological infrastructure: three computer labs, 11 dispersed computer pods, several class sets of laptops, and wireless Internet and intranet connection. The school has an intranet and a well-established centre that is used for teachers to communicate with one other and with students. The school is piloting Ultranet, a learning management system with a wide range of software and teaching resources, which should enable the school to amalgamate its intranet, attendance records and formal curriculum structure. At year 9, the school has instituted a laptop program for all students (see below). The school also participates in Creating eLearning Leaders (CeLL), which is part of Microsoft’s Partners in Learning initiative with Victoria’s Department of Education and Training.

Three classes were observed using TLF’s learning objects: a year 9 Studies of Society and Environment (SOSE) class that was using several learning objects; a year 7 English class that was using ‘Dream machine’, which introduces students to metaphor; and a year 9 Science class that was using ‘Reading between the lines’, which is related to the effect of various lenses on vision. The students were deeply engaged on each occasion and their teachers were enthusiastic about the use of the learning objects.

Ringwood Secondary College provides an interesting case in implementing change processes. The principal, Mr Michael Phillips, who has been at the school for ten years, tells the story:

It’s a matter of dealing with change … When I arrived … what I wanted to achieve was, very simply, teachers teaching better and students learning better. It should be made clear that this wasn’t a matter of turning a lousy school into a good school, but a good school into a better school. There was a lot of technology hardware around; in fact it had been around for a long time. It was a matter of changing expectations about the ways in which it could and should be used.

Teachers had laptops as administrative tools, but … could choose to use them or not. In fact there wasn’t even much pressure on staff to use them for administrative purposes. Some of the initial steps included a requirement to record and report attendance via laptops, and email was used more consistently as a vehicle for communication. You must have the daily practice. For adult users in these circumstances [ICT use] has to become part of your life. It is unlikely that it ever will be for adults the way it is for kids, but some move in that direction – if you’re working with today’s kids – is absolutely essential.
The second step was to stop the haphazard roll-out of hardware and infrastructure. We developed a three-year plan to ensure that we had the sorts of things we needed to enable us to get where we wanted to go.

Also, the shape of the leadership team and their roles changed. We appointed an ICT leader, who is in charge of all the hardware at the school, an e-learning leader, and a professional learning leader, which we hadn’t had at this level before, and they were encouraged not just to be very proactive in their roles, but to work together so that the two areas could become better synthesised. The professional learning built up the degree of concentration on technology and learning.

At around the same time we instituted a fairly thorough consultation process with the KLA leaders, investigating with them what the faculties thought they needed in the way of technology. This took us towards a major investigation of software, but also developed an increasing level of interest across the board, and several ‘champions’ of the educational use of ICT emerged.

Subsequently we shifted the nature of our professional learning teams. They became cross-faculty based. This gave the staff the opportunity to work together to develop curriculum that would specifically target and engage groups of students. We also began to redesign our learning spaces. The general principle was to provide greater access to hardware through a higher level of distribution. We had a number of labs at the time, but we built 11 computer pods connected to classroom areas in various parts of the school.

We significantly upgraded our intranet so that digital resources could be shared much more readily. Three years ago we built a new staffroom and made serious efforts to try to capture the way people work and translate that into a built space. This staffroom has a large open ‘social’ space that adjoins a series of long tables separated by banks of lockers and other personal storage facilities. Network connection points are incorporated into the tables, although in the last 15 months the school has had wireless connection throughout all buildings.

With the support of our parents we have also introduced a laptop program. Currently this is just with our year 9s. The laptop program is an initiative that will continue to be rolled out over three years. As of next year the laptop program will be with years 9 and 10. In 2008 we will have laptops in years 9, 10 and 11. We needed 70 per cent of students to commit [to laptops] to break even – costs work out to about a dollar a day – and we got 87 per cent. We have a parallel model of the program that enables students who could or did not join to still have their own laptop; they become ‘school users’ whose laptops are checked out in the morning and returned in the evening.

The dynamic in the school has changed, at least partly because of the number of young teachers. They treat ICT as an automatic, intuitive resource. This has challenged our more experienced and very capable teachers. They can see the value in extending their teaching repertoire with these new techniques. We have six ICT mentors on staff, and that process has been very successful. We have had some great pairings: the excitement of the new with the wisdom of the past if you like.

Kimberley Hall, only in her second year of teaching, is the school’s appointed e-learning leader. She sees giving staff the confidence to try new and different uses of ICT in their teaching as among her major roles. She has designated meeting times with teachers in their KLA groupings to talk with them about their needs and ideas and to share what she knows that would help. In a recent survey of staff’s professional learning needs (what they wanted included in the school’s in-house program), seven of the top ten
requests related to learning with ICT, which provides an indication of the grasp that digital learning has on the staff.

We are now taking another step up.

The school is working on further improving teacher effectiveness through trialling the Victorian Department’s Blueprint for this process. It is part of an Innovation and Excellence cluster; it has a grant for being a Leading School (Technology); and one of the new Australian Government technical colleges is currently being built on the site.

These initiatives all increase the range of resources we can draw on and employ. Having said all that, I still want to emphasise that learning technology is only a tool, even if one that is critical to effective practice. We now have most teachers having a go. The classroom dynamics change. There is more one-to-one work. I think it increases the degree of empathy and the quality of rapport between staff and students. The shifts we have made in the organisation of the school have, I hope, placed students closer to the centre of our operations.

One of the tools the school uses to assess its progress in the use of ICT is the progressive capabilities chart (see Table 3 below), which was developed in Victoria for schools involved in the ICT strand of the Leading Schools Program. Ringwood Secondary College’s assessment of its capabilities in August 2006 is shown in bold.
### Table 3: ICT capabilities – self-assessment rubric
*(Ringwood’s status is shown in bold)*

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<thead>
<tr>
<th>DIMENSION</th>
<th>SUB-DIMENSION</th>
<th>LIMITED ICT USE</th>
<th>DEVELOPING ICT USE</th>
<th>INTEGRATED ICT USE</th>
<th>TRANSFORMATIVE ICT USE</th>
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<tbody>
<tr>
<td>High Levels of leadership, confidence and competence</td>
<td>Leadership of ICT</td>
<td>There is no collective or written agreement or understanding about the potential for ICT.</td>
<td>There is a draft vision statement which identifies the potential of ICT. The vision is set by other members of staff.</td>
<td>The Principal has worked with all staff to create a well-written vision statement.</td>
<td>There is an innovative vision statement that matches the schools overall aims.</td>
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<tr>
<td>ICT planning</td>
<td>There is no detailed ICT development plan or ICT element in the school improvement plan.</td>
<td>There is an up-to-date and detailed plan embedded within school-based planning. It has clear targets for ICT.</td>
<td>There is a long term strategic plan for future developments with school based planning.</td>
<td>Planning reflects a commitment to developing ICT across the whole school and curriculum.</td>
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<tr>
<td>Leadership of ICT developments</td>
<td>If there is an ICT coordinator they have few skills and make minimal impact.</td>
<td>The ICT coordinator has been trained and works across the school to support staff.</td>
<td>There is an experienced and skilled ICT coordinator who leads the developments in ICT.</td>
<td>The ICT coordinator is highly skilled and trained. They lead innovations and motivate staff to be interested in ICT.</td>
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<td>Transformed teaching, learning and assessment</td>
<td>Embedded teaching and learning with ICT</td>
<td>Some staff use ICT in some of their subject teaching. Some units of work may include explicit ICT activities.</td>
<td>Most staff use ICT in their teaching of other subjects, but there is no overall guidance on how this should be done.</td>
<td>Most subject coordinators have identified key uses of ICT within planning. These are followed by all staff.</td>
<td>ICT has been embedded centrally into all subject plans. The school regularly develops, stores and shares subject ICT resources for future use.</td>
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<td>Transformed curriculum</td>
<td>The curriculum is organised on traditional lines with discrete ICT lessons, or ICT is seen as an extra burden.</td>
<td>Some discussion and exploration has taken place to explore new methods of working and organisation based around the potential of ICT.</td>
<td>Some innovation has taken place to look at new ways of working and curriculum organisation based around ICT. Impact is evaluated to inform future discussion.</td>
<td>The curriculum content and organisation has been redesigned around the benefits that ICT can add to teaching and learning.</td>
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<tr>
<td>Using the internet for teaching and learning</td>
<td>Little or no use is made of the Internet in teaching or for students' learning.</td>
<td>Some staff make use of Internet resources. Few students have email addresses.</td>
<td>Most staff use the Internet to find teaching resources. Most students have email addresses and some use is made of email.</td>
<td>Extensive use is made of the Internet for locating resources and supporting teaching and learning. Email is used by most students within the curriculum.</td>
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<td>DIMENSION</td>
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<td>Using ICT for management processes and data analysis</td>
<td>Analysis of attainment and progress</td>
<td>The school uses little or no information technology to record, analyse or track student attainment or progress. Some staff may use systems they have developed.</td>
<td>The school has begun to explore the use of ICT to record, track or analyse attainment and progress, but its use is limited to a few staff.</td>
<td>Most staff record attainment and progress using an agreed electronic system which is networked across the whole school.</td>
<td>The school has an integrated assessment and recording system available from school and home. All staff make regular use of the system.</td>
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<tr>
<td>ICT professional learning for all staff</td>
<td>Planned staff learning in ICT</td>
<td>Individuals have to identify their own needs and learning. Those who are not interested or with low skills do not undertake training.</td>
<td>Needs are identified through performance management reviews but targets may not be set.</td>
<td>There is regular identification of ICT development needs. Annual targets, included with school planning, are set for all staff. There may be some evaluation of impact.</td>
<td>All staff have a school-supported continuing professional learning plan for ICT. Impact of development is evaluated in relation to classroom performance.</td>
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<td>Professional learning options</td>
<td>Most PL is undertaken individually or through school-based training sessions for the whole staff.</td>
<td>The school makes use of regional or face-to-face training courses for identified staff. Some staff use online training resources.</td>
<td>Staff development uses a mixture of face-to-face and online activities. There are good support systems in school.</td>
<td>Extensive use is made of online learning resources. Staff use online communities to share and develop their skills and ideas.</td>
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<td>New approaches to teaching and learning</td>
<td>Although some individuals may try out new ideas and approaches in their classrooms there is no planned innovation in school. Pilots are not evaluated.</td>
<td>New ideas may be piloted in an ad hoc way with no evaluation or process for further development.</td>
<td>New ideas are discussed before being piloted with selected staff. Pilots are evaluated but there are no systems for embedding successful innovation across the whole school.</td>
<td>New ideas and innovations are carefully planned and piloted, with full evaluation of implications and impact. If successful they are embedded across the whole school/curriculum.</td>
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<td>Improved student learning outcomes</td>
<td>How ICT can improve teaching and learning</td>
<td>There is little understanding across the school about how ICT can improve teaching and learning and standards. Staff can use ideas but cannot build on these.</td>
<td>Some staff and coordinators are aware of ways that ICT can be used. There is no conceptual framework against which evaluations can be made.</td>
<td>Most staff have an understanding of the ways that ICT can be used in teaching and learning and to raise standards. They can evaluate and reflect on their own practice.</td>
<td>All staff have a conceptual framework against which to make evaluations about the effective use of ICT. The school devotes time to exploring new approaches to using ICT to raise standards.</td>
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<td>Monitoring and Evaluating ICT</td>
<td></td>
<td>There is no formal monitoring of the use of ICT within teaching and learning. Staff do not feel competent to evaluate ICT lessons.</td>
<td>The coordinator does ad hoc monitoring as and when the need arises. This may include lesson observations and planning. Some staff are confident to evaluate ICT lessons.</td>
<td>There is regular ICT monitoring which includes classroom observations, scrutiny of work and planning and discussions with students. Most staff are competent to observe ICT lessons.</td>
<td>Regular and planned monitoring and evaluation identifies practice and areas for individual and whole school development. These are reported to governors.</td>
</tr>
<tr>
<td>Appropriate resource allocation</td>
<td>Sufficient ICT resources</td>
<td>There are limited or out-of-date ICT resources in poor state of repair.</td>
<td>There is a sufficient number of resources. These are a mixture of older and newer technologies. There are sufficient peripherals for effective use.</td>
<td>There is a good ratio of resources to users (1:5). Resources are mainly up-to-date, and in good repair. There is a wide range of peripherals.</td>
<td>There is a high pupil computer ratio of up-to-date resources. There is a range of traditional and innovative peripherals.</td>
</tr>
<tr>
<td>In-school connectivity</td>
<td>Most computers are stand-alone.</td>
<td>There is a networked central resource or some clusters which are networked.</td>
<td>Most computers across the school are networked.</td>
<td>All students have regular access to either central, portable and/or class based ICT resources.</td>
<td>All management and curriculum systems are networked together for sharing resources and data.</td>
</tr>
<tr>
<td>Organisation of students’ use of ICT</td>
<td>Students mainly use the computer as a reward or when other work is finished.</td>
<td>Most teachers plan for all students to have their turn at the computer.</td>
<td>Teachers plan students’ use of ICT related to subject needs as learners or as an entitlement to develop ICT capability. A range of grouping strategies is used.</td>
<td>Students’ use of ICT is planned in relation to subject and individual need. Students are encouraged to be independent ICT users.</td>
<td></td>
</tr>
<tr>
<td>Availability and access to technical support</td>
<td>Distribution and equality of access</td>
<td>There is no clear distribution strategy. Some classes/students have greater access than others.</td>
<td>There is an equality of access to resources across the school.</td>
<td>All students have regular access to technical support for maintenance and problem solving.</td>
<td>All students have access as required to ICT resources according the curriculum and their needs.</td>
</tr>
<tr>
<td>Technical support</td>
<td>The ICT coordinator is responsible for all technical problems.</td>
<td>The ICT coordinator is supported by regions/other resources when needed.</td>
<td>The school has regular access to technical support for maintenance and problem solving.</td>
<td>The school has its own technician for day-to-day management and problem solving.</td>
<td></td>
</tr>
<tr>
<td>DIMENSION</td>
<td>SUB-DIMENSION</td>
<td>LIMITED ICT USE</td>
<td>DEVELOPING ICT USE</td>
<td>INTEGRATED ICT USE</td>
<td>TRANSFORMATIVE ICT USE</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>High expectations</td>
<td>Creative uses of</td>
<td>ICT is used to service or deliver aspects of the curriculum.</td>
<td>A few staff understand how ICT can be used as a creative tool and allow some students to experiment out of lesson time.</td>
<td>Some staff use ICT in creative ways that extend students learning and skills within lessons.</td>
<td>Students are encouraged to use ICT in creative ways, make choices, try new ideas and techniques and challenge their own boundaries.</td>
</tr>
<tr>
<td>for students</td>
<td>ICT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT used for</td>
<td>Relationship to</td>
<td>There is no discernable improvement of ICT programs in the school.</td>
<td>ICT programs in the school have generally improved. LSF projects have benefited as a result.</td>
<td>School planning has identified ICT outcomes, strategies and resources relating specifically to achievement of LSF targets. Progress is measured and tracked through specific tools.</td>
<td>Data analysis shows the achievement of LSF targets coincides with the introduction and deployment of ICT programs.</td>
</tr>
<tr>
<td>targeted initiatives</td>
<td>LSF projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Marist College Ashgrove

Marist College Ashgrove is a large boys’ school in the north-eastern suburbs of Brisbane, with an enrolment of 1,485 students across years 5 to 12. The school draws extensively from its local area, a predominantly middle-class location. It also has about 200 boarders whose homes are widely dispersed across Queensland. It has 110 teaching staff, most of whom have been teaching for more than 16 years but 25 per cent of whom possess ten years or less teaching experience. Almost all of them use a computer at home as well as at work.

It is a long-established school with a history of strong achievement in a range of areas: sport, academic performance and the performing arts. Its new performing arts centre has a strong emphasis on music, drama, film, television and visual arts. It has outstanding sporting facilities.

We spoke with the head of school, Br Neville Solomon, Mr John Raiti (ICT curriculum support coordinator) and Brother Adrian (his co-worker), Mrs Margaret Keetels (deputy head of school, curriculum) and a number of other members of staff whom we observed using TLF’s learning objects during our visit.

Brother Neville acknowledged the significance of the school’s tradition:

We need to maintain some continuity with the past, but we also have to rise to the challenge of change.

That view is explained further in the college’s statement of its professional development program:

The way we work is changing. Globalisation and the information age have impacted on our cultural values, our experiences and language, our relationships with the world around us, the ways we communicate and the ways we transact business in the commercial world. Part of this change we are experiencing is also due to the impact of ICT on our society.

The students currently enrolled at Marist College Ashgrove have grown up with digital technology and, in particular, the Internet. Hence, it is widely accepted that their attitudes and values differ to those of previous generations. This necessitates that educators, and those who work with educators, attain greater understanding of the digital culture we live in and the learning preferences of our students.

Consequently teachers need to reconceptualise notions of curriculum, pedagogy, learning and assessment. This necessitates that teachers, as professionals, are engaged in continuing professional development in order to navigate the changes and enhance learning environments.

(Marist College Ashgrove, ‘ICT Professional Development Program’, Semester 2, 2006, p 3)

Brother Neville is a committed advocate of learning via the use of ICT:

When I came here four years ago, I thought we were a bit behind technologically. We are a boys’ school, and we always need to think hard about what sort of education it is that boys need. ‘Hands on’ is very important – and the use of ICT has to be part of that thinking. The stars aligned, and we found that we had the personnel and the capacity to support student-centred classrooms in which the development of ICT was a significant factor.
It is very important for us to keep learning alive, active and interactive. Where learning is boring, other sorts of trouble emerge. We encourage a wide range of learning activity which is increasingly student-centred, designed to keep our students engaged and busy. One of the best ways to do that is to concentrate on learning through setting up a task to solve a problem.

John Raiti added:

The big task is to develop a wider range of learning styles – multimodal learning with the use of ICT as a strong influence.

The school is increasingly well equipped with ICT hardware and software, achieved through a levy that was introduced, following a survey of parents, with their strong support. This levy produces a fund of approximately $1 million annually to further develop the school’s ICT capacity.

Brother Neville outlined the evolving nature of school policy on ICT configuration:

I’ve never really believed in labs, and we didn’t want to go down the compulsory laptop route. There are still people who say ‘great’ if there is a computer on every desk. But it’s what is being done with the computer that matters. We are constantly evaluating what sort of equipment would be best. At the moment things like palm pilots don’t seem to have the capacity we need and individual laptops present too many other problems.

The college currently has 800 computers on the network: 650 computers for students and 150 for staff; all teachers have a computer. There are 12 areas/labs of 20+ computers, as well as various other learning areas in the school where there are 10 to 20 computers. Forty-eight classrooms have data projectors installed. The school uses the eduKate learning management system. Brother Neville was conscious of the risk:

The teachers are our biggest asset, and teaching is the way in. The biggest challenge is to change teachers’ attitudes. The professional development of teachers is half the battle. We all know that. But it was still a bold move to take this step.

**ICT learning for college staff**

The evident commitment of the school leadership has been indicated. The major way in which this has translated into practice has been through a very extensive professional learning process that includes team teaching, focus groups, small-group work, presentations to whole-staff meetings and meetings of KLA/subject staff, and individual ‘just in time, just for me’ support.

As defined in the college’s statement of its professional development program, the governing principles adopted for professional learning in 2006 define the school’s clear priorities and reflect the school’s interest in developing the digital teaching capabilities of staff. The priorities are:

- ICT-related courses offered internally at the college
- ICT-related activities designed and delivered by external providers, which are not delivered at the college
- Professional development activities that are directly related to the core business of teaching and learning. Attendance at such activities requires that knowledge and practices attained be shared with colleagues in the relevant
areas of the college (such as teachers in the same subject area) and implemented in the curriculum

- Queensland Studies Authority professional development activities, with the clear intention that knowledge and practices attained at such activities be shared and evaluated
- Activities that focus on Marist spirituality and that are sponsored by the Marist Brothers Ministries Office
- Activities that focus on ‘Pastoral care in the Marist way’ and that are sponsored by the Marist Brothers Ministries Office
- Activities that focus on Queensland legislative mandates
- Activities identified as priorities through the employee appraisal process
- Other activities requested by the college leadership team


As Brother Neville explained:

We want to concentrate on one thing at a time, a straightforward initiative, on the basis that if it’s not going to affect the teacher in the classroom and what happens there, it’s a waste of time. We established a moratorium on other topics and have tried to create a situation where we have a high level of immersion in something specific and practical that will effect change in classroom practice.

The school has committed the work of two full-time staff to making this happen, and established a very well-appointed training room.

The range of the support offered is indicated in the list of in-house courses offered in the second semester of 2006, which included the following:

- Using the computer and managing files
- Uploading resources to eduKate (the school’s learning management system)
- Using the calendar in eduKate
- Creating activities in eduKate
- Communicating and collaborating with eduKate
- Using search engines effectively
- Using graphic organisers and mind maps
- Creating presentations with PowerPoint (at various levels of sophistication)
- Publish your knowledge with wikis
- Creating web quests for middle schooling
- How to scaffold research tasks to increase student independence in learning
- Design with Publisher
- Digital video production with Windows Movie Maker
- Creating basic web pages with Front Page
- Using the Mimio interactive whiteboard
- Using databases
- Using The Le@rning Federation content stored in eduKate.
One of the features of the school’s work in the ICT area is the regular collection and use of data. At the time of our visit two staff surveys had just been conducted, one relating to attitudes to and uses of ICT, and the other a self-evaluation of skill levels. The results of these surveys, which were made available to us, provide a convenient way of describing not just the college’s achievements but a broader picture, including some characteristics of the staff who are involved in developing their ICT capacities.

Nearly 90 per cent of the staff (89 of the 102 survey returns) had participated in the college’s in-house short courses; the vast majority had participated in more than one of these, and some in as many as seven. In addition, 22 members of staff are enrolled in or have completed the ‘International computer driving licence’, a skills-development course run by the Australian Computer Society, roughly equivalent to a Certificate I in Information Technology.

The report of the surveys summarises the situation as follows.

Teachers generally recognise the place of ICT in their daily work practices, with very high levels of usage of the college email system and ICT to prepare units of work and lessons.

Teachers at the college are generally confident users of ICT.

Most of the teachers at the college indicated that they were confident about managing basic computer processes. Ninety per cent consistently used word processing in their work. Nearly two-thirds could use drawing, painting or image manipulation applications. They indicated lower levels of familiarity with graphic organisers and mind-mapping software, and more familiarity with charts and graphs (but only about 40 per cent thought they were capable users). In relation to database software and spreadsheet applications, most knew about their function and could do some basic management, but few were sophisticated users. Almost everyone can and does use email and the Internet. Creating web pages and using more specialised applications (such as video editing and creating web quests) yielded a lower level of positive response.

The most common uses for the school’s learning management system eduKate were uploading resources for student use, emailing students, creating activities and adding dates to the calendar. Twenty per cent of the staff said they either had not used eduKate or did not know how to use it.

The survey results expressed a high level of satisfaction with both technical and professional learning support available at the college.

In answer to the question ‘In one week how many times on average would your class use computers?’, teachers’ responses were ‘once’ (40 per cent), ‘twice’ (17 per cent), ‘three times’ (nine per cent) ‘more than three times’ (25 per cent), and ‘not at all’ (seven per cent). Almost 85 per cent of staff used email and the Internet in their classrooms.

In response to ‘How you would feel about having some computers in every classroom?’ responses were: ‘a great teaching resource’ (nearly 70 per cent) and ‘could cater for students and their individual learning styles’ (just under 60 per cent). The preferred models of access to computers for students were ‘whole class using a data projector’ and ‘individual access’. Respondents were largely aware of the computer applications available to them in the school and were very satisfied with them.
More than 90 per cent of staff uses computers to plan units/classes and to prepare resources/activities for their students. The outstanding problem was the customary one of having enough time to do so.

Use of TLF’s learning objects

Although the classroom use of ICT in the school is well advanced, the use of TLF’s material was still in its early stages, especially in the secondary school years where the school’s curriculum is modularised. We observed the use of TLFs’ learning objects in three classes.

The first was in a high-stream year 10 Science class taught by Gerard Effeney. To introduce the idea of vectors, he used the learning object ‘Where does speeding get you?’ Relationships between route plotting, distance and speed were examined, with distinctions being made between distance and displacement, and velocity and speed. Using a class set of laptops, this inquiry was linked to a recent excursion to the Willowbank raceway. This class was taught using a wide range of activities, many of which could be described as ‘hands on’ (model making and testing, for example).

It was suggested that the chief criterion for use of learning objects was the value for learning: could the material be taught better through the use of ICT resources? A view reiterated by several informants during this visit was that ‘you don’t include them just for the sake of including them’. In discussion on this point the comment was made that, for students of high ability, at this year level, it was likely that more value would be found in TLF digital resources rather than in the learning objects, which were thought to be more suitable for younger or less able students.

The second class was undertaking a year 7 Studies of Society and Environment unit on ‘Renewable energy resources’, which involved students in researching and reporting on a number of energy resources – solar, wind, geothermal, biomass and hydropower – using a framework of questions. The unit, spanning approximately two weeks, was to conclude with a ‘town meeting’ at which students would advocate particular energy sources.

The lesson we saw was conducted in the library with students, in pairs, using the bank of computers there. They had reached ‘wind energy’ and were using recent newspaper articles about approval for a large wind farm, and also the learning object ‘Wind farm: pros and cons’ (which had been loaded into eduKate), the purpose of which is to develop letters to a newspaper in which students take a variety of points of view. The boys were highly engaged with this process.

Anne Quill, the teacher of this class and a recent convert to using digital content in the classroom, commented:

These resources make the classroom a much bigger space. They suit the boys’ interests and learning styles. They are already good researchers using the Net. I don’t want them to just ‘click and go’. It’s very important that they understand what they’re working on, and for that to happen they need the right level of challenge; for about 80 per cent of these students, that occurs with the learning objects. I find they can be an effective motivational tool for strugglers, and I can see how they might be used as ‘time fillers’. That’s why it’s very important that they are embedded in learning activities to maximise their value. In this case I think using this learning object is helping their comprehension levels.
We also saw a class using ‘Letter to the editor’. Gerard McKeown, the junior school curriculum coordinator, was impressed with the versatility of the literary material produced by TLF. The lesson commenced with a whole-class focus, using a projector. Work in pairs followed.

The final class we saw was a year 8 Maths support class of 16 students. They were working through a carefully structured process of developing their understanding of how to calculate the area of a triangle. Kathy Sydes, the teacher, noted the common difficulty of keeping these boys on task, and that the use of learning objects to support this process was valuable. That was evident in this case.

**In conclusion**

Interviews and observations conducted during the eight site visits (including the six presented in Appendix 2) showed that learning objects form part of diverse ICT and curricular programs across these schools. While the role of learning objects in familiarising students with digitally based learning was a common theme, the nature of that learning varied considerably across sites.

Regarding the kind of pedagogy used and the manner in which digital materials are integrated into everyday classroom work, it is the capacity for such integration that attracts some schools to the learning objects; while for other schools it is the learning objects’ capacity for stand-alone status that proves attractive. Interviews and observations conducted during site visits confirm the view taken by teachers in the survey that use of learning objects motivates students to learn and also helps them learn.
Field experiment

A small-scale field experiment was undertaken as a ‘proof-of-concept’ for the effects of learning object usage on learning. It had two main purposes: to observe the range of ways in which teachers were using learning objects in schools with a view to beginning a documentation of good practice; and to test for possible gains in students’ learning as a result of their use of learning objects.

Methodology

Participants

Participating in the study were 708 students from 41 classrooms in 19 schools in the Australian Capital Territory, New South Wales and Queensland. At year 5 there were 371 students from 20 classrooms, and at year 7, 337 students from 21 classrooms.

Design

Classrooms were assigned to either ‘Business-as-usual’ (quasi-control) or ‘Learning object use’ (treatment). Thus, the participating students were roughly distributed across four design groups: two year levels each with two learning conditions (‘Business-as-usual’ and ‘Learning object use’). Cell sizes are shown in Table 4.

<table>
<thead>
<tr>
<th>Group</th>
<th>Year 5</th>
<th></th>
<th>Year 7</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n students</td>
<td>n classrooms</td>
<td>n students</td>
<td>n classrooms</td>
</tr>
<tr>
<td>‘Biz-as-usual’</td>
<td>170</td>
<td>9</td>
<td>99</td>
<td>8</td>
</tr>
<tr>
<td>Learning object use</td>
<td>201</td>
<td>11</td>
<td>238</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 4: Distribution of students and classrooms across the grade x condition design

Mathematics at years 5 and 7 were chosen as the target curriculum domains largely because of the availability of year 5 and year 7 results of national testing in Mathematics. Following a general briefing on the use of learning objects, teachers taught for six weeks on two topics in Mathematics: Basic number operations (Number) and introductory probability (Chance), each of these topics being related to years 5 and 7 syllabuses.

Pre-tests and post-tests were administered using assessment exercises taken from a bank of standardised items normed for each of the two year levels and related directly to Number and Chance. (That is, different tests were used for year 5 from those used for year 7).

Pre-tests and post-tests each contained 15 items, but the number of Number and Chance items differed between pre-tests and post-tests, and between year 5 and year 7 tests. For the year 5 pre-test there were two Chance items and 13 Number items; and for the post-test, three Chance items and 12 Number items. For the year 7 pre-test there were three
Chance items and 12 Number items; and for the post-test, four Chance items and 11 Number items. Unequal item numbers reflected unequal availability of normed, standardised items at the two year levels.

Tests contained free-response and multiple-choice items. Students’ performance was scored according to answer only; that is, there was no opportunity for students to show or demonstrate their reasoning and, as a consequence, no scope for partial marks to be awarded.

**Methods of analysis**

- Some aspects of the data precluded the use of standard multivariate analyses of variance to test group differences.
- Intact groups of students (usual classroom groups) were assigned to the treatment and control groups. Therefore, some of the assumptions underlying conventional MANOVA-based analyses, particularly those concerning independence of observations, are unlikely to be tenable. A multilevel analysis is called for.
- This in turn raises another issue: Maximum likelihood methods for estimating parameters assume a large number of cases, and in multilevel analyses, that assumption extends to the number of level 2 units (classrooms). For the data at hand, this means Maximum likelihood methods would not be appropriate given the small number of classrooms (the level 2 units). Bayesian methods would be more suitable. Markov Chain Monte Carlo (MCMC) methods are used to give parameter estimates. MCMC methods are implemented in the MLwiN software package (see Appendix 3 for details).
- Multivariate analyses, multilevel or otherwise, that deal with pre-test and post-test as two variables, and that deal with scores for the Number and the Change components as two variables, assume that tests are scored on continuous scales and that the scores have a normal distribution. With the small number of items for some of the Chance components, this assumption is unlikely to be tenable. The response variable (the number of correct Chance items) takes the form of an ordered categorical scale, and an appropriate analysis is a proportional odds analysis. It returns the odds that a student scores 0 correct, 1 correct, and so on, (see Appendix 3 for details of the proportional odds analysis applied in this case).
- At each year level, four groups of proportional odds analyses were run: Chance pre-test, Chance post-test, Number pre-test and Number post-test. Each group of analyses comprised three analyses: a single-level analysis to establish base-line estimates of odds; a multilevel analysis with ‘Classroom’ as a random factor to determine whether or not there was variation at the classroom level; and treatment (‘Business-as-usual’ and ‘Learning object use’) added to the model to determine whether or not students using the learning objects performed better than students in business-as-usual classrooms.

Even though separate analyses were conducted for the pre-tests and post-tests, students were dropped from both analyses if they were missing results for one or the other test. The number of students remaining in each of the analyses was: year 5 Chance – 341; year 5 Number – 349; year 7 Chance – 323; year 7 Number – 323.
Findings

The proportions of students getting each question correct for each year level and each instructional condition (‘Business-as-usual’ and ‘Learning object use’) are shown in Table 5.

<table>
<thead>
<tr>
<th>Year 7</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Year 5</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biz as usual</td>
<td>LO use</td>
<td>Biz as usual</td>
<td>LO use</td>
<td>Biz as usual</td>
</tr>
<tr>
<td>Q 1</td>
<td>97</td>
<td>98</td>
<td>82</td>
<td>88</td>
<td>90</td>
</tr>
<tr>
<td>Q 2</td>
<td>95</td>
<td>94</td>
<td>77</td>
<td>83</td>
<td>82</td>
</tr>
<tr>
<td>Q 3</td>
<td>70</td>
<td>70</td>
<td>78</td>
<td>91</td>
<td>89</td>
</tr>
<tr>
<td>Q 4</td>
<td>89</td>
<td>85</td>
<td>60</td>
<td>74</td>
<td>73</td>
</tr>
<tr>
<td>Q 5</td>
<td>90</td>
<td>88</td>
<td>85</td>
<td>89</td>
<td>81</td>
</tr>
<tr>
<td>Q 6</td>
<td>81</td>
<td>82</td>
<td>38</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Q 7</td>
<td>46</td>
<td>59</td>
<td>52</td>
<td>60</td>
<td>53</td>
</tr>
<tr>
<td>Q 8</td>
<td>51</td>
<td>51</td>
<td>55</td>
<td>64</td>
<td>66</td>
</tr>
<tr>
<td>Q 9</td>
<td>63</td>
<td>64</td>
<td>68</td>
<td>74</td>
<td>22</td>
</tr>
<tr>
<td>Q 10</td>
<td>64</td>
<td>71</td>
<td>19</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Q 11</td>
<td>22</td>
<td>40</td>
<td>37</td>
<td>46</td>
<td>22</td>
</tr>
<tr>
<td>Q 12</td>
<td>12</td>
<td>10</td>
<td>63</td>
<td>86</td>
<td>12</td>
</tr>
<tr>
<td>Q 13</td>
<td>74</td>
<td>75</td>
<td>55</td>
<td>64</td>
<td>5</td>
</tr>
<tr>
<td>Q 14</td>
<td>21</td>
<td>32</td>
<td>43</td>
<td>65</td>
<td>54</td>
</tr>
<tr>
<td>Q 15</td>
<td>81</td>
<td>92</td>
<td>36</td>
<td>54</td>
<td>61</td>
</tr>
</tbody>
</table>

Table 5: Percentage of students correct on each item in each cell of the design.

These results, depicted graphically in Figures 12 to 15, are summarised below (see Appendix 3 for detailed computations of significance levels):

- As expected, there was no effect for the treatment group on any of the pre-tests; that is, groups were effectively equivalent on this item bank prior to the intervention period.
- There were statistically reliable effects for treatment for the year 5 and year 7 Chance post-tests; students in ‘Learning object use’ classrooms scored more correct items than students in ‘Business-as-usual’ classrooms.
- There were no effects for treatment for the year 5 or year 7 Number post-tests; post-test scores on Number items for year 7 students showed a non-significant advantage for students in ‘Learning object use’ classrooms.
One major issue in outcome-based evaluations such as this is gauging the optimal intervention period. Interventions may be too long or too short, and lead to false-positive or false-negative results. The relatively short period of intervention used in this design took into account the highly constrained nature of the topic focus – two aspects of Mathematics that were both covered in some form at the two participating year levels and for which some standardised assessment items were available.

It is for further research to begin developing a sense of optimal intervention periods for instructional devices with as short a history as digital learning objects. The demonstration of a reliable effect for the Chance items, and the indication of possible effects for one of the year levels for the more general Number item bank, together suggest that even six weeks of diverse and ‘uncontrolled’ exposure to some learning objects can have some demonstrable positive effects.

![Figure 12: Year 7 Number pre-test and post-test probabilities for total number of questions correct](image-url)
Figure 13: Year 7 Chance pre-test and post-test probabilities for total number of questions correct
Figure 14: Year 5 Number pre-test and post-test probabilities for total number of questions correct.
Over the course of the intervention period, observers visited each school and observed the lessons taken by those teachers using the learning objects. Analyses of field notes will be reported in a separate document. In general, observers reported, among other things, that the Chance items were challenging to teachers and students generally, and were often avoided in the ‘Business-as-usual’ condition. So from ‘guild-knowledge’, anecdote, and more specifically from observations and explicit statements to observers...
during the intervention period, it is clear that there is a notion that the topic area of
Chance/Probability is regarded as difficult to teach, certainly when compared with
concepts involved in the topic area of Number.

This difficulty seems, from the observations, to relate as much to pedagogy as to
intrinsic conceptual structure, in that teachers indicated that scenarios could be
constructed in the learning objects that would be either impossible or highly time-
consuming for them to set up in classrooms. The view was expressed that number
concepts were more straightforward – conceptually,logistically, and pedagogically – to
teach well.

The speculation arising from the findings, therefore, is that it was this ‘difficulty’ edge
that caused the effect to appear more clearly for the Chance/Probability items in this
intervention. The short time frame and small bank of items prevent any direct
acceptance of this hypothesis, but the indication is that further evaluations, along with
‘homing in’ on optimal periods for different kinds of learning objects, should be
designed with the ‘difficult to teach’ factor in mind. Such a design brief is also
compatible with TLF’s commitment to capitalise on digital resources to tackle
conceptually difficult, complex, and pedagogically challenging learning tasks.
Conclusions

The various elements of the evaluation continue to converge on a positive message concerning the use of learning objects in an increasingly broad sample of schools. While there are predictable variations relating to a particular learning object in use and the curriculum domain from which it is drawn, there are persistent patterns of positive judgements by users and productive understandings of possibilities for use in a variety of educational circumstances. There is also evidence of outcome gains on standardised test items not particularly chosen for their format equivalence to the learning object materials.

Recurring in the data in a variety of guises, in this and the earlier evaluations, are issues to do with pedagogy in relation to use of learning objects. Teachers used learning objects as they might use textbooks, library resources or educational childminders. As reviewed in a section above, there is ongoing debate about the optimal uses of such materials, and about even whether any guidance at all should be given. It is clear that consideration needs to be given to developing theorisation of the tension noted by Boyle (2003):

> From a software engineering perspective, each learning object should be as cohesive and de-coupled as possible. This greatly facilitates re-use and re-purposing. From a pedagogical perspective, however, there is a need to create an overall coherent learning experience. These design challenges may be in conflict. (p 50)

Research agenda in the areas of both pedagogy and ICT usage need urgently to document – over the long term and in an ecologically valid range of settings – both the immediate and sustained consequences of engagement with online curriculum content for both teachers and students, and the differential consequences for varying curriculum or disciplinary domains. This is not just a research question related to student outcomes, notwithstanding their primary significance. If an understanding is to be developed of the potential for learning object use, then that needs to be informed by studies of how teachers understand and use digital materials. Documentations of student outcomes that set aside the question of pedagogy (as does the initial field experiment reported above) or that assume pedagogies can be considered either generic and common or too messy to contemplate, need from now on to be supplemented by systematic examinations of learning objects in use. Only in this way can an appreciation of the true potential of learning objects in a variety of educational circumstances, including circumstances where there are no formal teachers, be developed.

What now needs to be documented, over timeframes that allow a reasonable establishment phase for the learning objects in individual classrooms, is how teachers’ and students’ perceptions are acted out in sequences of teaching and learning activities, and the nature and extent of changed pedagogies and learning that actually result from the use of learning objects. Enhancing the substantial investment in the development phases of the initiative means planning for patient but rigorous research in the implementation phase. This in turn means there is now more responsibility placed on school systems and colleagues in schools to take the investment to the next phase with regard to producing high-quality teaching and learning environments. The research imperative is to support, expand and document those ‘best processes’ in close collaboration with school colleagues. This amounts to a recognition that the outcomes
of using learning objects are outcomes of enhanced teaching and learning, not automatic outcomes of the intrinsic properties of the learning objects.

Pushing forward with the initiative towards studies of implementation and outcomes is not only an inescapable conclusion from this and earlier evaluations; it is also in line with the best advice from researchers and professional educators currently grappling with questions of ICT in education. The educational point of departure now seems to be how to encourage and document the broadest possible range of good practices with learning objects while at the same time actively prosecuting agenda that remain attentive to the retrograde uses to which any promising initiative can be put. To respond with principled answers to these issues will mean acknowledging the high stakes of failure for target communities, educational systems, schools, individual teachers and students.

In debates about knowledge and the optimal mixtures of syllabus content and process (the ‘essentials’ have again become central in many Australian jurisdictions), it is important to recognise that students encounter and work with these essentials, however they may be defined in material and technological settings of some sort. Part of the justification of syllabus activities is that they have the potential to afford some simulation of real-world practices in vocational, domestic and leisure settings. The interface of curriculum with both technological and modality changes becomes critical to progress in the school years and beyond. Building bridges between the powerful curriculum formations and the repertoires of skills, attitudes, understandings and dispositions that underpin real-world activity becomes an important role for the next phase of research and development initiatives, including that of The Le@rning Federation.

In his outline of the rapid transformations facing contemporary societies, Kress (2003) has identified four domains of high-speed change that should be preoccupying educators:

- Changes in economic structures and opportunities (and see Ball, Maguire & MacRae 2000), with the corollary that the production and management of texts assumes increasing significance in an information-driven economy;
- Changes in the forms and modalities of communication, with a move away from the single dominance of written language and a move toward the use of image;
- Changes in social structures and relations of social power, with the reworking of new socioeconomic hierarchies; and
- Changes in the technologies of communication, with a move away from the single dominance of paper texts and towards digital–screen texts.

The educational distribution of these new forms of communication becomes a system imperative if schools are to retain their currency and connection with the civic and domestic lives of young people and simultaneously with the labour markets that they face after school (Lankshear and others 1997). This is the broader policy setting for initiatives such as The Le@rning Federation, and for its ongoing evaluation. It calls for a programmatic approach to trialling and monitoring the use and efficacy of TLF products, one that is rich and multifaceted enough to rise to challenges that are socioeconomic, cultural and intellectual, as well as technological.
References


Evaluating The Learning Federation’s online curriculum content initiative


Kress, G 2003, Literacy in the New Media Age, Routledge, London.


Marzano, RJ, Gaddy, BB & Dean, C 2000, What works in Classroom Instruction, Midcontinent Research for Education and Learning, Aurora, CO.


Appendix 1a: Survey questionnaire for students’ responses, 2006

Please tell The Learning Federation what you think about using learning objects to help you learn. Thank you very much.

1. What is the name of your school?

2. Where is your school?
   - Australian Capital Territory
   - New South Wales
   - Northern Territory
   - Queensland
   - South Australia
   - Tasmania
   - Victoria
   - Western Australia
   - New Zealand

3. What grade or year level are you in?
   - K/P/R
   - 1
   - 2
   - 3
   - 4
   - 5
   - 6
   - 7
   - 8
   - 9
   - 10
   - 11
   - 12

4. Are you
   - Male
   - Female

5. How often do you use computers outside of school?
   - Everyday
   - Four to six times a week
   - Two to three times a week
   - Two to three times a month
   - Rarely or never
6. How often do you use the internet outside of school?

☐ Everyday
☐ Four to six times a week
☐ Two to three times a week
☐ Two to three times a month
☐ Rarely or never

7. What subject do you enjoy most?

☐ Maths
☐ English
☐ Science
☐ SOSE/HSIE
☐ Art
☐ Technology
☐ Health PD/PE
☐ Other (please specify)

8. What is the name of the learning object you have just used?

9. How much do you agree with these statements?

(Tick the boxes to show how much you agree with the statements)

- The learning object was interesting and fun
- The learning object was easy to work through
- The learning object helped me think about new ideas
- It helps working with a partner to do the learning object
- I needed a lot of help from my teacher to do the learning object

10. How helpful were these features / aspects of the learning object for your learning?

(Tick the boxes to show how much you agree with the statements)

- The colour, pictures, animations, videos and sound
- Interacting with the learning object
- Working at my own pace
- Repeating activities until I was successful
- Getting feedback which told me if I was right or wrong
- Getting information which told me how to do the activity better
11. How would you rate the learning object you have just used?

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<thead>
<tr>
<th>Not good for learning</th>
<th>Good for learning</th>
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<tbody>
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</tbody>
</table>

12. How would you rate the learning object in making you want to learn?

<table>
<thead>
<tr>
<th>Does not make me want to learn</th>
<th>Makes me want to learn</th>
</tr>
</thead>
<tbody>
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</table>

13. Overall, do you think using this learning object is a good idea? Why, or why not?
Appendix 1b:  
Survey questionnaire for teachers’ responses, 2006

This survey is designed to be completed after teachers have used a learning object with students. A separate survey is to be completed for each learning object used.

Please remember that your students also need to complete the Student survey relating to the same learning object that you comment on in this survey.

Thank you for completing the survey for The Le@rning Federation. Your responses and those of your students will provide us with important information that can be shared with all education sectors in Australia and New Zealand.

Olivia Clarke  
Program Implementation Advisor  
03 9657 9796  
olivia.clarke@thelearningfederation.edu.au  
www.thelearningfederation.edu.au

About you

1. What is the name of your school?

2. What teaching qualifications do you have?
   ☐ 2 or 3 year teaching diploma  
   ☐ 4 year Bachelor of Education  
   ☐ Undergraduate diploma or degree plus teaching diploma or degree

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

4. Do you have any post graduate qualifications? (Tick all that apply)
   ☐ Specialised graduate certificate or diploma (e.g. in educational leadership, curriculum, special education)?  
   ☐ Master of Education?  
   ☐ Other Masters degree?  
   ☐ PhD or DEd?  
   ☐ Other (please specify)
5. Do you have any post graduate qualifications that specifically relate to Information Communication Technology in education?

☐ Yes
☐ No

6. What is your gender?

☐ Male
☐ Female

7. How long have you been a teacher?

☐ 1st year of teaching
☐ 2 – 5 years
☐ 6 – 10 years
☐ 11 – 15 years
☐ 16 – 20 years
☐ more than 20 years

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

☐ 1st year of teaching
☐ 2 – 5 years
☐ 6 – 10 years
☐ 11 – 15 years
☐ 16 – 20 years
☐ more than 20 years

ICT knowledge and professional development

1a. How familiar would you say you are with the use of Information Communication Technologies in the classroom as they relate to standard ICT activities such as Word and or PowerPoint?

Not at all familiar 3 4 5 Very familiar

1b. Have you engaged in professional development activities to enhance your familiarity with use of ICT of this kind in the classroom?

No PD Extensive PD

1 2 3 4 5 6 7

2a. More specifically, how familiar are you with the use of digital online curriculum resources, e.g., digital encyclopaedia, websites, in general in the classroom?

<table>
<thead>
<tr>
<th>Not at all familiar</th>
<th>Very familiar</th>
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</table>

2b. Have you engaged in professional development activities to enhance your familiarity with the general use of digital content in the classroom?

<table>
<thead>
<tr>
<th>No PD</th>
<th>Extensive PD</th>
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</table>

3a. More specifically again, how familiar are you with the use of learning objects, such as those produced by TLF, in the classroom?

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<tr>
<th>Not at all familiar</th>
<th>Very familiar</th>
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</table>

3b. Have you engaged in professional development activities to enhance your familiarity with the use of digital learning objects in the classroom?

<table>
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<tr>
<th>No PD</th>
<th>Extensive PD</th>
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</tbody>
</table>

About your school

1. Country/state/territory of school

- [ ] ACT
- [ ] NSW
- [ ] NT
- [ ] NZ
- [ ] QLD
- [ ] SA
- [ ] TAS
- [ ] VIC
- [ ] WA

2. School sector

- [ ] Government
- [ ] Independent
- [ ] Catholic

3. The school is

- [ ] Co-educational
- [ ] Single sex – female
- [ ] Single sex – male
4. What is the total enrolment of your school?

- [ ] 1-25
- [ ] 26-100
- [ ] 101-200
- [ ] 201-300
- [ ] 301-400
- [ ] 401-500
- [ ] 501-700
- [ ] 701-1000
- [ ] more than 1000

5. Does your school include proportions of students who are:

   **Language backgrounds other than English**
   
   None 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100%
   
   - [ ] None
   - [ ] 1-10%
   - [ ] 11-20%
   - [ ] 21-30%
   - [ ] 31-40%
   - [ ] 41-50%
   - [ ] 51-60%
   - [ ] 61-70%
   - [ ] 71-80%
   - [ ] 81-90%
   - [ ] 91-100%

   **Indigenous**
   
   None 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100%
   
   - [ ] None
   - [ ] 1-10%
   - [ ] 11-20%
   - [ ] 21-30%
   - [ ] 31-40%
   - [ ] 41-50%
   - [ ] 51-60%
   - [ ] 61-70%
   - [ ] 71-80%
   - [ ] 81-90%
   - [ ] 91-100%

   **Low socio-economic**
   
   None 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100%
   
   - [ ] None
   - [ ] 1-10%
   - [ ] 11-20%
   - [ ] 21-30%
   - [ ] 31-40%
   - [ ] 41-50%
   - [ ] 51-60%
   - [ ] 61-70%
   - [ ] 71-80%
   - [ ] 81-90%
   - [ ] 91-100%

**About the learning object you are using**

1. What year level/s are you teaching with this learning object? (please circle)

   K/P/R 1 2 3 4 5 6 7 8 9 10 11 12

2. What is the name of one TLF learning object used with your class? (Please refer to one learning object only).

3. In what curriculum area did you use this learning object?

   - [ ] English/Literacy
   - [ ] LOTE: Chinese, Japanese or Indonesian
   - [ ] Mathematics/Numeracy
   - [ ] Science
   - [ ] SOSE/HSIE
   - [ ] The Arts
   - [ ] Integrated Unit
   - [ ] Other (please specify)
4. How did you use this learning object? (Tick all that apply)

- [ ] as an orienting or tuning-in activity
- [ ] as a teacher-directed demonstration tool
- [ ] to help students develop new knowledge, a concept or skill
- [ ] to model or simulate activities not normally possible in the classroom
- [ ] as a stimulus for discussion, developing higher order thinking skills or critical literacy
- [ ] as revision or review of new knowledge, a concept or skill
- [ ] as an assessment component
- [ ] to allow students to work at their own pace and level
- [ ] in conjunction with other ICTs (e.g. with Word, PowerPoint, Internet research, data base and graphing tools, Inspiration, communication tools)
- [ ] as a model for students to build new knowledge products
- [ ] Other (please specify)

5. How did the students view the learning objects? (Tick all that apply)

- [ ] on CD-ROM
- [ ] online, using a Learning Management System or digital resource repository
- [ ] Interactive whiteboard
- [ ] Data projection to whole class
- [ ] Other (please specify)

6. Which statement best describes the class environment in which the learning object was used?

- [ ] individuals or small groups using 1-5 desktop computers
- [ ] half a class or more simultaneously using 6-30 desktop computers
- [ ] individuals or small groups using 1-5 laptop computers
- [ ] half a class or more simultaneously using 6-30 laptop computers

---

**More about the learning object**

1. **Factual / content learning**

*How well did the use of the learning object help your students:*

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<th>7</th>
<th>N/A</th>
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<tbody>
<tr>
<td>To know the key factual content of the topic?</td>
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<tr>
<td>To know the key processes involved in the topic?</td>
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<td>To label elements and parts?</td>
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<tr>
<td>To state and define ideas and processes?</td>
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</table>
2. Conceptual / understanding

How well did the use of the learning object help your students:

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<th>Not at all</th>
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<tr>
<td>To summarise and paraphrase key concepts?</td>
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<tr>
<td>To explain ideas and connections among key concepts?</td>
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<tr>
<td>To compare and contrast among key concepts?</td>
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<tr>
<td>To evaluate and justify key concepts?</td>
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3. Transfer of knowledge

How well did the use of the learning object help your students:

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<th>7</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>To apply key ideas and processes to new settings or problems?</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
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<tr>
<td>To demonstrate applications to new settings or problems?</td>
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<tr>
<td>To design and or construct new objects or processes through the application of key concepts?</td>
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General

1. The learning object helped students to increase their:

Motivation to engage in the task

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2. The learning object helped students to increase their:

Persistence in doing the task?

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3. The learning object helped students to increase their:

Enjoyment of doing the task?

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</table>
4. The learning object helped students to increase their:

   Ability to collaborate with peers in doing the task?
   
   Not at all | Extremely
   1 | 2 | 3 | 4 | 5 | 6 | 7

5. The learning object helped students to increase their:

   Independence in managing and completing the task?
   
   Not at all | Extremely
   1 | 2 | 3 | 4 | 5 | 6 | 7

6a. Have you used other TLF learning objects?

   □ Yes  □ No

6b. If yes, what were they?

6c. With respect to your students’ learning, how would you rate the learning object you are using now compared to other digital learning objects you have used?

   Much worse for learning | Much better for learning
   1 | 2 | 3 | 4 | 5 | 6 | 7

6d. With respect to your students’ motivation, how would you rate the learning object you are using now compared to other digital learning objects you have used?

   Much worse for motivation | Much better for motivation
   1 | 2 | 3 | 4 | 5 | 6 | 7

7. Overall, do you think using this learning object is a good idea? Why, or why not?

Please provide your email, so that we can contact you regarding your feedback if necessary.
Appendix 2: Reports of site visits

Bournda Environmental Education Centre

Bournda Environmental Education Centre is located in the Bournda National Park between Merimbula and Tathra on the south coast of New South Wales. It is one of approximately 20 such centres (once known as field study centres) operating under the aegis of the New South Wales Department of Education and Training. The teacher-in-charge, Mr Doug Reckord, runs the centre with support from the centre’s administrative manager, Jan Lynch.

The centre’s building consists of just one reasonably sized room; but its teaching location, as well as its resource, is the 2,590 hectare coastal park, with extensive freshwater lakes and saltwater estuaries in close proximity, and a small area of rainforest-like vegetation. The park is also rich in Aboriginal history.

In curricular terms, the content of student encounters with the centre ranges widely. Its environmental education programs cover a wide range of syllabus areas, including visual and other creative arts and creative writing, and a wide range of topics related to Human Studies and its Environment and to Science. The centre also offers student-leadership and peer-support programs, expedition training for Duke of Edinburgh awards, and programs in Physical Education, Health and Personal Development. Student groups visit the centre just for the day or camp there for two to five days.

Of the some 9,000 students who used the centre’s services in the 2005, most came from the local area, while others came from much further afield. Inland schools, for example, seek coastal experiences for their students. Visitors ranged in age from kindergarten students to adults.

One of the challenges confronting Doug (and others working in similar situations) is how to maximise the value of these short-term encounters, and to get the best possible educational outcomes from them. To meet this challenge, Doug encourages the teachers to integrate their visit with their current classroom work. With that in mind, he spends a good deal of his own time in schools, both teaching students and providing teachers with relevant pre-visit and post-visit materials, ideas and activities.

Doug came to this job after working as a Science consultant in the Western region of the State – a role that required him to be familiar with a range of relevant teaching and learning resources and how these could be widely used and shared. He had found ICT to be a great asset.

> For us the web [is] an ideal medium for this sort of thing. The online publishing of support materials [is] easier to coordinate and organise than print – it’s flexible and easy to update or adjust. To find relevant materials readymade is always fantastic. It saves a lot of time and effort.

The centre has three desktop computers, and also five laptops that can be used as ‘a lab in the bush’. Doug finds considerable educational value in using geographic information systems (GIS) to help students explore various sites. GIS enables them to match visual data gained from this process with direct visual observation.
Use of TLF’s learning objects

In his previous role and then at the centre, Doug explored the value of using TLF’s materials to support teachers’ and students’ preparation and follow-up work.

Finding them was just fantastic. I was looking for resources, went to the TALE (Teaching and Learning Exchange) site [the point of access for TLF’s materials in New South Wales], registered and found exactly what I was looking for.

I was working on a unit concerned with energy [generation and use] – steam engines, generating electricity for lighting … environmental sustainability in domestic environments – when I found [TLF’s learning objects] ‘Energy efficient house’, ‘Solar cooker’, and others about water use.

I tried ‘Solar cooker’ with a group of students, and it went over well. They were very engaged, but more to the point we had a discussion of the principles underpinning the material and the impact of changing the relevant variables, and I could see quite clearly that they had internalised the main ideas.

I don’t like to just let students ‘play’ with the learning objects, although I’ve got nothing against play as such. It’s just that it is possible to get so much more out of them if they’re ‘taught’, with questioning and discussion and reinforcement of the right points and so on.

Doug has become an advocate for TLF’s materials among the staff of the schools who use the Bournda centre. In that context, he comments:

I tend to cart them round on my laptop because of the high degree of variability in schools’ hardware set-ups and differences in teacher usage rates and familiarity in working with ICT.

Doug has also found another source of support for digital learning. Teachers have been contributing digital learning ideas and material to the curriculum support site of the New South Wales Department of Education and Training, especially via units developed by Connected Outcomes Groups. A number of these units have TLF’s learning objects embedded in them.

We saw Doug working at Tathra Public School with a group of year 6 students who were involved in a modified version of one of these units, ‘Interconnecting growth and change’, which in its focus on ecosystems draws on science and technology. The students had been testing water quality at various locations in the Bournda Park, including those that required them to kayak across the lagoon to sample algal blooms. The use of TLF materials supported the field work that had been organised in conjunction with class teachers Kerry Love and Molly Leharne.

Doug had prepared a simple but effective entry page for following up this activity, in which he provided students with access to six TLF learning objects (‘Frog pond habitat’, ‘Rain forests’, ‘Feral peril’, ‘Ecosystem’, ‘Save the lake’ and ‘The colour of water’), along with a survey questionnaire to provide him with feedback on students’ reaction to those materials.

Doug was working with the 32 year 6 students in the computer lab at Tathra Public School, which was equipped with a data projector and approximately 20 computers. Using the data projector, Doug explained how to access the learning objects and invited the students to choose which learning objects they wished to work with. He also asked students to complete the questionnaire.
The students were practised computer users and got into the learning objects quickly and easily. In the time available (about 50 minutes) most of the students (largely working in pairs) used several of the learning objects.

Responses to queries indicated that all 32 students had a computer at home; that almost all of them had Internet access at home; that 26 used their home computers for email, about half of them used their home computer for games, and about one-quarter of them for wider Internet purposes.

The survey data collected suggested that the most popular learning object had been ‘Feral peril’, largely due to the appeal of its name, a finding of some significance for situations in which students can choose their learning object. Of all six learning objects it was probably the least relevant to the students’ preceding work on ecosystems; and its multiple-choice answers (often used by the students as ‘guess and click’) and low level of interactivity would not have provided much learning.

However, students were certainly able to identify the learning objects that had most relevance to what they had been learning about at Bournda. Two-thirds of the students thought that this was a good way to learn (‘It helped me learn’) and about the same proportion would recommend particular learning objects to their friends. They were discerning and opinionated about which learning objects were good and which were not, on which there was a reasonable consensus. More than 90 per cent of them liked using computers to learn and the same proportion found the learning objects easy to use.

Doug commented that this sort of work was just an early stage in his plans to work in a hands-on (rather than simulated) way with what is taught at the centre. However, he commented:

> There are scientific phenomena that take time to develop, or which you simply can’t do in a hands-on or any other way, but which can become accessible through the use of digital simulations. For some issues [TLF learning objects] provide an excellent introduction to concepts like turbidity or ph.

> I like the idea of some summary activity, a report generator or something like that to check what has and what hasn’t been learnt. That provides an indication of the quality of the interaction.

The survey data, collected towards the end of the lesson, was shared with the students, who found this data most absorbing, highlighting what a good idea it was to share it with them. This sharing also provided a very useful summary discussion, exemplifying the value that Doug had placed on such an activity.
Cairns School of Distance Education

Cairns School of Distance Education, located in a suburb of Cairns, has 480 students (some full-time and others part-time), some of whom live just around the corner, others of whom live in remote parts of far north Queensland, others in overseas countries and yet others who live at sea. This school is one of seven distance education centres in Queensland that service the needs of a wide range of students who for various reasons do not or cannot attend a mainstream school or whose schooling is being supplemented by access to the resources of these centres.

This was the second site visit made to Cairns School of Distance Education, the first having been 16 months previously. Since that time a significant influence on the school’s work had been Cyclone Larry, which had damaged infrastructure such as roads, power and communications.

Another developing influence to which the school was responding was the change in the composition of the school’s enrolment caused by a continuing trend towards home schooling. Ten years earlier, 70 per cent of the school’s students were geographically isolated whereas those students now account for just over 40 per cent of enrolments. During the same period the percentage of home-schooled students has risen from six per cent to nearly 30 per cent. There has been a threefold increase in the proportion of such students in the past three years.

The remaining 30 per cent of students are travelling or residing overseas, at home for medical reasons, not engaging with mainstream schooling for one reason or another, or are in juvenile justice institutions. The school also provides support for students whose home schools cannot offer a sufficiently wide curricular range to meet their needs.

Cairns School of Distance Education has 42 teachers (full-time, part-time and sessional) who cater for students from pre-school to, for the first time in 2006, year 12. The school has three sections: a junior school for years P–4, a middle school for years 5–8 and a senior school for years 9–12. In years P–7 the curriculum is integrated, except for Mathematics. For years 8–12 the curriculum is organised according to separate subject areas. The school supports many other schools in the provision of LOTE courses – Italian, Indonesian, German and Japanese; and in assisting students with special needs, and teachers of ICT and multimedia.

The transformation of the work of the Cairns School of Distance Education was described at greater length in the 2005 study (see Freebody 2005). However, in summary, the Cairns School of Distance Education is one of the successors to the ‘School of the Air’, which began at this site in 1974 when the medium of instruction was textbooks, assignment/work books and radio contact. Quite recently the radio contact has shifted to telephone ‘bridges’ (‘teleconferencing’ in other contexts). The school also does its best to provide face-to-face ‘getting to know you’ contact through a field program – an annual school camp held for all students who can get there, through regionally based mini-schools, and through at least one home visit per year. The teaching program has remained mainly paper-based. These materials, which are produced by Access Education in Queensland, can be (and are) updated by users, and are generally well regarded.

Considering that 96 per cent of students’ families had computers, 92 per cent were connected to the Internet, with 60 percent of them having broadband connection, an
effort began in 2002 to digitise these paper-based materials, mainly by just scanning the
paper materials and distributing them on CD, rather than by changing the nature of the
medium more radically. (It is significant that a number of students’ homes in more
remote areas have quite advanced two-way satellite connections, but do not necessarily
have continuous power because generators are turned off to conserve fuel or for other
reasons.)

The teachers we spoke to noted that there has been a longstanding concern to try to
make the materials as interesting as possible, and to avoid the ‘spoon feeding’ that is
hard to obviate in assignment-based learning for a wide range of abilities. For a number
of years Internet sites suitable for research and other uses have been explored, and
various new means of interaction and communication have been investigated and
instituted.

The duration of contact varies from time to time but at present students in years 1 to 4
receive five half-hour lessons per week and also individual reading lessons; while
students from years 5 to 7 receive two three-quarter hour lessons and two half-hour
lessons via phone contact per week; and those from years 8 to 12 receive a session
lasting between a half-hour and an hour for each of their subjects. What is the secret of
making the most of this? Head of the junior school Jim Buzacott says:

Kids talk as much as possible; teachers as little as possible.

In the past, surface mail could take up to three weeks from the time a student sent work
for marking and feedback, to having it returned. Today, email has added a significant
dimension to the teaching because of the potential increase in the speed of turnaround of
work. Chat rooms and use of EQ’s Blackboard platform have been other valuable ICT-
based additions to the work of the school. TLF’s learning objects have been very
warmly welcomed as they provided a new dimension to the scope of the school’s work.

During the 2006 visit, there were indications of a very sharp progression in the school’s
provision of sophisticated digital learning and learning resources. We spoke with
Richard Huelin, the school’s principal; Theresa Felatar, the school’s online learning
coordinator; and Jim Buzacott, head of the junior school, about this progression.

Richard Huelin commented:

Technology is the key to overcoming the one drawback of distance
education, the absence of a teacher. Our students have a right to expect
genuine participation in technology for their learning. There is really no
alternative to [our students having] consistent access to a quality computer
with high-speed Internet connection. Within two years we expect that every
one of our core students will have their own computer. Subsidies of $250 for
computer maintenance and $500 for Internet connection are now available
to students’ families.

Access to suitable hardware is basic to this change. Our informants suggested that
equally important was an increase in the skill levels of the school’s teachers. Richard
Huelin commented:

We simply must have teachers with these skills and who are comfortable
working in this way.

A review of these skills late last year indicated that a number of members of
staff [did not possess] the level of skills required. [However, while] changes
in expectations have to come from the top, ‘you can’t mandate what matters’
(a quote from Michel Fullan, Richard thought). There is no legal authority
that states that these types of skills are essential. What I try to do is to generate conversations among the staff and to promote a climate where decisions [to increase their skills] can be taken by the staff members themselves. [However,] ... what teachers usually talk about when confronted by a situation like this is the difficulty in finding time, uncertainties about the reasons for change, and whether the effort required would be worth the result.

The school had just finished a review of future directions in relation to issues such as these. The team was confident about the outcomes:

It’s surprising how change is occurring before the need becomes formalised. Pressure comes from our [students’] families. Their expectations have changed, and they have their own network to discuss these issues, and then there’s the peer influence as well.

The previous report of our visit to Cairns School of Distance Education (see Freebody 2005) indicated the very strong approval of online learning in general and of TLF’s learning objects in particular.

It will take time, but people will see the results in better teaching and learning. Even in the last two months things have escalated dramatically in the development of online learning materials. We would now have a dozen or more staff active in this regard. It’s being driven by the kids’ interest. It’s easy for them and more difficult for us because we haven’t grown up with it like they have. Beyond the time it takes, and it does take some time, there’s a natural fear and plenty of reasons why it seems you mightn’t be able to do it.

In the natural turnover of staff, we want [the new] people to be technologically savvy, but not at the expense of being pedagogically savvy – that is at least as important. Distance education has tended to be separated from the mainstream, and curriculum development has been a centralised function — set, created and made available, and not technologically based. We are really opening up a new area, and I think some of the excitement of that process is being communicated. Those involved can immediately recognise its power. We also want to pick staff for their attitude rather than their experience, so it is likely that the average age of our staff may drop, although it is some of our more experienced staff who are now taking this issue up most enthusiastically.

We are working on the inclusion of a substantial amount of technologically based alternatives for learning at each level in the junior, middle and senior schools. In the senior school we are increasingly embedding learning objects in units of work. All our literacy-based and numeracy-based units of work for years P–7 will be digital by 2008. We have teams of staff working on this at present. None are experts yet, but they are learning very quickly. Theresa helps out a good deal with the more technical aspects. It is an excellent opportunity to get straight about outcomes and effective indicators of those outcomes.

**Use of TLF’s learning objects**

TLF’s learning objects accessed via the Education Queensland site ‘The Learning Place’ (http://learningplace.eq.edu.au) are an important resource for this process, along with other web-based resources like video clips and Macquarienet.

We plunder anything that is available, but TLF stuff has been most important, a staple of our work really.
The principles on which this work is based include:

- using problem-solving as the basic strategy (Web quests have provided a helpful model in this regard);
- integration of students’ work across key learning areas in years P–7; and
- extensive and more effective use of communication tools, with a focus on the development of wider communication networks, peer-to-peer teaching and other forms of collaboration that digital learning can support in a way that was impossible previously.

We are still struggling with the notion of the ‘virtual classroom’. The quality of our students’ Internet connections doesn’t necessarily allow this to work as we would want. You really do need consistent, permanent and fast connectivity. But we notice that we are thinning out everything that might be unnecessary. There is more talking and teaching time, less filling in the spaces on paper-based work. We have even been able to start working on oral assessments through the use of Audacity (a recording and assessment program). There is a chance to make everything more ‘hands on’.

Andrew Dalgliesh from Education Queensland’s Learning Place suggested that the most effective means of changing practice was to provide teachers with products that entice them to change their practice towards more connected, student-centred approaches rather than trying to deliver digital versions of traditional teacher-centred learning.

We distinguish between ‘ready to go’ and ‘ready to use’ resources. ‘Ready to go’ means pre-developed courses, events and activities with quality instructional design embedded, which prompt less interpretation on the part of the teacher. Like a Sara Lee cake mix, you add your students and a good connection to the rest of your unit. ‘Ready to use’ resources differ in that they can be likened to the ingredients that a chef, Jamie Oliver for example, may use – resources that need interpretation, judgement, a knowledge of students and good pedagogy for obtaining a fine result.

He describes The Le@rning Federation’s learning objects and digital resources as ‘ready to use’ resources, as these learning resources tend to have just the right kind of space around them, prompting effective teaching and learning to occur.

Andrew said:

While we all need to rely on Sara Lee solutions sometimes, teachers should – and usually want to – aspire to more powerful and expert skills and practices in teaching and learning, using the tools, resources and models of practice available through e-learning solutions in the same way a great chef uses appliances, ingredients and recipes to create more enticing and nutritious cuisine.

Richard Huelen supported Andrew’s analogy, commenting on the ‘ready to use’ model:

Like all teachers, we are looking for meaningful leverage, that teaching moment when things happen for the student.

The Learning Place was spoken of very highly in this regard, in so far as it was organised around teachers’ work rather than via a listing of applications and tools, and in its focus on the suitability of resources for individualised learning.

We spent some time with a group of four junior-school teachers who were hard at work developing a new unit, ‘Rangers to the rescue’, which integrated curriculum content in
most key learning areas, to deal with some environmental issues. They described the steps in their work as follows.

The first thing we do is to get on the same page about outcomes. We go through the official documents from the Queensland Curriculum, Assessment and Reporting Framework and discuss our understandings of what is meant.

Then we ask ‘What KLAs?’ Session 1 is usually concerned with literacy – reading and writing. Session 2 has a stronger focus on content related to particular KLAs. We decide which will be the ‘host’ KLA. We look at the sorts of tasks that will get the sorts of outcomes that are specified, and look at the degree of their continuing relevance.

Then we design the learning tasks with consistent reference to the assessment criteria that we have embedded in the unit.

Then we think about the ‘learning episodes’ and how these fit together as a sequence to make the whole process as seamless as possible.

They were also considering ways in which they might combine sessions 1 and 2, ways in which learners could assess their own progress, and how to provide learners with other forms of feedback.

Regarding the inclusion of TLF’s learning objects in their planning, these teachers stated that the learning objects had a significant place in this process of development as long as they fitted the learning tasks and the outcomes criteria.

We wouldn't include them for the sake of inclusion.

This report concludes with an example of a unit that was developed through the above process.
Cairns School Of Distance Education

Online Unit  Year 2 Unit 13

Day One  Day Two  Day Three  Day Four  Day Five

Possum Magic

Day Six  Day Seven  Day Eight  Day Nine  Day Ten

Home Tutor Guide
DAY ONE – The Story Begins

TODAY’S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson to learn how to write a story map.

You will learn to use the Inspiration program to create your story map. Save your story map by exporting it as a JPG and print it out and paste it in your Possum Magic workbook.

CLICK HERE for your home tutor to get a tutorial to help you out if you find Inspiration a bit tricky.

You will find the 3 versions of the story on the ‘Possum Magic Resources CD’. If you have the CD, you will not need to download them. If you do need to download the stories below, you will only need to do it once in the beginning of this unit and save them to your computer. You will not need to ever download them again. You will be able to open them offline and listen, watch or read them as many times as you like. You will need DNL Reader to view them.

RIGHT CLICK HERE and ‘save target as’ to save the story to listen to it being read to you.

Filename: PMPlosWithSound.dnl
(Pictures with sound)
11MB

RIGHT CLICK HERE and ‘save target as’ to save the story to read by yourself or with a home tutor.

Filename: PMPlosWithoutSound.dnl
(Pictures with no sound)
3MB

RIGHT CLICK HERE and ‘save target as’ to save the story to listen to without seeing the pictures.

Filename: PMPlosWithoutPics.wma
(Sound with no pictures)

Retell the story to your home tutor in your own words.

What happened first?
Then what happened?
Why did that happen?
What did they do to try to solve the problem?
What characters are in your favourite part of the story?

Use Audacity to record your retell in your own words and tell your friends what your favourite part of the story was.

Why was it your favourite part?
What characters are in your favourite part of the story?

CLICK HERE to print out your Possum Magic Workbook if you do not already have a copy of it.

In your best handwriting, write the book title, your name and draw a cover picture.

Keep this workbook handy. You will need it throughout this project.

CLICK HERE to go to the discussion board in your Blackboard classroom and add your recording to the forum titled, “My Favourite Part of Possum Magic”.

Listen to what your friends say about their favourite part.

Does anyone have the same favourite part as you?

Tell your home tutor about what your friends thought was their favourite part.

CLICK HERE to print out your Possum Magic Handwriting Book if you do not already have a copy of it.

You will need this throughout the unit.
Home Tutor Guide - DAY ONE

Materials for today
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Sharp pencil
- Coloured pencils, felt pens, paints or collage materials
- Microphone and Audacity
- Inspiration program installed (found on the LTPJuniorCD)

Downloading the different versions of the story.
You will find the 3 different versions of the story on the Possum Magic Resources CD. You can view them from there at any time. This will save you time downloading them from the internet.
You need only download the 3 different versions of Possum Magic once. If you right click and ‘save target as’ you will be able to save them to your student’s folder and view and/or listen to them from there. You will find the links to download all versions on day one of the Online Unit materials in Blackboard.

Outcomes: Technology - Information INF2.2; English- Reading and Viewing CU1.2;

Reading, listening and retelling.
Allow your student time to listen, watch and enjoy the story by themselves for the first time.
During the second reading, join your student and share the experience by making comments about the story as you listen and watch. You are able to pause the story as you enjoy it together to chat about the story and what is happening.
- Discuss the problems that Grandma Popp and Hush face and how they solve them.
- Discuss the types of animals in the story.
- Discuss the places around Australia they visit.
- Discuss the foods they find to help Hush become visible.
- Discuss familiar words they may recognize.

After you have finished enjoying the story together, have your student retell the story to you in their own words.
Set up Audacity and a microphone on the computer and allow your student to record their retelling.
Encourage your student to read the story without the sound and assistant only if they have trouble. Encourage them to sound out unfamiliar words.

Creating a Story Map.
A story map will assist your student with understanding the structure of the story as well as sequence events to assist with retelling. The Inspiration program will assist you to easily create a story map. You will find the Inspiration program on the LTPJuniorCD in the ‘programs’ folder. You will also find the serial number to install it in a Microsoft Word document in the ‘programs’ folder. Your teacher will work with helping you to use the Inspiration program during the telephone lesson. You can also learn how to use Inspiration from the website link in the online course material.

Discussion Board - Sharing favourite part of a story
Go to the discussion forum titled, "My Favourite Part Of Possum Magic" and attach your sound recording. Encourage your student to listen to other people’s recordings and reply to them to discuss why they chose that part.

Possum Magic Workbook
Your should have received a printed copy of the Possum Magic Workbook in the mail. If you do not have it, you can download it and print it out from the online course materials. Your student will need to keep this Possum Magic Workbook handy throughout this unit. It will need to be sent to the teacher on completion of this online unit. Your student will need to write the title of the story in the top space, design a new cover in the middle space and write their name in the bottom space. Encourage your student to use their best handwriting or experiment with different styles of writing for the title. They can also choose to use felt pens, coloured pencils, paint or collage material for their cover design. Encourage your student to talk about their plan with you before they begin.
DAY TWO - Retrieving and Recording Information

TODAY’S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson discussing the benefits of using graphs to show information or data collected.

You will explore different types of graphs and when it would be best to use them.

Read through the book page by page with the sound.

Filename: PMPicWithSound.dll (Pictures with sound)

Take notice of the number of times each character appears in the story.

In your Possum Magic Workbook on the ‘graph sentences’ page, using your best handwriting, write some sentences about the information or data you recorded on your graph.

Which animal was there more or less of than others?

How many more of one animal was there than another?

Choose 10 words from your graph sentences and make a word search out of them online with Word Turtle on the internet.

Print out your word search and give it to someone else in your family to try.

Spelling practice. For you to be able to write good sentences, it is important for you to practice spelling different words. Play some of these games to help you practice your spelling. Can you find words you used in your graph sentences?

Spelling Game One

Spelling Game Two

Type your sentences about the data you collected from your graph in an email and send it to your teacher. Attach the snapshot you took of your graph so that your teacher can see it.

CLICK HERE to send an email to your teacher.

Keep a record of what you find on the “Animal Notes” page in your Possum Magic Workbook. You will need to tally up how many times each animal appears in the story.

The website below to Maths Dictionary will help you learn how to tally. You will need this information for your next task.

Maths Dictionary -
choose TALLY & GRAPHS

CLICK HERE to spend 10 minutes practicing your keyboarding using Dance Mat Typing. This will help you to become more confident on the computer keyboard so that you can get work finished more quickly and go outside to play.
Day Two continued....

Complete the handwriting task on page 1 in your Handwriting Book about the koala and Australian cities. Look carefully at the mistakes in the handwriting and circle them as you find them.

CLICK HERE go to a fantastic website where you can create a graph. Record the number of times each animal appears in the story.

Take a screenshot of your graph and save it to your computer folder. Print out your graph and glue it into your Possum Magic Workbook. You will need it to solve some math problems later in the project.
Home Tutor Guide - **DAY TWO**

**Materials for today**
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil

**Outcomes:** Maths - Number N2.2; Maths - Chance and Data CD2.2;

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**Reading and note taking.**
Allow your student time to listen and watch the story.
- Discuss the idea of making notes.
- Discuss how making notes is writing keywords to prompt a thought or remind about a fact.
- Model note taking by writing a heading of each animal name as they appear in the story and tallying as an animal appears.

**Tallying and Graphs**
Discuss with your student how much easier and faster note taking is and how fast tallying is compared to writing whole numbers. Demonstrate by timing to see how long it will take to write numbers to ten and then time how long it will take to tally to ten using the four strokes and slash through for every fifth one. Discuss how easy it is to count up by then counting in 5s. The maths dictionary is a good tool to help you and your student understand tallying.
Discuss with your student how graphs are another easy way to record and see information. The maths dictionary is a good tool to help you and your student understand graphs. Go to the create a graph website and discuss the parts of a graph and what each part of a vertical bar graph means.
- **Labels** - they are the names or titles of the objects being counted. The labels are found on the bottom of the columns of the graph.
- **Numbers** - each row in a graph is numbered on the left hand side. The numbers of the rows start with one at the bottom and count up.
You will need to take a screenshot of your students graph and save it to your students working folder on your computer. You will attach this screenshot to an email later on today.

**Handwriting - Mistakes in the letter formation**
Encourage your child to complete the handwriting task on page 1 of your handwriting book and identify the mistakes and circle them. Ask your student to write wrong letters the correct way at the end of the sentence on the pare lines. Encourage them to have their feet flat on the floor and their back up nice and straight to assist them with having beautiful handwriting.

**Writing about the information from a graph**
Encourage your student to write some sentences about the information or data you recorded on your graph in the Possum Magic Workbook. For example, “There are 5 more kolas than snakes in the story.” Or “There are not as many possums as kangaroos in the story.” Encourage your student to use comparative language such as ‘more than’, ‘less than’, ‘as many’, ‘fewer than’, ‘greater than’ or ‘the same number as’
- Which animal was there more or less of than others?
- How many more of one animal was there than another?
- Were there any two animals that appeared the same number of times in the story?
Allow your student to type their sentences in an email to send to their teacher. Attach the screenshot of the graph your student created. You will find a link to the teacher’s email address in the Possum Magic Day Two online unit materials.

**Create a word search**
Allow your student to open the word search creator on the internet and choose ten words from their writing about information from a graph. Choose the MEDIUM level in the options for adding 10 words and then choose the ‘Make puzzle t print on paper’ option.
Challenge your student to complete the word search for themselves while timing and then encourage them to present the challenge to another family member and compare time taken.

**Spelling Practice Online**
These are online interactive games that your student can play independently to assist them with spelling core words. Allow your student to explore and play these games for no more than 20 minutes.
DAY THREE - Australian Animals

TODAY'S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson brainstorming things you will need to know to do great research and present a great report.

Also, have your LTPJuniorCD handy as well, your teacher to remind you about how to find learning objects on the CD.

Read through the book page by page without the sound.
Filename: PMPicsWithoutSound.dnl (Pictures with no sound)

Take note of how many different Australian animals there are and list them in your Possum Magic Workbook.

Listen to some of these great Australian ballads. A ballad is also like a story. Do they talk about any animals in them? Tell your home tutor in your own words what the story is in these ballads. Sing along. You will find the words to these ballads in your Possum Magic Workbook.

Save

Explore the "Who Lives Here" learning object on the LTPJuniorCD. Use your torch and explore the different habitats and find creatures, learn about them and write a report for the local scientist, Jen and send it off to her.

You will find this learning object in the "LEARNING OBJECTS > SCIENCE" folder on the LTPJuniorCD.

In your best handwriting, write 3 environment related words you learnt from the learning object and their meanings in your Possum Magic Workbook on your 'animal notes' page.

CLICK HERE to complete the Final Animal Report page and submit your report to your teacher. You will need to use your research notes to help you.
Complete the handwriting task on pages 4, 5, 6 and 7 in your Handwriting Book about the swagman from the ballad, Waltzing Matilda, you just listened to. Look carefully at the shape of the letters as clues to help you with spelling and neat handwriting. Read the sentences out loud to your home tutor.
Home Tutor Guide - DAY THREE

Materials for today
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil
- Recipe books from around the home if you have them
- LTFJuniorCD - Learning Object - Science: “Who Lives Here?”

Outcomes: Technology - Information INF2.2, Science - Life and Living 2.3:

Reading and observing
Allow your student time to read the story, assisting with words and recognising names of different types of Australian animals in the story. As a new animal is mentioned in the story, encourage your student to list them in their Possum Magic workbook while sounding out parts of the word.

Listening and observing
Allow your student time to listen to three Australian songs. If you right click and 'save target as' on each song, you will be able to listen to them offline as many times as you like. You will find the words to the songs in your Possum Magic workbook so that you can sing-along. Encourage your student to listen to the words of the song and add any new animals, not already mentioned in the Possum Magic story, to their list in their Possum Magic workbook.

Handwriting - Waltzing Matilda
Encourage your student to use a sharp pencil, put their feet flat on the floor and keep their back nice and straight while completing the tasks on pages 4, 5, 6 & 7. Sound out unfamiliar words and rewrite any incorrectly formed letters in the spaces at the end of the sentences.

Researching Australian animals online
Allow your student time to explore the 3 websites to learn more about Australian animals. Once they have explored many different types of animals, discuss new information and facts they discovered. Ask your student questions such as...
- What kind of animal are they? Mammal, bird or reptile?
- What do they eat?
- What type of environment or habitat do they live in?
- How are their babies born?

Encourage your student to observe the headings each website uses to organise the information. For example, habitat, diet, breeding, behaviour or reproduction. Your student will need to choose 2 animals that interest them and make notes using headings for each animal.

Learning Object - Who Lives Here?
Allow your student time to explore the learning object and use the torch to search through the bush to learn about different Australian animals. Once they have explored many different types of animals, discuss new information and facts they discovered. Ask your student questions such as...
- What kind of animal are they? Mammal, amphibian, bird or reptile?
- What do they eat?
- What type of environment or habitat do they live in?
- How are their babies born?

Writing - new and unfamiliar words
Encourage your student to ask about meanings of new and unfamiliar words as they research using the websites and learning object. In the Possum Magic workbook, your student will write 3 new animal or environment words they have never read or written before. Talk about the meanings of the new words.

Inspiration - organising research
Your teacher will work with you and your student on the telephone lesson to use Inspiration to plan and organise animal research. Export the final research as a JPG and save it to your computer to attach to the discussion board to share with the class.

Discussion Board - Sharing research
Go to the discussion forum titled, “Animal Research” and attach your Inspiration JPG research to a message for everyone to see. Encourage your student to check out other people’s research and reply to them to discuss facts they may have missed or not known about or tell them about how great their research is.
You will work as a class on the telephone lesson using your imagination to come up with ways that Grandma Poss could cook in the bush.

Bring your imagination and sense of humour to this lesson.

You will also discuss how to write a science report under the headings of:
1. What I need
2. What to do
3. My Predictions
4. My Observations
5. My Conclusions

Read through the book page by page without the sound.

File name: PossumsWithOutSound.dnl (Pictures with no sound)

Take notice of how many different kinds of food are mentioned in the story.

Grandma Poss used magic to make Hush invisible.

What was the main reason for making Hush invisible?

Grandma Poss had magic books with spells which are a bit like recipes and science experiments.

In all 3 things you mix ingredients together to make something happen.

In recipes for cooking, spells for magic and science experiments for discovering you have to do a lot of stirring, blending, mixing and combining of different ingredients.

Today you will be experimenting, cooking and discovering. You will need to practice writing your ‘ir’ words because you will be doing a lot of stirring.

CLICK HERE to send an email to all you classmates and tell them which of the foods in the story is your favourite and why.

Reply to an email that a friend sends you and ask them how they think they might make that food.

Imagine Grandma Poss didn’t have a bicycle to get around to search for food for Hush. If she had to cook the food in the bush, without electricity, how would she cook it? Discuss some possibilities with your home tutor.

Look at these great recipe books online. Can you find recipes for any of the foods in the story. Look at the way the recipes are written. Is it in dot points or is each step numbered? Why do you think it is written this way?

RECIPE BOOK ONE
RECIPE BOOK TWO
RECIPE BOOK THREE

Chat with your home tutor about the way recipes are written and see if your home tutor has any recipe books that are written the same way for you to look at. Which is your home tutors favourite recipe in a recipe book?

On the Possum Magic Resources CD, you will find the Outback BBQ video. If you do not have the resources CD, RIGHT CLICK HERE to save this Scope science experiment video to watch as many times as you like and learn how you can cook in the bush without using an electric microwave, stove or oven.

Have your Possum Magic Workbook handy to take notes on your “Outback BBQ” page. You can pause the video to take notes while you watch. If you have the equipment for this experiment, give it a try! Don’t forget to get adult help for cutting the aluminium can.

Time to conduct your own experiments. Now you know what adding heat from the sun can do to a sausage, what will happen to different substances if you combine them, add heat or cold or just stir them together.

Check out these experiments online at Zoom and Questacon. On the Zoom experiment website you will be able to read what other kids have done and find out what they discovered.
Day Four continued....

Complete the handwriting task on pages 8 and 9 in your Handwriting Book.
Read the sentence out loud to your home tutor.
Home Tutor Guide - **DAY FOUR**

**Materials for today**
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil
- Outback BBQ Experiment Resources - Optional but encouraged.

**Outcomes:** Technology - Information INF2.2; English - Speaking and Listening CU2.1; OP2.1

**Reading and speaking**
Read the story along with your student and discuss the types of food Grandma Poss and Hush find in their travels around Australia. Chat about how each of the foods are made and share experiences with tasting these kinds of foods and describe how they taste and look. For example, sweet, crunchy, fluffy, crumbly top, easy to make, salty, difficult to make. Discuss what ingredients might be needed to make each food. Discuss and use terminology to describe how each food might be made. For example, stirring, mixing, blending, sprinkling, baking, adding, boiling, spreading.

**Reading recipes**
Allow your student time to explore some of the yummy recipes in the online recipe books. Discuss the structure of a recipe and how it is written with the two separate sections, ingredients and method. Also discuss the formatting of the text in these two sections. Dot points for list of ingredients and numbered lines for method or instructions.
Compare the styles of recipes and their similarities and differences. Use terminology such as, list of ingredients, order of method, numbered set of instructions, temperature, mix, blend, fold, thoroughly, measure, cups, teaspoons, tablespoons.

**Emailing friends - Favourite foods**
Allow your student time to write and send an email to their classmates which foods in the story are their favourites and why. Encourage them to describe their favourite foods using the words you discussed while reading the story. Allow your student to read other people's emails and reply to someone who might have the same favourite food as your student.

**Cooking in the bush**
Discuss some possible ways Grandma Poss and Hush could cook lamingtons, pavlova and vegemite sandwiches in the bush without electricity for stoves, ovens, microwaves, blenders and refrigerators. Spend some time with your student coming up with ways they could cook using the natural environment. Talk about using the sun (solar energy) to cook things. Allow your student time to watch the Scope science experiment, Outback BBQ video. If you right click and 'save target as' and save the video to your computer, your student will be able to watch it as many times as they like. It is a very fast moving, entertaining science experiment presented by a primary school aged boy. Question your student about the video and how the boy in the video explains how the sun will cook the sausage. If you have the resources, allow your student to make their own outback BBQ and cook a sausage.

**Explore experiments online**
Encourage your student to explore some of the experiments on the Zoom and Questacon websites. Discuss how these experiments are written in a similar structure to a recipe.
Discuss...
- why the structure of a recipe and science experiment are the same?
- What would happen if the method, instructions or what to do section wasn’t in the correct order?
- On the zoom science website, read and discuss what other kids have written about the experiments when they tried it?
- How to write a real science report under the headings of “What you need”, “What to do”, “My predictions”, “My Observations”, “My conclusions”.
- How important it is to learn something from a science report from predicting, observing and forming a conclusion about why things happen.

**Experiment and report**
It is time for your student to become a scientist and conduct experiments and then report on them using the science report template in Inspiration. You will find the template in the Possum Magic online unit materials. Discuss with your student how to write a real science report under the headings of “What you need”, “What to do”, “My predictions”, “My Observations”, “My conclusions”.
DAY FIVE - Cooking and Designing

TODAY'S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson preparing to make lamingtons. Have your cooking ingredients ready by the phone as well as your Possum Magic Workbook and sharp pencil.

You will share tips for cooking and check out the labels and packaging and make sure you are able to understand how a recipe is written, measure amounts and cook a fluffy lamington. YUMMMY!!

Read through the book page by page with the sound.

You will need to know about measuring weight and volume, which is knowing how you will be able to fit six lamingtons into one box. You had better play these games to learn more about measuring and making shapes fit!

How will 6 lamingtons fit into one box?

Maths Dictionary Game
choose AREA and VOLUME
Rainforest Maths
choose AREA and VOLUME

How will you know how to measure ingredients for cooking?

Maths Dictionary Game
choose GRAM and WEIGHT
Rainforest Maths
choose WEIGHT and CAPACITY

Complete the handwriting task on page 12 in your Handwriting Book.

You will need to work with a lot of numbers while cooking from a recipe. It is a good idea to practice writing your numbers to help you later on.

You are going to start your own lamington business so that Grandma Poss and Hush will never run out of lamingtons. Your lamingtons are so fantastic, everyone will want one!

Design a box and label to fit lamingtons.

Boxes are easy to make and if you use this pattern and learn a bit about symmetrical shapes, you'll have no problem at all.

Explore online games to help you understand symmetrical shapes.

Maths Dictionary Game
choose SYMMETRY

Symmetrical Shape Game 1
Create a rubber band shape and then create a square and then use another rubber band to show the line of symmetry.

Symmetrical Shape Game 2
Look up 'ASYMMETRY' and learn what symmetrical and asymmetrical means as you create a symmetrical clown.

Symmetrical Shape Game 3
Make this picture into a symmetrical pattern using colours.

Now you have the box made, it is time to make it look good enough to impress Grandma Poss and Hush.

Look at all the information that is on the labels of your ingredients.

What do they all have in common?
What kind of information do you need to put on yours?
What part of the label is the biggest and brightest?
Why do you think they used the colours they did on your ingredient packages.

Design a label for your lamingtons. You will need to cut out some paper the correct shape. You can use coloured pencils, felt pens, crayons, cut out pictures from magazines, print out clipart from the computer...anything you think you will need to make it the best lamington package you have ever seen.

Filename: PMPaosWithSound.dnl
(Pictures with sound)

Take notice of the 3 kinds of food that make Hush visible. Think about how tasty they will be. YUM!!
**Day Five continued....**

- **Math Skills**
  - How much? How many?
  - How heavy? How long?

You will need to use your math skills to solve these problems.

You will need all your cooking ingredients to do some searching for numbers to find answers.

In your Possum Magic workbook, you will find your Measuring Madness maths problem solving sheet. Complete the measuring tasks as you cook your lamingtons and get your home tutor to check it for you.

- **Photography**

If you have a digital camera, take a photograph of you and your delicious lamingtons and email it out to all your friends so they can see how delicious they are. Tell them about any trouble you may have had and how messy it was. Also describe to your friends how tasty they are.

- **Creative Activity**

In your Possum Magic workbook, you will find the lamington box pattern. What? There is only half of it?

Use this half to create the full box using what you have learnt about symmetrical shapes.
Home Tutor Guide - DAY FIVE

Materials for today
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil
- Lamington Recipe Ingredients
- Access to the kitchen and kitchen resources
- Access to the kitchen food cupboard to investigate labels and packaging


Reading and listening
Allow your student to read and listen to the story and take notice of the 3 kinds of food that made Hush visible. The teacher will discuss cooking lamingtons and as a group the students will share cooking tips and how to read and understand a recipe. They will discuss units of measure for cooking such as teaspoons, tablespoons, cups, litres, grams and millilitres.

They will discuss the amounts in the recipe and how to measure different amounts of different ingredients like scales, spoonfuls or cupfuls.

Handwriting - numbers
For your student to be able to write a good science report and work through recipes they need to be able to write numbers clearly and neatly. Encourage your student to sit with their feet flat on the floor, back up nice and straight as they practice writing their numbers in their handwriting book on page 12. Discuss the correct direction to write numbers in.

Measuring madness - maths activity sheet
In your Possum Magic workbook, you will find the Measuring Madness activities as well as the recipe for lamingtons. Your student will complete this activity sheet as they cook lamingtons. The ‘maths dictionary’ and ‘rainforest maths’ websites will assist you and them with understanding units of measure and when and how to use them.

Cooking lamingtons
Assist your student with cooking lamingtons using the recipe form the Possum Magic workbook. While cooking, encourage your student to describe what they are doing as they read the recipe, measure, pour, mix, blend, stir, bake, cut and roll. If you have a digital camera, take photos of your student cooking and measuring as well as a photo of the completed lamingtons. You may wish to print out the photos and add them to your Possum Magic workbook and email the photo of the completed lamingtons to their classmates.

Lamington box - learning about symmetry
Describe a scenario to your student where Grandma Poss and Hush think their lamingtons are the best and would like to buy them so that Hush can stay visible forever. Discuss with your student how to make a box and design a label to be attractive to possums if it was on a shop shelf. Use the box template in the Possum Magic workbook. The problem is that there is only half of a box. Your student will need to learn about lines of symmetry to complete the box to cut it out and make it. There are some online games including the maths dictionary to help you and your student understand symmetry. Once your student has made their lamington box, they will need to design the label. Look at labels on the ingredients you used to cook the lamingtons and products in the fridge and kitchen cupboard. Discuss:
- which products stand out and catch their eye and why.
- Colours used on product labels.
- Size of different text on the label – product or brand name bigger or smaller than other info?
- What kinds of pictures are on packages?
DAY SIX - Chance and Data

TODAY'S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson creating graphs and seeing the different types of graphs available. You will explore bar graphs, pie graphs and many others.

Mmmmm... a pie graph sounds tasty!

You will also look at the types of ways to get around a game board and explore dice and spinners and the benefits of them. You will explore the concept of chance and data and the possibility of predicting what might be thrown or spun based on recording data of what is thrown.

CLICK HERE to open the program that lets you create some delicious pie graphs during your telephone lesson.

Read through the book page by page without the sound.

Filename: PMPicsWithoutSound.doc (Pictures with no sound)

Think about how you could change the story to make it original. Choose one part of the story and create a new page with your own illustrations and text to go with it in your Possum magic workbook on the 'my new possum magic story' page.

You will need to interview people and complete a survey to find out which are the most popular foods in the Possum Magic story.

In your Possum Magic Workbook, you will find the Food Survey. Survey your family and friends and find out which foods they like best and record their answers on the survey document.

Keep your survey handy because you will need to organise the data so that you can quickly see the results. A graph like you did on day 2 is the best way to see information. That graph was very easy to create but there are so many different kinds of graphs.

Play these games as you learn more about 'ar' phonemes.

Graph, chart and bar all have something in common. They all have the 'ar' sound but don't all have 'ar' in their spelling.

There are so many ways to spell words that have the 'ar' sound in them.

Play this game and graph the number of Australian animals you can see.

Postcard Game choose the SHARK postcard

Clamshell Game choose ANIMAL

Data graphs

Simple Graph Bright Fancy Graph
What do you notice about these words? Something is different yet the same about them. Chat with your home tutor about what you notice.

Interactive Stories
Click on the books to watch and listen to the stories being read and click to play in parts of the story. Listen carefully to the 'ar' words.

After you have listened and played through the story books, print out the text for each story and circle all the 'ar' words in red and then circle all the words that sound like they have the 'ar' phoneme but don't.

Use your printouts of the 'Molly's Card' story and create a bar graph to show the number of times the following words appear in the story.

CARD CARDS PARTY
DIWALI AFTERNOON

How will you create your graph?
Day Six continued....

Once you have completed your new page, scan it or take a photo and share it with your friends on the discussion forum.

CLICK HERE to go to the discussion board in your Blackboard classroom and add your modified story to the forum titled, "My New Possum Magic Story".

Check out your friends stories. Did anyone choose to change the same page as you? Reply to them and tell them what you think of theirs.

CLICK HERE to go to the discussion forum titled, "My Possum Magic Graphs" and let everyone know about what you have learnt about using different kinds of graphs.

What kind of graph did you find easiest to read and understand?

Why do you think it is better than another one?

In your possum magic workbook you will find a dice and spinner template to cut out and put together for use in your game.

CLICK HERE to open the program that lets you create a spinner online for you to use in your board game.

Complete the handwriting task on pages 10 and 11 in your Handwriting Book.

Try your best at writing the 'ar' words by yourself first and then ask your home tutor to check it for you and help you out if you had trouble spelling or correctly forming your letters.
Home Tutor Guide - **DAY SIX**

**Materials for today**
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil

**Outcomes**
- English Speaking and Listening CU2.1; OP2.1; Writing and Shaping 2.3

**Reading and speaking**
Read the story along with your student and discuss possible changes to one part of the story. In your Possum Magic workbook, you will find the “My New Possum Magic Story” page. Encourage your student to change one page in the story. Possible suggestions could be, the place that Grandma Poss and Hush visit and the kind of food that makes Hush visible. Maybe your student could come up with a different way to get around Australia. Your student will need to hand write the text as well as illustrate their new part of the story. Once your student has finished their new part of the story, scan it or take a digital photograph and share it with the rest of the class on the discussion forum titled, “My New Possum Magic Story”. Allow your student time to look at other people’s new stories and respond to them.

**Interviews and surveys**
Your student will find a food survey sheet in their possum magic workbook. They will need to learn about doing a survey and getting information from it much like the tallying and graph activities completed earlier in the unit. Encourage your student to interview people (even family members over the phone if necessary) and ask them which foods from the story is their favourite. Remind your student about how they have recorded information before, note taking and tallying because they will need to transfer that information into a graph later on.

**Better understanding of graphs**
Allow your student time to explore the online games to help them better understand graphs and reading information from graphs using the websites on the Possum Magic online unit. Encourage your student to explain what graphs are and give examples of types of graphs in their own words. Once your student demonstrates they have a good understanding of graphs and their purpose, allow them time to go to the discussion forum titled, “My Possum Magic Graphs” and let everyone know what they have learnt while using graphs.

**Words with ‘ar’ sounds**
Bring to your student’s attention the fact that many of the words, chart, bar and graph have something in common. They all have the ‘ar’ sound in them yet do not have ‘ar’ in their spelling. Spend 5 minutes, brainstorming other familiar words that have the ‘ar’ sound in them. Allow your student time to play through the online spelling games that will assist them with spelling and differentiating between words that have ‘ar’ in the spelling and words that have ‘ar’ sounds in them. After they have played through the games independently for no more than 15 minutes, ask them to tell you 5 ‘ar’ words that they explored.

**Handwriting - ‘ar’ words**
While practicing handwriting, your student will also learn new spelling words. Complete the handwriting and spelling tasks in the handwriting book on pages 10 and 11.

**Interactive stories and ‘ar’ words**
Allow your student time to independently watch, listen and play through the interactive stories online. Encourage them to take notice of the ‘ar’ words in the stories. Once they have read through the stories, print out the text to the stories (you will find the option for this beside the story on the screen) and circle all the ‘ar’ words they can find. Your student will then need to use the printout of the ‘Wishing Upon A Star’ story to graph the number of times the following words appear in the story. CARD CARDS PARTY DIWALI AFTERNOON
They will need to choose which of the two style of graphs (links to simple or bright and fancy graphs online in the Possum Magic online unit) to record their data about the ‘ar’ words in. Encourage your student to talk to you about the type of graph they choose and why they chose that one.
TODAY'S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson and talk about all the fantastic places you have seen or will see on your virtual tour.

Your teacher and your friends will share stories about places they have been around Australia and what they thought about it.

You will also discuss a very unique and special place in Australia - where you live. Think about what makes it unique and why people might like to come and visit the place where you live.

Do you have plants and animals that are unique to where you live? If you have, find out some information about them to share. What kind of environment do they live in? Water? Bush? Underground?

Read through the book page by page with the sound.
Filename: PMPosWithSound.dnl (Pictures with sound)
Take notice of the places in Australia that Grandma Poss and Hush visit to get food to make Hush visible.

Where did Grandma Poss go to get the people food?

RIGHT CLICK HERE to save a map of Australia to your computer. Open the map in your Paint program. Use the paint brush tool to draw show the way that Grandma Poss and Hush travelled around Australia. Write in the names of the cities they visited.

CLICK HERE to see a map of Australia which might help you with some of the spelling of the cities. Ask your home tutor to tell you about places they have been in Australia and what they saw when they were there.

CLICK HERE to send your map in an email to your teacher.

Take a virtual tour around each state in Australia for yourself and see all the exciting places. Maybe your home tutor has visited some of these places. Chat to them about it.

Australia has a very unique environment. Imagine all the sites that Grandpa Poss and Hush saw along the way.

Queensland
News South Wales
Victoria
Australian Capital Territory
South Australia
Tasmania
Western Australia
Northern Territory

Complete the handwriting task on pages 2 and 3 in your Handwriting Book about something that is very unique to the Australian bush.

Read the sentence out loud to your home tutor and draw a picture to go with the sentence.

CLICK HERE to go to the discussion board in your Blackboard classroom and share 5 reasons why your place in Australia is so special on the discussion forum titled, "My Special Place In Australia".

Check out your friends stories. Reply to them and ask questions if you'd like to know more about their unique part of Australia.

If you have some photographs about your special place in Australia, attach them to your message.
Complete the handwriting task on page 13 in your Handwriting Book about the cities that Grandma Poss and Hush visited. Look carefully at the shape of the letters as clues to help you with spelling and neat handwriting.

Read the sentences out loud to your home tutor.
Home Tutor Guide - **DAY SEVEN**

**Materials for today**
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil

**Outcomes**: SOSE - Place and Space PS2.4

**Reading, listening, and speaking**
Read the story along with your student and discuss the places around Australia that Grandma Poss and Hush visit. Write down the names of the places in the order they appear in the story. Right click and 'save target as' to save and then open the blank map of Australia in your Paint program. You will find the Paint program in **START > ALL PROGRAMS > ACCESSORIES > PAINT**. Your student should use a different colour to show each step of Grandma Poss and Hush’s travels. They will need to use the text tool to type the names of the cities as well. You can use the online map to assist you with helping your student to know where these cities are in Australia. Encourage your student to find them first with clues, guidance and information from you.

**Virtual tour around Australia**
Allow your student some time to explore the virtual tour of each state. Share your experiences and knowledge of places you may have been or have read about or seen on television. Encourage your student to read the captions attached to the photographs and discuss what the weather, lifestyle and people might be like who live in the different places. Encourage as many describing words as you can for environments such as... rocky, mountainous, wet, bushland, rugged, desert, dry and cliffside. Make sure the students are aware of major landmarks, names of capital cities for each state and enjoy the trip!

**What makes Australia special**
During the telephone lesson the teacher, home tutors and students will share stories about places they have been around Australia and what they thought about it. You will also discuss a very unique and special place in Australia - *where you live*. Think about what makes it unique and why people might like to come and visit the place where you live. Before the lesson, discuss any unique features about your special place in Australia so that they are able to share with the group.

**Discussion Board - My Special Place In Australia**
Allow your student time to go to the discussion forum titled, “My Special Place In Australia” and share 5 reasons why your place in Australia is special and why people would want to come and see it... If you have digital photographs, attach them to the message.

**Handwriting - gum trees**
Gum trees are very unique to Australia, encourage your student to complete the sentence in their best handwriting with their feet flat on the floor and their back up nice and straight. If you have a gum tree in your yard, you might like to do a leaf rubbing or stick them in the picture section of pages 2 and 3 of your handwriting book.
DAY EIGHT - The Game Begins

TODAY'S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson to imagine what it would be like to play a game with such fantastic characters.

You will work as a group to design and create a board game you can all play. You can create question cards and video question cards using your digital video camera.

Make sure you type the answers below the questions in your Word template. Format the answers in a different font to the questions so that it is easy to tell the difference.

Don’t forget to save it!

It is time to create some question cards for the game.
You should have your topic given to you by your teacher during the telephone lesson.

RIGHT CLICK HERE to save the question card template in Microsoft Word and type your five questions using information you have learnt during this unit.

Use the information on the websites, your Possum Magic Workbook, recipes, graphs or handwriting book to help you type up your question and answer cards. You may even need to check out the discussion boards to find information.

If you have a digital video camera, you will need to record your 2 video question and answer cards.
Use your best speaking voice so that the players will be able to hear every word you say. When you are recording, ask your question, then silently count to five (which gives the player time to answer) and then say the answer.

The board game has some symbols on it for specific tasks in the game.
+ means ‘a good thing happened to a character, move ahead 3 spaces’.
- means ‘a bad thing happened to a character in the story, go back 3 spaces’
You will need to come up with 2 positive things that happened in the story and write them on the +spaces and then think of 2 negative things that happened in the story and write them on the -spaces.
You will also see spaces where you have to pick up a question card if you land on it or spaces where you have to click to open a video question card if you land on it.

Take a photograph of your game board so far so that everyone can see what it looks like.

CLICK HERE to share your board game photograph with your friends in the discussion forum titled, “Possum Magic Board Game”.
Check out how fantastic they all are and let people know what you think of theirs.

Bring your ideas and imagination to this telephone lesson and be ready to work as a group to create something fantastic you can play with your family.

CLICK HERE to email your questions and answers to your friends and they will send theirs to you. Save your friends’ questions to your computer. You will need them tomorrow.

This task could take a while to type up if you haven’t been practicing your keyboarding skills. Have you been practicing?
Day Eight continued....

Listen to the story without the pictures.
Filename: PMSoundWithoutPloc.wma
(Sound with no pictures)

Lay down or sit quietly with your eyes closed and imagine the characters in the story. Imagine Grandma Poss and Hush and all their adventures around Australia.

CLICK HERE to spend 10 minutes practicing your keyboarding using Dance Mat Typing. This will help you to become more confident on the computer keyboard so that you can get work finished more quickly and go outside to play.

In your Possum Magic Workbook, you will find an A3 size board game template. You will see it in the shape of Australia. What kind of artwork could you add to the board game to make it look like it is Australian made and Australian owned?

Maybe some of the graphics you add, could be Australian animals or Australian environments or parts of nature.
You could draw, paint or collage your game board artwork.

Chat about your plans with your home tutor and plan what you would like to do before you start.
Home Tutor Guide - **DAY EIGHT**

**Materials for today**
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil
- Scissors

**Outcomes:**  English Speaking and Listening CU2.1; OP2.1; Writing and Shaping 2.3

**Listening**
Allow your student time and space to lay down and close their eyes and listen to the story (without pictures) and imagine the characters and their adventures.

**The game begins**
During the telephone lesson the teacher will discuss the possibility of combining all the facts and information the students have gathered about Possum Magic, Australia and Australian animals into a board game that they collaboratively work on and design. Each student will be given a topic to focus on for their contribution to the group board game. The students will need to draw on information from the Possum Magic workbook, handwriting book, discussion forums and internet sites they have visited to gather information they need. The teacher will also give you instructions and guidance to designing the board game using the A3 board game template in the Possum Magic workbook.

**Make a set of question cards**
In the Possum Magic online unit materials, you will be able to right click and ‘save target as’ on the link to download the question card template. Your student will need to decide on and type up their question and answer cards. There is a sample card for them to see and they are encouraged to use a different font for the question and answers on each card. Don’t forget to remind your student to save the question cards as they work on them. Your student will need to attach their question card template to an email to each student in the class so that you end up with 5 question cards from each person in the class.

**Video question cards**
If you have a video camera that you student is able to use, allow them to create video question cards. Encourage them to use their best speaking voice so that the players are able to hear every word clearly. After videoing the question, get your student to stand and count to five in their mind and then say the answer. This will give the player time to answer during the game. The video files may be large, so you will need to drop them into the digital drop in Blackboard. Instruction for doing this are on the “Tips and Tricks” page of this home tutor guide.

**Tors to get around**
Each player will need a tor to get around the board. Your student will need to collect 4 natural objects from their special place in Australia to use as tors. Encourage your student to keep the tors 2cm or less in size.

**The board**
Bring to your students attention that on the board game template (found in the Possum Magic workbook), there are two (+) symbols and two (-) symbols. This is where your student will need to recall two good incidences that happened in the story and two bad incidences that happened in the story. They will need to write the four incidences in their appropriate places in the form of an instruction. For example, a good incidence could be, “Hush discovered that a vegemite sandwich made his tail visible. Go ahead 3 spaces”. A good incidence will instruct the player who lands on it to go ahead 3 spaces and a bad incidence will instruct the player to go back 3 spaces. The student will also need to consider where they would like to start and finish. They will also need to choose 3 spaces on the board where a question card will need to be picked up and 2 spaces where a video question card can be picked up. Encourage your student to design a picture or icon that shows the player that lands on it, what the instruction is.

**Decorate the board**
Encourage your students to use Australian related images or objects to decorate the board game. They may choose to use pencils, crayons, felt pens, natural collage materials or paint. Once the board has been designed and tors found, take a photograph and share it on the discussion forum titled, “Possum Magic Board game”. Allow your student to look another people’s board games and respond to them.
### DAY NINE - Testing The Game

#### TODAY'S TELEPHONE LESSON FOCUS

You will work as a class on the telephone lesson to make sure you have all the items you need for your board game.

Let your teacher know if you have not received any question cards from friends in your email or if you are having problems with any part of your board game design.

Tell your teacher which good and bad things in the story you came up with for your board game for the 'go ahead' and 'go back' spaces.

Your teacher will also email you the website hyperlink that will have your video questions from everyone on it so that you can use them in your game.

You will also talk about how you are going to get around the game? There are some online spinners and dice you could use. Your teacher will email you about them to check out before the lesson.

You will discuss any other things you need to complete your game.

<table>
<thead>
<tr>
<th>Have you...</th>
<th>Test out your game!</th>
<th>Complete the handwriting task on page 15 in your Handwriting Book but instead of writing what you think 'True Blue' means, write 4 things the players had to say about your board game.</th>
<th>Take a photograph of you and your family playing the game.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished the artwork on your board game?</td>
<td></td>
<td>Ask people in your family to come and play your Possum Magic board game with you.</td>
<td>Try writing by yourself and then show your home tutor and they will help you if you have trouble forming some of your letters and help you with your spelling.</td>
</tr>
<tr>
<td>Designed the pictures to go on the board to show spaces where card and video questions will be picked up?</td>
<td>Explain the rules to them, make sure you have the internet on and away you go!</td>
<td>Explain the rules to them, make sure you have the internet on and away you go!</td>
<td></td>
</tr>
<tr>
<td>Written the positive and negative things that happened in the story for the 'go ahead' or 'go back' spaces on the board.</td>
<td>Send your teacher an email and let them know how it went.</td>
<td>Send your teacher an email and let them know how it went.</td>
<td></td>
</tr>
<tr>
<td>Printed, cut out and stacked all the question cards you and your friends wrote.</td>
<td>Did everything work?</td>
<td>Did everything work?</td>
<td></td>
</tr>
<tr>
<td>Added the video question card website to your FAVOURITES in Internet Explorer.</td>
<td>Who won?</td>
<td>Who won?</td>
<td></td>
</tr>
</tbody>
</table>

**CLICK HERE** to send an email to your teacher and your friends and tell them about how it went.
Home Tutor Guide - **DAY NINE**

Materials for today
- Access to Blackboard (with username and password)
- Possum Magic Workbook
- Handwriting book
- Sharp pencil
- Digital camera

**Outcomes:** English  Speaking and Listening CR2.1; OP2.1; Writing and Shaping 2.3

**Finishing the game**
Today is the day to complete all the tasks from the previous days and make sure your student has received all other student's question cards, completed their board games, collected tors and received the link to the video question cards from their teacher. Allow your student time to check their Possum Magic workbook as well as your handwriting book and make sure that all tasks are completed and they are ready to send to the teacher either by scanning and attaching to an email or sending through the post.

**Game review**
Once the game is complete, your student will need to test it with family members and get four comments about their game and write them as a review on page 15 of their handwriting book.

**Photograph of your family playing**
Take a photograph of your student with their completed game being played by members of their family and email it to the teacher and classmates and tell them how it went.
DAY TEN - Feedback and Free Choice

Home Tutor & Student Feedback

If you have finished all your tasks from days 1 to 9 and you feedback, here are some fun games, information websites and stories about Possum Magic and things that are unique to Australia.

Home Tutor Guide - DAY TEN

After you and your student have completed the feedback about this unit, there are some stories, games and exciting websites to find out more about Australia, Australian animals and the story, Possum Magic.
Tips and Tricks....

Blackboard - This is an online classroom that is accessed through the student gateway on the Cairns School of Distance Education website. Blackboard is password protected so that students can share their work, photographs and information between each other without concerns about strangers from the internet looking on. It is the space where all the unit tasks, information and resources will be kept. Your student will need a username and password to access this. Please contact your teacher if you have lost or forgotten your username and password. Blackboard also contains an email facility for students to easily contact their teacher and classmates.

Learning Objects - These are interactive short videos, animations or games that you work or play your way through to help you to better understand a particular topic, subject or skill. You will find the learning objects you need throughout the year on the two LTPjuniorCD in a folder named, “Learning Objects”. The list of learning objects will open up in an internet browser so it will look like you are on the internet but you don’t have to be. The browser will be getting all the information from the CD, so make sure the CD is in your CD drive while using the learning objects. You will need to make sure you have Macromedia Flash and Shockwave plugins running on your computer. These plugins allow all the animation, sound and fantastic graphics to be viewed as they are meant to. You will find the Flash and Shockwave plugins on the LTPjuniorCD in the ‘Programs’ folder. Depending on your browser settings, you may need to ‘allow blocked content’ once you have started a learning object.

Inspiration - You can install the Inspiration program from the LTPjuniorCD, make sure you take your time and read the instructions carefully and be certain it is being installed into the correct place on your computer. Make sure you read the licensing agreements and understand the terms and conditions the developers have put on their software. You will need a serial number to install Inspiration. You will find this in a Microsoft Word document in the ‘Programs’ folder. The document is named, ‘Passwords’. After you create your inspiration document, you will need to export it as a JPG (picture file). You do this by going to FILE > EXPORT > JPG > SAVE and save the jpg to your student’s folder.

Handwriting book - This is the book that comes with the unit specifically for handwriting practice. Students will need to keep this available for daily handwriting and it will need to be returned to the teacher at the end of the unit. It is good to remind the students about good handwriting posture before they start handwriting.

1 2 3 4 feet flat on the floor, 5 6 7 8 back up nice and straight.

Keyboarding practice - It is important that students be given the opportunity to spend 10 minutes each day working on their keyboarding skills. Students are able to use the online Dance Mat Typing or Typing Tournament if you have it on CD and installed on your computer. It is good to remind the students about good computing posture before they start work on the computer.

1 2 3 4 feet flat on the floor, 5 6 7 8 back up nice and straight.

Taking A Screenshot - If you need to take a screenshot of something to send to the teacher for assessment, you can do this by holding the SHIFT key and PRT SCR on your keyboard. (You will find the PRT SCR beside the F12 key at the top of the keyboard.) Once you have done that, open Microsoft Word and click on EDIT then PASTE. This will give you a copy of your screenshot. Save the word document to your computer so that you can email it or attach it to the discussion board if you need to.
Reading, watching and listening to the story, Possum Magic - There are 3 versions of the story in this unit. You will find them on the Possum Magic Resources CD. You can view them anytime from the CD. This will save you time downloading them. If you choose to download them, you need only do it once. Once you have downloaded the files and saved them to your student's folder on your computer, you need not ever do it again. Version 1 and version 2 require DNL reader to view them. You will find a link to download the reader on day one of the online unit or on the CD. Once you have downloaded and installed the reader onto your computer once, you need never do it again.

1) Version 1 - Story with pictures and sound  *Filename: PMPicsWithSound.dnl*
2) Version 2 - Story without sound  *Filename: PMPicsWithoutSound.dnl*
3) Version 3 - Story being read without pictures. *Filename: PMSoundWithoutPics.wma*
Campbell Primary School

Campbell Primary School is in Canning Vale, an outer southern suburb of Perth, an area of rapid urban development and high growth. There are 22 nationalities represented in the school’s enrolment of 880 students across years K to 7, with quite a number from Malaysia and Singapore. Although only five to eight per cent of the students are officially deemed to be from non-English-speaking backgrounds, as many as 30 per cent of students use a language other than English at home and in other social settings. The school is ranked in the second highest of seven socioeconomic categories applied to Western Australian government schools.

The school draws on a population of predominantly white-collar professionals, who live in ‘big houses on big blocks’. In many families both parents are out at work. The parents and the community generally prefer low levels of involvement in the school’s decision-making processes but are keenly involved in other school activities.

The school has a staff of 75, which includes a number of assistants for supporting students for whom English is a second language, those with disabilities and those with other special needs.

The school is in its fifth year of operation. From the beginning, the parent body has supported a strong ICT presence in the education of their children. It remains a pivotal issue in school development.

The school has wireless Internet and intranet connection, four electronic whiteboards, seven sets of six laptops and two larger portable labs consisting of 16 notebooks. Elsewhere in the school there are 30 workstations for students. The school has technical support for two hours per week. Under a leasing arrangement, all teachers own their own laptops. Students can access the school site from home, where the vast majority have a computer. The school’s newsletter is circulated online. Each class has a home page on the school’s intranet.

Use of the school’s intranet evolved from presenting collections of photos (‘entertaining’) to seeking the best educational value from it. Now the pages present plenty of learning activities. Electronic student portfolios are also available on the intranet so that parents are able to view them at home.

One of the school’s three deputy principals has designated responsibility for the management of ICT, including the provision of guidance and support for teachers (see the school’s policy related to ICT at the end of this report), the other two having responsibility for curriculum, and for students with special needs. Su Goddard, the school’s first appointment to deputy principal (ICT), and who subsequently has worked as a consultant, joined Jenn Allsop, who currently occupies the ICT position and Peter Glendenning, the school’s principal, in a discussion of how the use of ICT had evolved at Campbell.

They referred to the stated wishes of the parents (see above) as one of the forces that encouraged the school to place emphasis on ICT in the curriculum; but noted that these wishes were well aligned with the goals of the school leadership team. An early decision of the committee set up to pursue the ICT initiative was to have a member of the leadership team designated responsibility for the school’s ICT development, a move designed to make sure that teachers would receive appropriate support and guidance and
that decisions regarding hardware and software would properly reflect the school’s strong emphasis on collaborative and cooperative learning.

In junior primary for example, we provide fixed settings because experience has shown us that that is an effective form of hardware provision. But we have laptops for the older students. Our question is always, ‘How can this tool support our teaching?’ and we adjust the infrastructure accordingly.

A considerable turnover in staff has highlighted the need for ongoing professional development related to ICT. The school has found the most effective form of professional learning for ICT to be that of staff working alongside colleagues in their classrooms. Also effective are the ‘cyber cafes’ where teachers talk to each other about their ICT experiences.

Use of TLF’s learning objects

We were able to watch two classes at work. The first was a year 4 class of 31 students of widely ranging abilities, including several with special needs, who were immersed in their work. Using laptops mainly in pairs, they were engaged in a wide variety of activities based on the use of three different types of learning objects, all leading to their creating a magazine about a pop star. Preliminary tasks included conducting research about their chosen figure, creating relevant text (including advertisements), collecting pictorial and graphic images, and making posters to advertise their product. A wide range of media was in use, including TLF’s learning objects ‘Wacky-oke song quest’, ‘Popstar puzzle’ and ‘Celebrity garbage’.

We also saw a years 1–2 class using, via an interactive whiteboard, TLF’s learning object ‘Night of the bilby’, which incorporates a game relating to animal habitats. Teacher Denise Milliken generated many learning possibilities from the learning object, seeking students’ ideas about the meaning of ‘habitat’ and ‘grid’ (to which the students responded rapidly and accurately), talking about the notions of ‘more’ and ‘less’ in relation to the weight of food, and discussing the various functions and symbols employed in the game.

As a class group the students investigated the logic associated with determining the level of threat to the bilby, and discussed ways in which the survival of the bilby might be encouraged. The inclusion of some counting and number activities in no way interrupted the flow of activity or students’ engagement in playing the game. It was a first-rate example of how to optimise use of a learning object in a whole-class situation. The students then went back to their desks to create their own ‘Bilby’ games. These dice-based counting games had problem and reward squares designed by the students themselves.

Denise constructs the content of her classes via suggestions from students about their interests, which she then integrates into a unit of study. The class had recently completed a unit on ‘Pirates’ in which they had considered questions such as how they might bury their treasure, how to navigate their way, and alternative destinations. Students’ work arising from that unit of study lined the walls, along with dozens of other pieces of student work. Denise said:

I’m not really a technical person. I use the learning objects when they [can] effectively tie in to our theme. They just add to the range of resources that the [students] can learn from. They find [the learning objects] totally engrossing, and I know they use them at home. They can access the ones
we are using in class through their class home page. I treat them the same as any other resource. It’s just the same. I don’t find preparing to use them more time-consuming than preparing to use any other resource. And, of course, as I’m getting to know them better it becomes quicker and easier.

I sometimes use them as a stimulus when we are beginning a topic or a theme. We can play the game together and I can talk about the ideas and spin-offs that come out of that. I have had a lot of value from ‘Let’s make a movie’ and ‘Picture this’. They’ve been a helpful prompt to talk about things like titles, background characters and editing. In terms of usage the [interactive] whiteboard is important at this level. We can share control of what’s happening and all be in it together. No-one gets left behind.

This report concludes with Campbell Primary School’s statement of its policy on Information and Communications Technology.
Related overarching statements

1. Students use language to understand, develop and communicate ideas and information and interact with others.
2. Students recognise when and what information is needed, locate and obtain it from a range of sources and evaluate, use and share it with others.
3. Students select, use and adapt technologies.
4. Students interact with people and cultures other than their own and are equipped to contribute to the global community.
5. Students are self-motivated and confident in their approach to learning & are able to work individually and collaboratively.

Values

1. A pursuit of knowledge and a commitment to achievement of potential
2. Respect and concern for others and their rights
3. Social and civic responsibility

Learning areas

Outcomes from all eight learning areas will be addressed.

Principles of learning, teaching and assessment

Principles relating to opportunity to learn, connection and challenge, action and reflection, supportive environment, motivation and purpose, inclusivity and difference, independence and collaboration will serve as guidelines for learning and teaching. Assessment will measure skill development within learning area tasks and be valid, educative, explicit, fair and comprehensive.

Audience

Internet use will be available for students in years K–7 with teacher assistance/supervision.

Key principles/background

The program for the integration of information and communications technology at Campbell Primary School will support key Department of Education goals and initiatives in working to ensure:

- All students will leave school as ‘confident, creative and productive users of new technologies, including ICTs, and understand the impact of those technologies in society’.
• All teachers will seek to integrate ICT into their operations to improve student learning, to offer flexible learning opportunities and to improve the efficiency of their business practices.

**Strategic summary**

• Strategies in place will support the seamless integration of ICT across the learning areas when the use of technology has the potential to improve learning opportunities. These include:

  • The appointment of an Assistant Principal with responsibility for the management of ICT, including the provision of guidance and support for teachers.
  • Access to hardware and software to promote effective and relevant integration of ICT in the learning and teaching program across the curriculum at the time of need.
  • Effective infrastructure to facilitate efficient online access, together with a switched network linked by optic fibre and wireless technology to allow ‘anywhere/anytime’ access to technology.
  • The provision of training and opportunities for collaboration to ensure teachers develop needed confidence and skills.
  • Promotion of teacher involvement in the Department’s Notebooks for Teachers project.
  • The development of a comprehensive intranet and Internet site ensuring effective use of the Internet as an information, communication and publishing tool.
  • The development of a comprehensive library database (Amlib Library System) accessible online throughout the school site and holding information resources both in book form and online.
  • Effective communication with parents and the wider community to ensure they develop an understanding of ICT in learning and teaching and can make valued contributions to planning and implementation.

**Criteria for assessment**

The level of success in the achievement of outcomes will be determined by the extent to which students:

• Develop confidence and skill in the use of ICT as a tool for learning, problem solving and communicating
• Explore the use of ICT to locate, analyse, present and communicate information to create knowledge and insight
• Develop an interest in the use of technologies in all areas of the curriculum.

For teachers success may be measured by the extent to which they:

• Develop confidence and skill in the use of ICT to enhance their teaching.

**Links/related documents**

Internet Usage – Policy and Guidelines (Education Department of WA 1996)
Network Security Guidelines for Schools and District Offices
Fitzroy Crossing District High School

Fitzroy Crossing is a remote town in the Kimberley on Highway 1, about 500 kilometres due east of Broome. The town itself has a population of about 1,300 but provides services, including education, to a significant number of small communities within a radius of about 100 kilometres. The regional population is about 2,500.

The town of Fitzroy Crossing, located on Bunuba land, caters for a variety of language groups, including Walmajari, Wangkajunga and Gooniyandi. Some commercial enterprises in the town, including a widely renowned art gallery, a supermarket and a roadhouse, are owned by various surrounding communities in which these language groups are used.

Fitzroy Crossing District High School enrolls students from pre-primary to senior secondary years, many of whom travel to school daily by bus from 14 communities, some as distant as 110 kilometres. The students from the outlying communities, who are mostly Aboriginal people, use Kimberley Kriol as their lingua franca. At the time of our visit the school had 50 pre-primary students, 139 in the primary section of the school (years 1–7) and 72 in the secondary section (years 8–11).

Until 2000, the highest level of education the school provided was year 10. Since that time there have been small numbers of years 11 and 12 students enrolled. Western Australia’s increasing the compulsory age of schooling to 16 years has seen some modest increase in enrolments at this level. The school has developed a number of initiatives for its senior students in partnership with TAFE. Aquaculture and rural skills programs are popular with students and going very well.

A mentoring/tutoring program is provided for 16 students in years 6 to 8 who are deemed to have high potential. They take part in leadership programs and special camps.

The school participates in a number of Australian Government programs provided for Indigenous students, including the tutorial assistance scheme at years 4, 6 and 8; the Parent–School Partnerships Initiative, and the Indigenous Language Support Scheme for students with non-English-speaking backgrounds. It uses the well-regarded resources *Fostering English Language in Kimberley Schools* and its companion *Making the Jump* to support the development of skills in Standard Australian English.

The school has 26 teaching staff, who are mostly non-Indigenous, and an equal number of Aboriginal and Islander education officers.

Many of the challenges that are apparent in more remote Aboriginal schools are present at Fitzroy Crossing. A youth support officer helps to maintain attendance (about 70 per cent at the time of the visit) at reasonable levels, given that the home lives of some of the students are marked by a significant degree of turbulence. Developing facility with Standard Australian English within a group of speakers of English as a second dialect or, in some cases, a foreign language, is a continuing challenge. Few students have access to computers at home.

The school is about to begin a rebuilding program on a new site. The present buildings are subject to flooding in the wet season and some show signs of damage. The
Education brief for the rebuilding process is given at the end of this report. It includes the following:

- School staff will develop and use a broad range of teaching and learning strategies, including contemporary learning technologies.
- Students will access knowledge from a broad range of sources, including the Elders, their parents and modern technologies such as the Internet.
- All students and teachers will have adequate access to learning technologies in all rooms.

The school currently has 30 computers in the primary section, 45 in the secondary section and 17 for administration and staff use. There is an electronic interactive whiteboard in every classroom, which is networked to the school’s three servers. The school has been using the Successmaker program and has access to a number of other digital and electronic resources. Use of TLF materials was at a very early stage.

Principal Peter Scharf described the value of using ICT as an education resource for students at Fitzroy Crossing as high.

They are visual, active. It's one-on-one. You can learn independently, which means 'no shame', and [students] can measure their own success. The staff have got very involved. We have three staff who are committed [to implementation and use]. We've made a significant investment in hardware and we've had professional development for staff. A lot of that has been internal, with the more capable users helping others.

We were able to talk to two members of staff who were the most active users of ICT in their classrooms. They noted the importance of self-paced learning for their students and the value they had got from the use of interactive whiteboards.

- It works well with [our students'] visual learning style.

Trevor Hinchliffe’s class of years 5 and 6 boys use their computers for access to big books, drawing, scanning in freehand images, claymation and publishing their own work. The Garage Band software is very popular.

The kids have a reasonable level of basic skills, and they're not afraid to have a go. We use basic spelling and numeracy software. We scan questions in and write the answers together. I've converted games for use with our Smartboards [interactive whiteboards] and we share resources, things we've developed, with other schools. I find using ICT produces a higher level of engagement and involvement, and it certainly helps me with preparation. I've seen [this process] shift kids from knowledge of the alphabet to [becoming] independent readers with some support. They make their own PowerPoint presentations.

They really get into it and always want to use the computers, not just for games but for what I would call proper educational uses. They are a very good avenue for pushing literacy.

Andrew Gunnell works with older secondary students and uses digital resources extensively for teaching Science and also Studies of Society and Environment.

**Use of TLF’s learning objects**

The Le@rning Federation’s materials had only just been introduced at the school at the time of our visit. Later on, after the school had made some use of learning objects, both
students and teachers were surveyed to gauge their reactions. Below are some summaries of the students’ responses. They had been asked to rate the learning objects as of low, medium or high value in relation to three qualities, and to respond with ‘yes’ or ‘no’ in relation to whether or not the learning objects had helped them think about new ideas.

**Responses of year 9 students**

(n = 18, one incomplete response)


<table>
<thead>
<tr>
<th></th>
<th>Low value</th>
<th>Medium value</th>
<th>High value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interesting and fun</strong></td>
<td>4</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td><strong>Rating of learning object as ‘good for learning’</strong></td>
<td></td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td><strong>As ‘making you want to learn’</strong></td>
<td>1</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td><strong>Helped me think about new ideas</strong></td>
<td>No: 5</td>
<td>Yes: 12</td>
<td></td>
</tr>
</tbody>
</table>

This class had used a wide range of learning objects over a period of time. The students’ responses reflect a range of past experiences rather experience of the learning object most recently used. The negative responses appear to be linked mainly to those learning objects that they experienced as being too easy. One student, for example, stated:

> It needs harder objectives to accomplish and it needs longer levels to complete.

Positive responses included reference to enjoying the interactivity, the ability to repeat for success and the availability of feedback.

> It helps us learn at our own pace, we become more independent and we are not asking the teacher for help all the time.

The teacher was enthusiastic about the impact and indicated he would pursue further use. He noted that there were some students who preferred the comparative regularity and predictability of Successmaker material.
**Year 9 students**

(n = 12, two incomplete responses)

At the time of the survey these students had used ‘Multiplication and division’, ‘Gold rush’ and ‘Photo hunt’

<table>
<thead>
<tr>
<th></th>
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<td>7</td>
</tr>
<tr>
<td>Rating of learning object as ‘good for learning’</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>As ‘making you want to learn’</td>
<td>1</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Helped me think about new ideas</td>
<td>No: 3</td>
<td>Yes: 7</td>
<td></td>
</tr>
</tbody>
</table>

In this group there was one resolute doubter:

> It’s not helpful and doesn’t explain the activity properly.

and five unqualified enthusiasts:

> Good stuff mate.

> It provides a lot of information for my learning.

The teacher was somewhat underwhelmed and rated the results of using this learning object towards the middle or negative ends of the scales offered, commenting:

> It is a good start, but there needs to be a way by which teachers can collect data. Also there should be a way to give appropriate content.

**Years 6–7 students**

(n = 7, two incomplete responses)

At the time of the survey these students had used ‘Catch a thief’.

<table>
<thead>
<tr>
<th></th>
<th>Low value</th>
<th>Medium value</th>
<th>High value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interesting and fun</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Rating of learning object as ‘good for learning’</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>As ‘making you want to learn’</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Helped me think about new ideas</td>
<td>No: 0</td>
<td>Yes: 7</td>
<td></td>
</tr>
</tbody>
</table>
This learning object was used as ‘shared reading’ activity during the two-hour block devoted each day to the development of literacy. The teacher, Tom Richards, remembers the event as having been very lively and enjoyed by all. In his survey he notes good increases in motivation and significant gains in persistence, enjoyment and collaboration while using the learning object, noting:

Great – the more resources like this the better.

He commented, however, that some students had found it difficult to complete the questionnaire.

**Years 5 and 6 students**

(n = 8, one incomplete response)

At the time of the survey these students had used ‘Selling soft drinks’ and its two variants.

<table>
<thead>
<tr>
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<th>Low value</th>
<th>Medium value</th>
<th>High value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interesting and fun</strong></td>
<td>1</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Rating of learning object as ‘good for learning’</strong></td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td><strong>As ‘making you want to learn’</strong></td>
<td></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Helped me think about new ideas</strong></td>
<td>No: 0</td>
<td>Yes: 8</td>
<td></td>
</tr>
</tbody>
</table>

These learning objects had been used in the context of making advertisements for claymations that students were close to completing. ‘Selling soft drinks’ was completed, and had been very much enjoyed by the students; and on completion they were making notes of ideas for making their own advertisements. This process took several days during which time students were still reflecting on what they had learnt from using the learning object. Their teacher commented:

Being able to hear the spoken word is a great support for students with low literacy levels. And it’s step by step, simple and clear. Another thing I liked was that it wouldn’t let you go on until you’d got the right answer. That’s a great thing for our kids. I can see why I should get on the bandwagon.

The majority of the students in this class obviously enjoyed the use of this learning object and felt it to be of value. They stated, for example:

It was fun jumping on the computer and it was fun having a go at the work.

In his survey response, their teacher noted the high value of the learning objects in terms of students’ motivation, persistence, enjoyment and collaboration; and good value in terms of independent learning. He commented:

It was clear to use, and provides clear concepts and processes for the students to follow.

The results of the survey indicate the positive way in which students at Fitzroy Crossing perceive the value of TLF’s learning objects. It is important to allow further time for
teachers to become more familiar with the learning objects themselves and the ways in which they might be used in class before any conclusion is reached regarding the value of the learning objects for Fitzroy Crossing District High School, but the data certainly suggest the desirability of such further acquaintance.

This report concludes with appending the Education brief for the new Fitzroy Valley Learning Centre.
Fitzroy Valley Learning Centre: Education brief for new site and buildings

**Ethos of a learning centre**

The school fosters an environment that reflects the learning and training and social needs of Aboriginal communities in the Fitzroy Valley while maintaining integrity with the directions of education as set by State and Commonwealth authorities.

To achieve these goals, the school has wide-ranging processes to work together with Aboriginal parents and communities in decisions regarding school activities and learning projects, as well as developing unique social and business links with the various corporations in the Fitzroy Valley.

Mindful of the legislated requirements of the school’s structure, the school community consistently reviews its practices and reflects upon student achievement to maximise all learning opportunities.

**Pedagogy**

Acknowledging that our pedagogy is student-centred, the *school staff* will:

- Develop strong and meaningful relationships with their students through cultural awareness programs and frequent community interaction with the school using two-way structures both on- and off-site
- Have a deep knowledge and understanding of their students’ culture and historical context with the use of displays that are interactive and welcoming throughout the school
- Work collaboratively to deliver learning activities that are across the curriculum within the developmental phases and planning areas. This is also reflected in common use of facilities across and within developmental phases. There is also a requirement for discrete areas for various staff including the AIEOs and students’ services
- Develop and use a broad range of teaching and learning strategies, including contemporary learning technologies
- Endeavour to provide meaningful cultural understandings in their lessons and, with the help of community and AIEOs, support community initiatives in this area
- Where possible, the school will provide support for development and implementation of language- and culture-based programs. This will involve collaboration with Kimberley Aboriginal Language and Culture Centre (KALACC) and the Kimberley Language Resource Centre (KLRC).

In their turn, *students* will:

- Be active and reflective in their learning process
- Develop independence in their learning
- Learn from and with their peers
- Access knowledge from a broad range of sources, including the Elders, their parents and modern technologies such as the Internet.
With the knowledge that schools are unique partnerships between students, parents (and community) and the teachers, parents will:

- Be actively engaged in decision making for best outcomes for students and the community
- Ensure and assist their children in maintaining high levels of attendance
- Provide the school with relevant information with regard to cultural awareness
- Assist the school in providing significant cultural opportunities such as NAIDOC and language programs.

Curriculum

The school offers a broad curriculum with primary focus on literacy and numeracy. However, we are mindful of the special needs of the community as expressed through various consultative groups and the school meets these needs through flexible and dynamic programs. These include language programs, rural skills programs and aquaculture. For the future, childcare, child health, crèches and other community and health services will be master planned.

The school is sensitive to the needs of all students and has an inclusive policy. This extends from those students with identified special needs through to dealing with cultural matters (particularly funerals and family deaths). There are also transition programs to facilitate movement of students from kindergarten to pre-primary and similarly for pre-primary to year 1. We are also mindful of the needs of students who come from contributing schools such as Bayulu and Muludja.

The curriculum is developed from quality data from teachers and system analysis. Using these data, the school develops programs to suit group and individual needs. This enables all students to maximise their learning opportunities and to develop self-worth and self-esteem.

School organisation and structure

Driven by system guidelines and policy, the school will be inclusive of all language groups and needs of students. The allocation of human, physical and financial resources will reflect identified needs from school planning. The school needs to be a place that welcomes parents and the community through mindful design of buildings and grounds.

The physical learning environment

The design of all rooms should reflect the principles of sustainability and energy management. Access to outdoor garden areas adjacent to rooms is seen as an essential element of design in providing a calming atmosphere and influence. Students need to have ready access to ablutions and wet areas and will require secure and safe storage areas for their work and personal possessions.

Rooms will be fitted with sound systems to enhance teachers’ voices to assist in overcoming difficulties in hearing, commonly experienced by Aboriginal students.

All students and teachers will have adequate access to learning technologies in all rooms. Small play areas suited to student developmental phases will be provided.
Mindful of student and staff safety and well-being, and the high cost of school maintenance, security must be provided that is tasteful and appropriate to the environment.
Woodcroft Primary School

Woodcroft Primary School, a large primary school, is located in the southern suburbs of Adelaide, 23 kilometres from the city, in an area that has been subject to very rapid housing development over the past decade. The school, which opened in 1992, now has an enrolment of 920 students across years R to 7. The area has fairly thin public infrastructure. Limited public transport makes for difficulties in school access for some students. Shopping and government agencies are located elsewhere.

The parents whose children attend the school are described as comparatively young, reasonably well off given their double incomes, but often with large mortgages that are serviced by working very hard. Parents’ involvement in the school’s day-to-day activities is limited, but they are interested in the school’s events, whether sport, fetes, public assemblies or concerts, and in developing the use of ICT in education.

Each of the school’s classrooms has two, three or four computers networked to the digital curriculum resources stored on the library server. There is a multimedia lab with a bank of 20 computers, two sets of laptops with wireless Internet connection, 11 computers in the school’s resource centre and six interactive whiteboards that are in high demand. One distinctive aspect of the school’s infrastructure is its having a technical assistant on staff, who was described as not just capable with the technology but also as having a very good understanding of school learning processes and effective set-up for classes.

The school has 35 classes, seven of them at Reception level, with composite classes at the upper levels where the school is exploring how best to structure its middle schooling. The students are described by staff as amiable, friendly and well-behaved, a perception supported by our short experience. The school has a staff of 72, of whom 53 are teaching staff.

Principal Anne Kibble spoke about the school’s curricular focus.

I think of it as teaching the three Rs plus information technology. In years R to 3 we have a literacy and numeracy focus along with general fitness and dramatic play. In years 4 to 7 we introduce other disciplines with a thematic focus. But through all year levels we also concentrate on developing the use of ICT as learning tools. This is both necessary and unavoidable. It is the students' mode of communication. I have watched that change happening over the years.

The school has an assistant principal whose major designated role is to promote ‘learning in the digital age’. Through some creative staffing arrangements she has been timetabled to work full-time in this role, in which her major task has been to work with staff, providing them with skills and resources to embed digital teaching and learning processes across the school. She conducts professional learning sessions for staff on a weekly basis, providing resource-based learning in the resource centre. (Half the staff participates for one semester and the other half in the next semester.) These sessions have included developing relevant skills and exploring the value of various pieces of software in a topic-based or theme-based context, but more recently the focus has been on effective classroom use of interactive whiteboards. After some initial uncertainties, this experience has been marked by a rapid increase in staff interest in ICT. A number of staff now include the interactive whiteboard as a feature of the rooms they request for their lessons. A large bank of digital resources has also been developed for staff access.
The school also has a designated ‘e-teacher’, Velma Beaglehole, who is responsible for developing e-learning experiences and activities and supporting the preparation of online units of work. In 2006, six teachers had produced their own class websites.

Anne Kibble, who at the time had been the school’s principal for eighteen months, described the process of reaching this stage of development in this way.

The school received a grant from the Technology School of the Future [an independent unit of the South Australian Education Department that has responsibility for helping to develop and spread the use of ICT in South Australian government schools]. Two members of staff and the school's technical support worker became involved. A class was volunteered as a site for the research involved in the project … [At that time] the school's [well-equipped] multimedia room was not integrated into the broader teaching and learning work of the school. Technology was a ‘coming and going’ proposition. It was not a really coordinated effort [in relation to ICT]. There was no clear direction with regard to how we wanted to use technology to support learning.

The library was becoming an obvious focus. Students were using the equipment there quite heavily, and we reached maximum usage rates in quite a short space of time.

The question was: how do we move this forward? The big issue was the need to create a critical mass for change, and instead of … weaving in and out [of ICT use], to focus on it consistently and to use the dynamism that a larger interested group would bring.

We had an active group of about 12 interested parents … An ICT levy was proposed and endorsed, which enabled us to put in a large amount of hardware at the one time. Initially we bought a considerable range of new resources and ensured that there was Internet access in every classroom. Our annual budget, now around $120,000, enables us to turn over older equipment … and to purchase new equipment. We have a target of four high-quality computers in every classroom.

Our next focus was extensive professional learning for teachers, initially in teams ranging in size from 7 to 12. Soon that evolved into wider provision. We now have 25 or more turning up for every weekly session, and they are active and involved and seem to get a lot of satisfaction out of this process. To try to get around the time issue, we have ‘Smartboard lunches’ where staff members go through new ways they have found to use the [interactive whiteboards]. These are very popular.

The students were extremely receptive to this process. They all have basic skills and most use computers at home. They are the ‘natives’ of this activity. We now provide 90 minutes of instruction each week for every student in two blocks: one of half an hour and the other of one hour. Almost every class finds a way to regularly use one of our Smartboards.

It is critical that this learning – all learning actually – is interactive [and not] a passive drill-and-skill process. This is one of the most important criteria for our judgment of resources, and TLF’s learning objects meet this requirement.

**Use of TLF’s learning objects**

We visited a year 2 Japanese class conducted by Cecily Wright, one of the two teachers of Japanese, who teaches class groups for one hour a week on a rotating schedule. The Japanese language work is integrated with students’ home-class theme or topics. Cecily
had used a number of TLF’s learning objects, among them ‘Japanese kites’, ‘Vending machine’ and ‘Dressing up’. She had no doubt of their motivational quality and the responsiveness of students to them, but was uncertain about aspects of the cultural accuracy or ‘embeddedness’ of some of those she had used. She is one of the few teachers we have met in the course of the site visits who has taken the opportunity to modify the learning objects, adding games and other activities that have been part of her previous repertoire, which shows that this can be done effectively, as long as the teacher has the fairly high level of requisite skill.

The class was using ‘Dressing up’ via an interactive whiteboard, a process of putting various items of clothing suitable for particular activities on male and female students. The learning object provides an auditory cue for naming the learning object, which the students repeat. They were deeply engaged and demonstrated that some of their previous learning in Japanese had stuck. Cecily has modified this learning object by taking the sound files and the clothing images to make a matching game that has the same purpose of reiterating the learning of vocabulary.

She provided a number of written comments about her observations of this process over time.

[The learning objects] produce increased oral language proficiency. Students hear a native speaker of Japanese on the learning object and join in with speaking when the learning object is being used in a shared learning situation, for example with the interactive whiteboard.

Learning is not linear. The learning objects encourage students to ‘have a go’. Prior knowledge (or lack of it) does not make use of the learning object any less interesting.

Valuable learning takes place whether responses are correct or incorrect. The students learn language all the time from the responses heard.

The learning objects provide opportunities for students to compare the culture and language in which they live with Japanese culture and language. They can learn more about their own language (in most cases English) by comparing it with Japanese.

Students are encouraged to make cultural comparisons and question observations. For example: Are there really vending machines on railway platforms? Can you really buy hot food from vending machines? Why do the girl and the boy in the ‘Dressing up’ learning object say they will put on their shoes when they go outside? This is one reason why it is vitally important for learning objects to be culturally authentic.
Yarralumla Primary School

Yarralumla Primary School is situated near the leafy south bank of Lake Burley Griffin in Yarralumla, one of Canberra’s oldest suburbs. It is a fairly small school of 130 students, with enrolment expected to increase to 150 in 2007 when the school will be 50 years old. Because two other primary schools (Red Hill and Forrest) are close by, parents make quite clear choices when they send their children to Yarralumla. Some are attracted by the school’s website; others are seeking a local school with a strong sense of community and a family atmosphere – one that children ‘can ride their bikes to’. The size and climate of the school supports these features. It has six classes and two learning support units for students with autism. The units and their students are well integrated into the life and structures of the school, which has a vocal, active and engaged parent body.

Sue Nott, the principal, has been at the school for three years. She arrived following a period of some turbulence accompanied by a relatively high turnover of staff. Her first task was to confirm with parents her long-term involvement and interest in the school. By addressing parent concerns in a very public way, these concerns are now in the past. At two previous schools, Bonython Primary School and Lanyon High School, Sue had encouraged use of information and communication technologies; and she had been deputy principal at Aranda Primary School immediately prior to her appointment at Yarralumla. The questions she uses to guide the school’s evolution are: ‘Is this right for this school? Can we see it working in this environment for these students?’

While Sue had a clear goal of integrating ICT as tools for teaching and learning and particularly for ensuring that staff members were using ICT actively and consistently, she had not foreseen use of ICT becoming such a feature of the school. In fact, she had thought that parents might be more inclined to limit computer use at home in an effort ‘to get kids out playing’ and to take the view that ‘there’s enough ICT in the world’. Unlike many of the students at other schools visited during this study, ICT is not really a big part of students’ lives at home.

The process of incorporating ICT within the curriculum was already in train when Sue arrived, but in its early stages. Teachers were ‘intermittent’ users of ICT. Email was in regular use, along with the school’s online calendar. Teachers had computers for their own use, and while ‘rather ordinary’ computers were available for students’ classroom use, they were frequently out of commission. There were also two computer labs, but no interactive whiteboards. The hardware was used mainly for word processing and for publishing students’ work.

At that time Sue saw the school’s strengths as the strong collaborative work practices of staff and its comparatively small size. The likelihood of building an active learning community was, she thought, strong.

We started by updating our literacy and numeracy plans together, setting up two teams, one for the staff of years K–2 and of the junior learning-support unit; and the other comprising staff from the more senior years and the senior learning-support unit. After a short period, the two ‘teams’ began working together.

We work on things together, and the rate of sharing is very high. Lots of talking, lots of chatting, lots of mutual reassurance. Lots of stories about
good things that have happened and useful (and less useful) resources.
Everything is out in the open.

The increasing use and increasingly sophisticated use of the Australian Capital Territory government schools’ learning management system My Classes was another stage of development. Two of the school’s staff members received training in the use of this system. At the time of the visit, all the school’s classes had their own site, which outlined what was happening at school, the resources being used and students’ work. Class sites are accessible from home via password use. As the school’s website states:

Our aim is to provide the Yarralumla educational community (parents, children and staff) with ‘one stop’ access to current, relevant information when and where they need it to support all aspects of teaching and learning.

Hardware has been significantly upgraded. The school now has a fully integrated network with interactive whiteboards in every classroom, which students and staff use to access all forms of electronic information (office documents, scanned documents, email, Internet, encyclopedias and ‘Alice’, the library system). Every classroom also has a printer/scanner/photocopier. There are four high-quality, functioning computers in every classroom for students’ use.

It was evident from our visit and from the comments made by teachers that the interactive whiteboards have had a significant impact. The school’s website describes their use in general terms:

Interactive whiteboards are fully embedded in the teaching and learning program at Yarralumla. They are not considered an add-on to the teaching program; rather they have effected a significant change in the way teachers and students participate in teaching and learning. [Interactive whiteboards] … enhance the professional skills of teachers as they teach concepts to class groups.

Sue commented on the use of interactive whiteboards:

For them to work effectively and become embedded in practice you must have the kids driving the process. They get the hang of them very quickly and become sophisticated users. It is also important to have all the teaching staff involved, all learning together. It will happen so much more slowly otherwise. They talk together about what they are doing … It gives the whole process a boost. We can regularly introduce new software and tools.

Use of TLF’s learning objects

TLF content has been introduced to great effect:

We use a huge amount of this for various purposes. The learning object on pulleys, for example, was fantastic. It has provided information and an effective educational experience about something that teachers aren’t necessarily up to speed on. But we use others for History, Science, Health and Physical education – right across the board really. [The learning objects] have provided considerable assistance with our curriculum renewal process (an initiative current in the Australian Capital Territory) by providing such … active and engaged learning. They are very good resources for that purpose.

We saw some of this in action in a number of the classrooms at Yarralumla. One of the highlights of our visit was watching students from the junior learning-support unit work with TLF’s learning object ‘Making music’. While there are normally five boys in this class, only three were present. That morning, one boy had managed to pick out and
write in musical terms the tune of the first few bars of Beethoven’s ‘Ode to Joy’ by using this learning object and an organ in the classroom. The students were tremendously engaged with the digital materials, which are used extensively by their teacher Phil Hall. He commented on the enormous value of this sort of learning experience to his students.

They are very systematic learners, very visual, and [digital learning] offers a range of stimuli that is suitable to them – and, I suspect, to many other children – that few other media do.

The learning object ‘Playground rules’, which relates to appropriate behaviour, was well known to and understood by the boys.

The school’s position on professional learning related to ICT is stated on its website:

To improve outcomes for students it is equally important to support staff in using and integrating ICT by providing quality professional development. We do this through providing ‘just in time’ professional development within our school and access to central courses, conferences etc. This has led to improved ICT standards for teachers and a higher take-up rate of ICT use for administration and teaching and learning.

Sue herself is an obvious resource given her background and experience, but the teaching staff has had some additional learning support from the staff of the ACT’s Department of Education and Training. As well, TLF’s contact liaison officers have provided advice about and access to TLF’s catalogues; and one of the Department’s learning technologies officers has provided one-to-one coaching and advice and also access to ‘twilight modules’ of professional learning. One staff member has also been involved in Microsoft’s peer-coaching program. Staff pairing has proved an important and effective medium for learning and has contributed to the collaborative nature of the enterprise.

Sue believes that it is important to allow teachers to ‘play’ with new resources (in this case the interactive whiteboards) for up to 12 months before building too much structure into the learning.

[By then] they know how [the interactive whiteboards] work and what they can do. They’re over the basic skill development stage and have their own views and ideas about what you can do with them. We’ve got to the stage now where the momentum is self-sustaining, perhaps with a bit of a push from me now and again. We try to set the bar a little bit higher from time to time, make sure no-one has forgotten skills through lack of use, try out new software and review what we’ve done to see how we can do it better.
Appendix 3a: Analysis of field experiment data (detail)

Analytic strategy
The design of the field experiment was outlined in the main body of the report. In summary, classrooms were randomly assigned to a control group (‘Business-as-usual’) or to a treatment group (‘Learning object use’). Students within each of the two classroom groups completed a pre-test and a post-test, each containing two components (Number and Chance). Tests for students at year 5 were different from tests for those at year 7. Thus the experiment entailed two learning conditions, two year levels, two topics and two tests.

A number of aspects precluded standard multivariate analysis of variance procedures to test for group differences. First, classrooms, not students, were selected and assigned to either the ‘Business as usual’ group or the ‘Learning object use’ group. Therefore, this treatment variable should be assigned to the classroom not to the student. Also, it is reasonable to assume that the classroom that a student attends has an effect on the student’s attainment, and moreover that these effects change from classroom to classroom. Put another way, the assumption of ANOVA procedures of independence of observations is not tenable when intact classrooms are selected. Multilevel modelling works with student-level and classroom-level variables simultaneously, and takes into account the clustering of students within classrooms. The multilevel models outlined in this appendix were analysed using the MLwiN software package (see Browne 2005, Rasbash, Steele, Browne, & Prosser 2005; for details concerning multilevel modelling and its application in a range of contexts, see, for example, Goldstein 2003, Hox 2002, Raudenbush & Bryk 2002 and Snijders & Bosker 1999).

Given a large number of questions, the assumption of conventional analytic methods (including multilevel regression methods) of normally distributed data on a continuous scale is reasonable. However, with the data at hand, there is only a small number of questions relating to the Chance component (in one test there are two Chance questions, and for any test there are, at most, four questions). With two to four questions, assumptions of normality and continuous scales are not likely to hold. It is better to treat the outcome variable as a categorical variable with categories of: none correct, one correct, two correct, and so on. The analysis operates on the proportion of students who got none correct, one correct, two correct, and so on. The question asked of the data using a conventional ANOVA-based analysis is: Are the means for the
‘Business as usual’ and ‘Learning object use’ groups different? When the outcome variable is a categorical variable, the question asked of the data becomes: Are the proportions of students in each category of the outcome variable (0 correct, 1 correct, 2 correct, and so on) for the ‘Business as usual’ group and ‘Learning object use’ group different? Thus the requirement is for a multilevel analysis that operates on an ordered categorical outcome variable. Such a model, referred to as a multilevel proportional odds model, is available in the MLwiN package (for a detailed discussion, see Goldstein 2003 and Raudenbush & Bryk 2002).

Estimation of parameters in multilevel models is mostly done using the maximum likelihood method, but for models with categorical outcomes, maximum likelihood methods are computationally intensive, and most software packages offer quasi-likelihood methods. However, maximum and quasi-likelihood methods assume a large number of cases, and the assumption extends to the number of level 2 units (that is, number of classrooms. In addition, quasi-likelihood methods are approximations and may lead to biased estimates. An alternative is Markov chain Monte Carlo (MCMC) estimation (implemented in MLwiN; see Browne 2005). In addition, Hox (2002) argues that when the number of level 2 units is small, MCMC methods may do better. MCMC is a Bayesian method that takes prior information about the probability distribution of unknown parameters, combines that with the data to produce a posterior distribution and then generates random samples from the posterior distribution. Every parameter must have a prior distribution but, in most instances, little is known about the parameters a priori. Therefore, MLwiN uses, as a default, uninformative or diffuse priors to express this lack of information – the uninformative priors have little influence and serve only to produce the posterior distribution. Typically, the number of random samples generated from the posterior distribution is large. As a default, MLwiN stores 5,000 iterations, but 10,000 to 50,000 samples are common. Means (or modes), standard deviations and 95 per cent confidence intervals are easily obtained from the stored samples.

There are a number of points to consider, but diagnostics from some initial runs answer these points. First, MCMC needs to converge on a target distribution. The iterations needed before the target distribution is reached (the burn-in period) are discarded. For the data at hand, initial runs indicate that somewhere between 2,000 and 3,000 iterations are needed before convergence. Therefore a burn-in period of 5,000 iterations was set. Secondly, the Reftery-Lewis statistic indicates that for some parameters in some models 50,000 stored iterations are required to achieve a pre-set level of accuracy (95 per cent confident that the 95 per cent confidence intervals are
Appendix 3 129

estimated with an error less than 0.005). Thirdly, it is desirable for successive iterations to be independent, but usually there is a degree of correlation, and this correlation has the effect of reducing the effective sample size from, for the data at hand, 50,000 to a few hundred. One way to reach independence is to discard a number of iterations before a new draw is stored. A thinning factor of 100 (meaning that every 100th iteration is stored) reduces the correlations to close to zero. Thus, all models were run with diffuse priors, a burn-in period of 5,000 iterations, a thinning factor of 100, and 50,000 iterations were stored. Run times, depending on the model, ranged from less than one hour through to three or four hours.

Finally, NLwiN produces a deviance information criterion (DIC) that can be used to compare models (see Browne 2005). It is a generalisation of Akaike’s information criterion (AIC), and like AIC, DIC measures the degree to which a model fits the data but then penalises the measure according to model complexity (that is, the number of parameters in the model). Smaller DICs indicate a better model.

Modelling categorical responses

Consider a situation in which there is one question. There are two possible outcomes: either a student gets the question correct (coded as 1); or the student gets the question incorrect (coded as 0). Such binary response data can be analysed using a logistic regression model. Denoting $y_i$ as the response for student $i$, and denoting $\pi_i$ as the probability that $y_i = 1$ (that is, $\pi_i$ is the probability that student $i$ gets the question correct), the logistic regression model with one explanatory variable ($x_i$) is:

$$\logit(\pi_i) = \beta_0 + \beta_1 x_i$$

$$\logitF(\pi_i)$$ is the natural logarithms of the odds ($\pi_i / (1 – \pi_i)$) that $y_i = 1$.

The model returns estimates for the regression coefficients $\beta_0$ and $\beta_1$.

The data at hand require the model to be extended in two ways. First, the model is extended to a two-level model in which classroom effects on the probabilities are taken into account. Denoting $y_{ij}$ as the response for student $i$ in classroom $j$, and denoting $\pi_{ij}$ as the probability that $y_{ij} = 1$, the two level logistic regression model is:

$$\logit(\pi_{ij}) = \beta_{0j} + \beta_1 x_{ij}$$

$$\beta_{0j} = \beta_0 + u_{0j}$$
In the two-level model, \( \beta_{0j} \) has two components: a fixed component (\( \beta_0 \)); and a classroom-specific component (\( u_{0j} \)). The two-level model returns, in addition to the estimates for \( \beta_0 \) and \( \beta_1 \), an estimate of the variance (\( \sigma^2_{u0} \)) for the values of \( u_{0j} \).

The second extension allows more than two categories in the outcome variable. If there were two questions then there are three possible outcomes: a student gets none correct; one correct; or two correct. Denoting \( y_i \) as the categorical response for student \( i \), then:

- \( \pi_{i}^{(0)} \) is the probability that \( y_i = 0 \)
- \( \pi_{i}^{(1)} \) is the probability that \( y_i = 1 \)
- \( \pi_{i}^{(2)} \) is the probability that \( y_i = 2 \)

To exploit the ordering of the categories, models are based on the cumulative response probabilities rather than the response probabilities for each separate category. Denoting \( \gamma_i \) as a cumulative probability, then the cumulative probabilities for the three responses are:

- \( \gamma_{i}^{(0)} \) - cumulative probability that \( y_i = 0 \) (i.e., \( \gamma_{i}^{(0)} = \pi_{i}^{(0)} \))
- \( \gamma_{i}^{(1)} \) - cumulative probability that \( y_i = 0 \) or \( y_i = 1 \) (i.e., \( \gamma_{i}^{(1)} = \pi_{i}^{(0)} + \pi_{i}^{(1)} \))
- \( \gamma_{i}^{(2)} \) - cumulative probability that \( y_i = 0 \) or \( y_i = 1 \) or \( y_i = 2 \) (i.e., \( \gamma_{i}^{(2)} = \pi_{i}^{(0)} + \pi_{i}^{(1)} + \pi_{i}^{(2)} = 1 \))

The model with one explanatory variable (\( x_i \)), a proportional odds model with a logit link, is:

\[
\logit\left(\gamma_{i}^{(s)}\right) = \beta_{0}^{(s)} + \beta_{1}x_{i}
\]

and the corresponding two-level model is:

\[
\logit\left(\gamma_{ij}^{(s)}\right) = \beta_{0j}^{(s)} + \beta_{1}x_{ij} + u_{j}
\]

For the three-category response variable being discussed here, the model represents two equations:

\[
\logit\left(\gamma_{ij}^{(0)}\right) = \beta_{0j}^{(0)} + \beta_{1}x_{ij} + u_{j}
\]
\[
\logit\left(\gamma_{ij}^{(1)}\right) = \beta_{0j}^{(1)} + \beta_{1}x_{ij} + u_{j}
\]
in which the effects of the covariate ($\beta_1$) and classroom-specific component ($u_j$) are common to each equation. Thus the model returns estimates for $\beta_0^{(0)}$ and $\beta_0^{(1)}$ (which, after reversing the logit transformation, yield the cumulative probabilities, which in turn, by subtraction, yield the probabilities), the effect of the covariate ($\beta_1$), and the variance ($\sigma^2_u$) for the values of $u_j$.

The proportional odds model provides more information than would have been possible had a continuous response model been employed. The latter provides estimates of averaged scores whereas the proportional odds model provides the probabilities that a student gets no questions correct, one question correct, two questions correct, and so on.

**Results**

Table A3-1 summarises the results of fitting three versions of the proportional odds model to the data for the year 7 Chance post-test. Model 1 is a single-level model; model 2 is a two-level model, but neither model contains an effect for treatment (‘Business as usual’ versus ‘Learning object use’). If model 2 proves to be a better model than model 1, then there are classroom effects; that is, some classrooms do better than other classrooms. Model 3 then fits the effect of treatment as an effect common to all response categories.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
</tr>
<tr>
<td><strong>Fixed:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td>-2.59 (-3.05 -2.19)</td>
<td>-2.73 (-3.38 -2.14)</td>
<td>-2.10 (-2.93 -1.32)</td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>-1.12 (-1.38 -0.87)</td>
<td>-1.14 (-1.65 -0.63)</td>
<td>-0.51 (-1.25 0.22)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>0.05 (-0.28 0.16)</td>
<td>0.12 (-0.37 0.63)</td>
<td>0.75 (0.03 1.50)</td>
</tr>
<tr>
<td>≤ 3 correct</td>
<td>-0.91 (0.67 1.16)</td>
<td>1.28 (0.79 1.83)</td>
<td>1.91 (1.19 2.71)</td>
</tr>
<tr>
<td>learning object effect</td>
<td></td>
<td></td>
<td>-1.00 (-1.89 -0.10)</td>
</tr>
<tr>
<td>- common</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Random:</strong></td>
<td>0.86</td>
<td>0.64</td>
<td>0.64</td>
</tr>
<tr>
<td>$\sigma^2_u$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DIC</strong></td>
<td>996.78</td>
<td>939.11</td>
<td>939.04</td>
</tr>
</tbody>
</table>

The DICs indicate that model 2 is a better fit to the data than model 1, that is, classrooms have an effect on students’ post-test scores. However, the DICs do not
clearly distinguish between models 2 and 3. The 95 per cent confidence interval surrounding the estimate for the common effect of ‘Learning object use’ (ranging from -1.88 to -0.10) does not span zero, and thus it can be claimed that the effect for ‘Learning object use’ is significantly greater than zero. In other words, being in a classroom where learning objects are used has a significant effect.

The year 7 Chance pre-test results are summarised in Table A3-2. The DICs indicate that model 2 is a better model than model 1, (that is, classrooms have an effect on students’ pre-test probabilities), but again, the DICs do not clearly distinguish between models 2 and 3. The 95 per cent confidence interval for the learning object effect (ranging from -1.53 to +0.19) does span zero, and thus it cannot be claimed that being in a classroom using learning objects has an effect on the year 7 Chance pre-test probabilities.

Table A3-2: Parameter estimates for the year 7 Chance pre-test

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
</tr>
<tr>
<td>Fixed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td>-3.99 (-4.98 -3.99)</td>
<td>-4.16 (-5.21 -3.36)</td>
<td>-3.47 (-4.92 -3.74)</td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>-1.08 (-1.34 -0.84)</td>
<td>-1.11 (-1.56 -0.67)</td>
<td>-0.68 (-1.39 0.01)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>1.40 (1.14 1.69)</td>
<td>1.65 (1.21 2.17)</td>
<td>2.09 (1.38 2.87)</td>
</tr>
<tr>
<td>learning object effect</td>
<td></td>
<td>-0.66 (-1.53 0.19)</td>
<td></td>
</tr>
<tr>
<td>Random:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma^2_u$</td>
<td>0.56</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>DIC</td>
<td>693.91</td>
<td>664.89</td>
<td>664.75</td>
</tr>
</tbody>
</table>

Table A3-3 shows the parameter estimates, cumulative probabilities and the probabilities for the two groups of students. The estimates for the ‘Learning object use’ groups are the estimates for the ‘Business as usual’ groups plus the additional common effect for ‘Learning object use’. The cumulative probabilities are calculated by reversing the logit transformation:

$$\gamma = \frac{1}{1 + e^{-\beta}}$$

where $\beta$ is the estimate.

The probabilities are then calculated by successive subtractions of the cumulative probabilities. Even though the treatment had no significant effect on the pre-test probabilities, the estimates, cumulative probabilities and probabilities for the pre-test
shown in Table A3-3 are those that derive from model 3. Figure 11 in the main report is a plot of the pre-test and post-test probabilities for the Chance component of the tests for the ‘Business as usual’ and ‘Learning object use’ groups. The probabilities plotted in Figure 11 and the probabilities shown in Table A3-3 for the ‘Business as usual’ and ‘Learning object use’ groups are separated, but the separation is not statistically significant. That is, the probabilities for the two groups, in effect, overlap. At the post-test, however, the separation of the lines is statistically significant: the ‘Learning object use’ groups have a greater chance of getting three or four questions correct than do the ‘Business as usual’ groups. At the other end of the scale, the ‘Learning object use’ groups have a smaller chance of getting none or only one question correct than do the ‘Business as usual’ groups.

Table A3-3: Year 7 Chance pre-test and post-test estimates, cumulative probabilities and probabilities

<table>
<thead>
<tr>
<th>Number of questions</th>
<th>Business as usual</th>
<th>Learning object use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Cumulative probability</td>
</tr>
<tr>
<td>Pre-test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-3.74</td>
<td>0.02</td>
</tr>
<tr>
<td>1</td>
<td>-0.68</td>
<td>0.34</td>
</tr>
<tr>
<td>2</td>
<td>2.09</td>
<td>0.89</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Post-test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-2.10</td>
<td>0.11</td>
</tr>
<tr>
<td>1</td>
<td>-0.51</td>
<td>0.38</td>
</tr>
<tr>
<td>2</td>
<td>0.75</td>
<td>0.68</td>
</tr>
<tr>
<td>3</td>
<td>1.91</td>
<td>0.87</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.13</td>
</tr>
</tbody>
</table>

A similar procedure was followed for the year 5 Chance pre-test and post-test data. Table A3-4 shows the estimates for the three models for the pre-test (upper part of the table) and the estimates for the post-test (lower part of the table). For the pre-test, there is a small drop in DIC values for model 2 compared to model 1. However, the classroom-level variance is zero, indicating that there are no differences among classrooms, and as a consequence, the ‘Learning object use’ effect (in model 3) is not statistically significant. For the post-test, model 2 is a better model than model 1 (that is, there are classroom effects). The 95 per cent CI for the ‘Learning object use’ effect (ranging from -1.70 to -0.11) does not span zero, and so it can be claimed that there is
a significant effect for ‘Learning object use’. After reversing the logit transformation to obtain cumulative probabilities, then successively subtracting the cumulative probabilities, the probabilities are obtained (shown in Table A3-5). Figure 14 in the main report is a plot of the year 5 Chance pre-test and post-test probabilities for the ‘Business as usual’ and ‘Learning object use’ groups. For the pre-test, the probabilities for the two groups in effect overlap whereas, for the post-test, there is a statistically significant separation. The ‘Learning object use’ groups are more likely than the ‘Business as usual’ groups to get all three questions correct.

Table A3-4: Parameter estimates for the year 5 Chance pre-test and post-test

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
</tr>
<tr>
<td>PRE-TEST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td>-1.45 (-1.73 -1.19)</td>
<td>-1.48 (-1.83 -1.16)</td>
<td>-1.34 (-1.82 -0.92)</td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>0.36 (0.15 0.59)</td>
<td>0.38 (0.10 0.69)</td>
<td>0.53 (0.11 0.95)</td>
</tr>
<tr>
<td>Learning object effect</td>
<td></td>
<td></td>
<td>-0.26 (-0.80 0.31)</td>
</tr>
<tr>
<td>– common</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random:</td>
<td>σ²_u 0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>DIC</td>
<td>718.78</td>
<td>714.18</td>
<td>714.87</td>
</tr>
<tr>
<td>POST-TEST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td>-2.55 (-3.00 -2.18)</td>
<td>-2.84 (-3.45 -2.31)</td>
<td>-2.30 (-2.98 -1.71)</td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>-1.30 (-1.57 -1.05)</td>
<td>-1.49 (-1.99 -1.06)</td>
<td>-0.96 (-1.53 -0.44)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>0.16 (-0.5 0.38)</td>
<td>0.15 (-0.29 0.57)</td>
<td>0.69 (0.15 1.22)</td>
</tr>
<tr>
<td>Learning object effect</td>
<td></td>
<td></td>
<td>-0.99 (-1.72 -0.28)</td>
</tr>
<tr>
<td>– common</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random:</td>
<td>Σ²_u 0.54</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>DIC</td>
<td>817.58</td>
<td>781.94</td>
<td>780.56</td>
</tr>
</tbody>
</table>
Table 3-5: Year 5 Chance pre-test and post-test estimates, cumulative probabilities and probabilities

<table>
<thead>
<tr>
<th>Number of questions</th>
<th>Business as usual</th>
<th></th>
<th>Learning object use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Cumulative probability</td>
<td>Probability</td>
<td>Estimate</td>
</tr>
<tr>
<td>Pre-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-1.34</td>
<td>0.21</td>
<td>0.21</td>
<td>-1.60</td>
</tr>
<tr>
<td>1</td>
<td>0.53</td>
<td>0.63</td>
<td>0.42</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0.37</td>
<td>1</td>
</tr>
<tr>
<td>Post-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-2.30</td>
<td>0.09</td>
<td>0.09</td>
<td>-3.29</td>
</tr>
<tr>
<td>1</td>
<td>-0.96</td>
<td>0.28</td>
<td>0.19</td>
<td>-1.95</td>
</tr>
<tr>
<td>2</td>
<td>0.69</td>
<td>0.66</td>
<td>0.39</td>
<td>-0.30</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0.34</td>
<td>1</td>
</tr>
</tbody>
</table>

There are probably enough questions in the Number component of the pre-tests and post-tests to run the more conventional multilevel model using maximum likelihood estimation procedures (that assume a continuous scale and normal distributions). But for purposes of continuity, the proportional odds model was applied to the Number tests. Tables A3-6 and A3-7 show the estimates and DICs for each of three models for the pre-test and post-test for year 7 and year 5 respectively. With the possible exception of the year 5 pre-test, the two-level models are better than the single-level models. That is, classrooms have an effect on the probabilities. However, the 95 per cent confidence intervals for the effects of ‘Learning object use’ for all tests span zero, indicating that there is no statistically significant effect for ‘Learning object use’.

After reversing the logit transformations, the probabilities for year 7 and year 5 are plotted in Figures 12 and 14 respectively in the main report. The two sets of pre-test probabilities and the year 5 post-test probabilities for the ‘Business as usual’ groups and the ‘Learning object use’ groups almost overlap. There is some separation of the two groups’ year 7 post-test probabilities, but the separation does not reach statistical significance.
Table A3-6: Parameter estimates for the year 7 Number pre-test

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Model 1 Estimate (95% CI)</th>
<th>Model 2 Estimate (95% CI)</th>
<th>Model 3 Estimate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-TEST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>-4.60 (-5.88 -3.74)</td>
<td>-4.78 (-6.11 -3.87)</td>
<td>-4.61 (-6.03 -3.57)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>-3.54 (-4.28 -2.97)</td>
<td>-3.71 (-4.51 -3.06)</td>
<td>-3.54 (-4.50 -2.71)</td>
</tr>
<tr>
<td>≤ 4 correct</td>
<td>-2.61 (-3.08 -2.22)</td>
<td>-2.77 (-3.35 -2.26)</td>
<td>-2.59 (-3.37 -1.87)</td>
</tr>
<tr>
<td>≤ 5 correct</td>
<td>-1.90 (-2.24 -1.59)</td>
<td>-2.01 (-2.50 -1.58)</td>
<td>-1.83 (-2.55 -1.16)</td>
</tr>
<tr>
<td>≤ 6 correct</td>
<td>-1.26 (-1.53 -1.00)</td>
<td>-1.33 (-1.76 0.93)</td>
<td>-1.15 (-1.83 -0.49)</td>
</tr>
<tr>
<td>≤ 7 correct</td>
<td>-0.54 (-0.77 -0.32)</td>
<td>-0.55 (-0.95 -0.16)</td>
<td>-0.37 (-1.02 0.28)</td>
</tr>
<tr>
<td>≤ 8 correct</td>
<td>0.12 (-0.10 0.34)</td>
<td>0.17 (-0.21 0.57)</td>
<td>0.36 (-0.29 1.01)</td>
</tr>
<tr>
<td>≤ 9 correct</td>
<td>0.99 (0.75 1.25)</td>
<td>1.10 (0.71 1.52)</td>
<td>1.29 (0.64 1.96)</td>
</tr>
<tr>
<td>≤ 10 correct</td>
<td>2.13 (1.79 2.50)</td>
<td>2.30 (1.84 2.80)</td>
<td>2.48 (1.79 3.22)</td>
</tr>
<tr>
<td>≤ 11 correct</td>
<td>4.46 (3.62 5.72)</td>
<td>4.69 (3.79 6.02)</td>
<td>4.89 (3.85 6.29)</td>
</tr>
<tr>
<td>Learning object effect: – common</td>
<td>-0.26 (-1.07 0.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Sigma_u^2$</td>
<td>0.43</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>DIC</td>
<td>1387.72</td>
<td>1359.96</td>
<td>1360.27</td>
</tr>
<tr>
<td>POST-TEST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>-4.88 (-6.39 -3.91)</td>
<td>-5.04 (-6.64 -4.01)</td>
<td>-4.61 (-6.24 -3.43)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>-3.25 (-3.88 -2.74)</td>
<td>-3.42 (-4.17 -2.77)</td>
<td>-2.96 (-3.88 -2.14)</td>
</tr>
<tr>
<td>≤ 3 correct</td>
<td>-2.28 (-2.68 -1.93)</td>
<td>-2.40 (-2.97 -1.88)</td>
<td>-1.94 (-2.73 -1.20)</td>
</tr>
<tr>
<td>≤ 4 correct</td>
<td>-1.56 (-1.86 -1.29)</td>
<td>-1.61 (-2.12 -1.14)</td>
<td>-1.14 (-1.90 -0.42)</td>
</tr>
<tr>
<td>≤ 5 correct</td>
<td>-0.91 (-1.15 -0.67)</td>
<td>-0.87 (-1.34 -0.41)</td>
<td>-0.40 (-1.13 0.32)</td>
</tr>
<tr>
<td>≤ 6 correct</td>
<td>-0.56 (-0.79 -0.33)</td>
<td>-0.48 (-0.93 -0.02)</td>
<td>-0.01 (-0.73 0.72)</td>
</tr>
<tr>
<td>≤ 7 correct</td>
<td>-0.19 (-0.41 0.03)</td>
<td>-0.05 (-0.49 0.41)</td>
<td>0.42 (-0.29 1.15)</td>
</tr>
<tr>
<td>≤ 8 correct</td>
<td>0.46 (0.23 0.68)</td>
<td>0.67 (0.24 1.15)</td>
<td>1.14 (0.44 1.89)</td>
</tr>
<tr>
<td>≤ 9 correct</td>
<td>1.35 (1.09 1.63)</td>
<td>1.66 (1.20 2.17)</td>
<td>2.13 (1.41 2.90)</td>
</tr>
<tr>
<td>≤ 10 correct</td>
<td>2.55 (2.16 3.01)</td>
<td>2.93 (2.38 3.56)</td>
<td>3.41 (2.62 4.26)</td>
</tr>
<tr>
<td>Learning object effect: – common</td>
<td>-0.72 (-1.59 0.16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_u^2$</td>
<td>0.67</td>
<td>0.59</td>
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<tr>
<td>DIC</td>
<td>1461.46</td>
<td>1417.56</td>
<td>1417.48</td>
</tr>
</tbody>
</table>
### Table A3-7: Parameter estimates for the year 5 Number pre-test

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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</thead>
<tbody>
<tr>
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<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
<td>Estimate (95% CI)</td>
</tr>
<tr>
<td><strong>PRE-TEST</strong></td>
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<td></td>
</tr>
<tr>
<td>Fixed:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0 correct</td>
<td>-5.25 (-6.89 -4.22)</td>
<td>-5.28 (-6.96 -4.23)</td>
<td>-5.19 (-6.84 -4.10)</td>
</tr>
<tr>
<td>≤ 1 correct</td>
<td>-4.70 (-5.99 -3.84)</td>
<td>-4.73 (-6.05 -3.86)</td>
<td>-4.64 (-5.95 -3.74)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>-3.73 (-4.52 -3.14)</td>
<td>-3.77 (-4.57 -3.16)</td>
<td>-3.69 (-4.51 -3.02)</td>
</tr>
<tr>
<td>≤ 3 correct</td>
<td>-3.08 (-3.64 -2.62)</td>
<td>-3.11 (-3.70 -2.63)</td>
<td>-3.01 (-3.64 -2.48)</td>
</tr>
<tr>
<td>≤ 4 correct</td>
<td>-2.01 (-2.35 -1.70)</td>
<td>-2.03 (-2.41 -1.70)</td>
<td>-1.93 (-2.38 -1.52)</td>
</tr>
<tr>
<td>≤ 5 correct</td>
<td>-1.08 (-1.33 -0.84)</td>
<td>-1.09 (-1.38 -0.83)</td>
<td>-0.99 (-1.37 -0.63)</td>
</tr>
<tr>
<td>≤ 6 correct</td>
<td>-0.29 (-0.50 -0.08)</td>
<td>-0.29 (-0.54 -0.04)</td>
<td>-0.18 (-0.54 0.17)</td>
</tr>
<tr>
<td>≤ 7 correct</td>
<td>0.44 (0.23 0.66)</td>
<td>0.45 (0.20 0.71)</td>
<td>0.55 (0.20 0.92)</td>
</tr>
<tr>
<td>≤ 8 correct</td>
<td>1.19 (0.95 1.44)</td>
<td>1.21 (0.94 1.50)</td>
<td>1.31 (0.94 1.70)</td>
</tr>
<tr>
<td>≤ 9 correct</td>
<td>1.91 (1.61 2.23)</td>
<td>1.93 (1.61 2.29)</td>
<td>2.03 (1.63 2.48)</td>
</tr>
<tr>
<td>≤ 10 correct</td>
<td>2.95 (2.52 3.48)</td>
<td>2.98 (2.53 3.53)</td>
<td>3.08 (2.57 3.69)</td>
</tr>
<tr>
<td>≤ 11 correct</td>
<td>3.74 (3.14 4.52)</td>
<td>3.77 (3.16 4.56)</td>
<td>3.87 (3.21 4.71)</td>
</tr>
<tr>
<td>≤ 12 correct</td>
<td>6.56 (4.03 6.56)</td>
<td>5.02 (4.20 6.58)</td>
<td>5.13 (4.12 6.68)</td>
</tr>
<tr>
<td>Learning object effect</td>
<td>-0.19 (-0.64 0.27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– common</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma^2_u )</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td><strong>DIC</strong></td>
<td>1564.51</td>
<td>1563.11</td>
<td>1564.06</td>
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<tr>
<td>Fixed:</td>
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</tr>
<tr>
<td>0 correct</td>
<td>-4.41 (-5.52 -3.63)</td>
<td>-4.60 (-5.75 -3.75)</td>
<td>-4.71 (-5.97 -3.75)</td>
</tr>
<tr>
<td>≤ 1 correct</td>
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<td>-3.59 (-4.34 -2.97)</td>
<td>-3.70 (-4.59 -2.95)</td>
</tr>
<tr>
<td>≤ 2 correct</td>
<td>-2.56 (-2.99 -2.18)</td>
<td>-2.72 (-3.28 -2.22)</td>
<td>-2.83 (-3.57 -2.18)</td>
</tr>
<tr>
<td>≤ 3 correct</td>
<td>-1.85 (-2.17 -1.56)</td>
<td>-1.99 (-2.47 -1.56)</td>
<td>-2.10 (-2.78 -1.50)</td>
</tr>
<tr>
<td>≤ 4 correct</td>
<td>-0.89 (-1.13 -0.66)</td>
<td>-0.98 (-1.40 -0.59)</td>
<td>-1.08 (-1.73 -0.51)</td>
</tr>
<tr>
<td>≤ 5 correct</td>
<td>-0.04 (-0.25 0.17)</td>
<td>-0.07 (-0.48 0.32)</td>
<td>-0.17 (-0.79 0.39)</td>
</tr>
<tr>
<td>≤ 6 correct</td>
<td>0.90 (0.67 1.14)</td>
<td>0.93 (0.53 1.34)</td>
<td>0.84 (0.22 1.42)</td>
</tr>
<tr>
<td>≤ 7 correct</td>
<td>1.41 (1.16 1.69)</td>
<td>1.47 (1.06 1.91)</td>
<td>1.38 (0.76 1.98)</td>
</tr>
<tr>
<td>≤ 8 correct</td>
<td>2.07 (1.75 2.42)</td>
<td>2.17 (1.72 2.66)</td>
<td>2.08 (1.45 2.73)</td>
</tr>
<tr>
<td>≤ 9 correct</td>
<td>2.97 (2.52 3.49)</td>
<td>3.11 (2.56 3.75)</td>
<td>3.03 (2.33 3.79)</td>
</tr>
<tr>
<td>≤ 10 correct</td>
<td>4.36 (3.59 5.46)</td>
<td>4.84 (3.70 5.70)</td>
<td>4.47 (3.51 5.69)</td>
</tr>
<tr>
<td>≤ 11 correct</td>
<td>5.52 (4.36 7.60)</td>
<td>5.72 (4.50 7.82)</td>
<td>5.68 (4.33 7.78)</td>
</tr>
<tr>
<td>Learning object effect</td>
<td>0.18 (-0.58 1.02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– common</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma^2_u )</td>
<td>0.41</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td><strong>DIC</strong></td>
<td>1544.01</td>
<td>1520.09</td>
<td>1519.96</td>
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</tbody>
</table>
References


Appendix 3b: Factor analysis

This appendix provides details of the factor analysis of the set of items from the survey in which teachers were asked to indicate the value of learning objects in helping their students to learn. Teachers were asked to assess 11 aspects of learning (see left column in Table A3-8 for a condensed version of the questions). Teachers responded on a 7-point scale, with 1 = ‘Not at all’ and 7 = ‘Extremely’. The aim of the analysis is to generate a smaller set of variables (that is, factors) so that the variables that contribute to the definition of a given factor are correlated with one another but are largely independent of other subsets of variables. ‘Factor analysis’ is the label for a family of analyses, and a particular factor analytic technique is selected according the characteristics of the data (and according to availability of particular techniques in software packages – see, for instance, Tabachnick and Fidell 2001 for a comprehensive treatment of factor analysis).

Table A3-8 shows selected descriptive statistics for the set of items, and Table A3-9 shows the correlations between pairs of items. Table A3-8 points to some difficulties with the data that indicate the need for caution in selecting a factor analytic technique. While the full range of the 7-point scale was used for all items, the means are all well above the midpoints of the scales. The skewness statistic indicates that most teachers indicate ‘value’ at the upper end of the scale while few teachers use the lower end of the scale. The values for skewness are all large. Also, large numbers of teachers did not indicate ‘value’ (although only five teachers did not answer any question). Table A3-9 shows that the correlations between pairs of items are moderate to high, indicating that any factors that emerge from the analysis are likely themselves to be correlated.

It is usual practice to treat Likert-type items as though they are continuous variables, but, as Muthén and Muthén (2003a) argue, when the variables are highly skewed, alternative procedures are warranted. Muthén and Muthén state that when the mode of the distribution of the scores is at one extreme or the other of the scale, it is better to treat the variables as categorical variables; and that when the mode is near one extreme or the other, the variable can be treated as a continuous variable but estimation procedures that are robust to non-normality should be used. The variables used in the analysis are skewed but none are so highly skewed that the mode is at the 7-point. For all variables, the mode is at the 6-point. Therefore, a non-normality robust procedure is used. The amount of missing data also needs to be considered. Listwise deletion would severely reduce the size of the sample, and so alternative methods are
Mplus (Muthén & Muthén, 2004) is a general latent variable analysis package in which it is possible to set up a variety of exploratory and confirmatory factor analysis procedures, including analyses of categorical or continuous variables, and analyses that are robust to non-normality, and that have built-in procedures for dealing with missing data.

Table A3-8: Descriptive statistics (sample size = 356)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number missing</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Skewness</th>
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<td>Know factual content</td>
<td>15</td>
<td>5.40</td>
<td>1.21</td>
<td>-0.88</td>
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<tr>
<td>Know processes</td>
<td>23</td>
<td>5.37</td>
<td>1.23</td>
<td>-0.98</td>
</tr>
<tr>
<td>Label elements and parts</td>
<td>76</td>
<td>4.99</td>
<td>1.51</td>
<td>-0.73</td>
</tr>
<tr>
<td>State and define ideas</td>
<td>51</td>
<td>5.21</td>
<td>1.37</td>
<td>-0.81</td>
</tr>
<tr>
<td>Summarise concepts</td>
<td>68</td>
<td>4.81</td>
<td>1.50</td>
<td>-0.70</td>
</tr>
<tr>
<td>Explain ideas</td>
<td>34</td>
<td>5.31</td>
<td>1.26</td>
<td>-0.82</td>
</tr>
<tr>
<td>Compare and contrast concepts</td>
<td>67</td>
<td>5.03</td>
<td>1.29</td>
<td>-0.69</td>
</tr>
<tr>
<td>Evaluate and justify concepts</td>
<td>80</td>
<td>4.96</td>
<td>1.37</td>
<td>-0.83</td>
</tr>
<tr>
<td>Apply ideas and processes</td>
<td>37</td>
<td>5.22</td>
<td>1.29</td>
<td>-0.76</td>
</tr>
<tr>
<td>Demonstrate applications</td>
<td>41</td>
<td>5.22</td>
<td>1.32</td>
<td>-0.69</td>
</tr>
<tr>
<td>Design or construct new objects</td>
<td>76</td>
<td>4.86</td>
<td>1.57</td>
<td>-0.62</td>
</tr>
</tbody>
</table>

Table A3-9: Pearson correlations between pairs of variables

<table>
<thead>
<tr>
<th>V1: Know factual content</th>
<th>V2: Know processes</th>
<th>V3: Label elements and parts</th>
<th>V4: State and define ideas</th>
<th>V5: Summarise concepts</th>
<th>V6: Explain ideas</th>
<th>V7: Compare and contrast concepts</th>
<th>V8: Evaluate and justify concepts</th>
<th>V9: Apply ideas and processes</th>
<th>V10: Demonstrate applications</th>
<th>V11: Design or construct new objects</th>
</tr>
</thead>
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<tr>
<td>V1: Know factual content</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2: Know processes</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V3: Label elements and parts</td>
<td>.56</td>
<td>.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V4: State and define ideas</td>
<td>.68</td>
<td>.67</td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V5: Summarise concepts</td>
<td>.56</td>
<td>.50</td>
<td>.51</td>
<td>.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>V6: Explain ideas</td>
<td>.60</td>
<td>.63</td>
<td>.56</td>
<td>.69</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V7: Compare and contrast concepts</td>
<td>.56</td>
<td>.55</td>
<td>.56</td>
<td>.64</td>
<td>.58</td>
<td>.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V8: Evaluate and justify concepts</td>
<td>.57</td>
<td>.62</td>
<td>.59</td>
<td>.68</td>
<td>.68</td>
<td>.73</td>
<td>.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V9: Apply ideas and processes</td>
<td>.50</td>
<td>.60</td>
<td>.42</td>
<td>.57</td>
<td>.49</td>
<td>.61</td>
<td>.47</td>
<td>.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V10: Demonstrate applications</td>
<td>.55</td>
<td>.63</td>
<td>.46</td>
<td>.58</td>
<td>.49</td>
<td>.63</td>
<td>.50</td>
<td>.63</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>V11: Design or construct new objects</td>
<td>.51</td>
<td>.59</td>
<td>.52</td>
<td>.55</td>
<td>.53</td>
<td>.57</td>
<td>.46</td>
<td>.57</td>
<td>.66</td>
<td>.73</td>
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</tbody>
</table>

Steps in the analysis

Exploratory factor analysis (EFA) with missing data can be conducted in Mplus using either maximum likelihood procedures (assuming continuous variables) or a number of least squares procedures (assuming categorical variables). However, the diagnostics obtainable from a categorical analysis are not extensive. Confirmatory factor analysis
(CFA) with missing data can be conducted using a variety of maximum likelihood and robust maximum likelihood estimation procedures. Muthén and Muthén (2003b) demonstrate how to conduct an EFA in a CFA framework:

- From an initial EFA, find an anchor item for each factor – an item that has a large loading for the factor and small loadings for the other factors.
- In a CFA, fix the loadings of the anchor items to zero for all the other factors.
- Allow all other factor loadings to be free.

The second analysis is an exploratory analysis because all factor loadings (except for anchor items) are estimated, but the CFA produces standard errors to determine if factor loadings are statistically significant.

**Results**

Figure A3-1 shows the scree test and fit indices for initial EFAs. All solutions between a 1-factor through to a 5-factor solution were requested. The analyses were conducted on categorical variables and generated unweighted least squares parameter estimates.
The scree test shows an elbow at 2 factors, but there is also an elbow at 4 factors, indicating that the optimal solution is located anywhere from 2 factors to 4 factors. The chi-square indicates a 5-factor solution, although chi-square is influenced by sample size. RMSR (average residuals for the correlation matrix) and RMSEA (a function of chi-square and tests closeness of fit) should both be less than 0.05. RMSR indicates a 2-factor solution, but RMSEA indicates a 5-factor solution. However, the 4- and 5-factor solutions contain factors defined by one or two items, and as a consequence, attention was focused on the 2- and 3-factor solution.

Anchor items were located in both the 2- and 3-factor solutions, and were used to generate the EFAs in a CFA environment. The CFA generated maximum likelihood parameter estimates with standard errors and chi-square test statistics that are robust to non-normality. Two additional test statistics were obtained from the CFAs – CFI which should be greater than 0.96 and TLI which should be greater than 0.95. Table A3-10 shows the fit indices for the 2- and 3-factor solutions. Both solutions are good fits with the data, and one index (RMSEA) and the chi-square statistic indicate that the 3-factor solution is the better solution.
Table A3-10: Fit indices for the 2- and 3-factor CFA solutions

<table>
<thead>
<tr>
<th>Fit statistics</th>
<th>2 factors</th>
<th>3 factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
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<td>31.7</td>
</tr>
<tr>
<td>df</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td>p</td>
<td>0.0001</td>
<td>0.166</td>
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<tr>
<td>CFI</td>
<td>0.972</td>
<td>0.995</td>
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<tr>
<td>TLI</td>
<td>0.954</td>
<td>0.989</td>
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<tr>
<td>RMSEA</td>
<td>0.057</td>
<td>0.028</td>
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<tr>
<td>RMSR</td>
<td>0.030</td>
<td>0.018</td>
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</table>

Table A3-11 shows the factor loadings for the 3-factor solution (note that the anchor items have their loadings on two factors fixed to zero). Item 4 is a double-loader; loading onto factors 1 and 2 (the two loadings are statistically significant, as indicated by the z-scores). Thus, items 1 to 3 contribute to the definition of factor 1; items 5 to 8 contribute to the definition of factor 2; and items 9 to 11 contribute to the definition of factor 3. Loadings for the items that contribute to the definition of a factor are statistically significant but no other loading is statistically significant. This is the same structure indicated by the EFA: one double loader and three factors. The three factors are highly correlated, particularly factors 1 and 2. It is noted that the 2-factor CFA solution combined the items of factors 1 and 2 into a single factor.

Finally, the Cronbach’s $\alpha$ reliabilities for factors 1, 2 and 3 are 0.84, 0.90, and 0.91 respectively; indicating three highly reliable factors. The factors are interpreted as:

- **Factor 1** – value of the learning object in helping students with factual and content learning;
- **Factor 2** – value of the learning object in helping students with conceptual understanding; and
- **Factor 3** – value of the learning object in helping students with transfer and application of knowledge to new situations.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Loading</th>
<th>estimate / se (z)</th>
<th>Loading</th>
<th>estimate / se (z)</th>
<th>Loading</th>
<th>estimate / se (z)</th>
</tr>
</thead>
<tbody>
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<td>0</td>
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<tr>
<td>2</td>
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<td>-.31</td>
<td>.116</td>
<td>1.31</td>
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<tr>
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<td>.548</td>
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<td>.254</td>
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<td>-.066</td>
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<tr>
<td>4</td>
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<td>.028</td>
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<tr>
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<td>.015</td>
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<td>-.16</td>
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<td>.163</td>
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<td>.118</td>
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<td>.888</td>
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<td>.235</td>
<td>1.31</td>
<td>.057</td>
<td>0.35</td>
<td>.532</td>
<td>6.67</td>
</tr>
</tbody>
</table>

**Correlations**

| Factor 1 | .     | .     |
| Factor 2 | .834  | .     |
| Factor 3 | .681  | .648  |

**References**


