Effects of The Le@rning Federation's curriculum content on Indigenous students' motivation to learn and their engagement in learning

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February 2008

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Acknowledgements

Contents

Executive summary

This study, which forms part of The Le@rning Federation's (TLF) Indigenous Project Plan, investigates the effects of using TLF's digital learning materials on Indigenous students' motivation to learn and their engagement in learning.

Conducted in 26 Australian schools that have a high proportion of Indigenous students, the study draws on data from surveys of the teachers and students, interviews held with the teachers, and observations of classroom use of TLF's digital learning materials. The schools were located in a variety of regional centres, remote areas and Indigenous communities across Australia.

Students' survey responses indicated that Indigenous students find that using TLF's learning objects helps them to learn, a result that is consistent with earlier previous research findings related to more general populations.

Teachers reported an increased motivation to learn among Indigenous students who were using TLF content, and improvements in Indigenous students' engagement in their learning. They identified a number of strengths of TLF content for Indigenous students' learning.

The study describes various opportunities and challenges in integrating TLF content into learning programs. It confirms previous research findings (Freebody 2005, 2006, 2007) regarding strategies that support teachers in taking up TLF content and working in digital learning environments, in that the schools with the strongest take-up of ICT and of TLF content in teaching and learning, possessed the following features:

- As part of whole-school planning for use of ICT and TLF content, school leaders appoint a particular staff member, or a group of staff, to lead and support other teachers.

- There is an individual teacher, or a small group of teachers, with experience and confidence in using ICT and TLF content ('champions') who can influence other staff members through advice and demonstration.

- There is access to reliable, user-friendly technology infrastructure that is accompanied by professional development in its use.

The study concludes that the relationships between Indigenous students' need for help with TLF content, their evident enjoyment in using TLF content to learn, their poor access to computers and the Internet out of school, and their low ICT and literacy proficiency present a significant issue for the jurisdictions to manage, in the interests of improving Indigenous students' motivation to learn and their engagement in learning.

Introduction

This study, which forms part of The Le@rning Federation's Indigenous Project Plan, investigates the effects of using The Le@rning Federation's digital learning materials on Indigenous students' motivation to learn and their engagement in learning. The study draws on related research, particularly previous studies generated by The Le@rning Federation, data from surveys of teachers and students who participated in the study, and data from interviews and observations conducted during site visits to participating schools and workshops for participating schools.

The Le@rning Federation

The task of The Le@rning Federation (TLF), established in July 2001, is to produce online curriculum materials for use, free of charge, across all Australian and New Zealand school jurisdictions. By the end of 2007, more than 6000 TLF content items were available for use.

There are two types of TLF content, learning objects and digital resources.

- Learning objects are stand-alone interactive learning activities, developed according to specified educational design principles. They are often multimedia items that integrate sound, animation, text and audio.

- Digital resources are items in digital format, for example, photographs, paintings, film images, sound files (such as speeches), obtained mainly from cultural and scientific institutions in Australia and New Zealand. Digital resources provide students and teachers with materials that are otherwise not readily accessible.

In one section of TLF's website ('Indigenous content and perspectives'), is a listing of all TLF learning objects and digital resources that relate to Indigenous perspectives or Indigenous content. This listing is continuously developed as part of TLF's continuing audit of its content, to ensure that Indigenous issues, places, histories and people are represented in a balanced manner, and that attention is drawn to them.

The Indigenous Project Plan

The Le@rning Federation's Indigenous Project Plan (2007–09), approved in February 2007 by the Ministerial Council on Education, Employment, Training and Youth Affairs Reference Group for Indigenous Education, has three areas of focus:

• Researching how Indigenous students and their teachers use online curriculum content

• Building communities of practice in the use of TLF content among Indigenous students

• Expanding the capacity of The Le@rning Federation to provide culturally appropriate and effective materials for Indigenous students in a range of educational settings.

The Indigenous Project Plan forms part of the ongoing research into the effectiveness of The Le@rning Federation's online curriculum content. The Indigenous Project Plan is consistent with the directions outlined in 'Online curriculum content investment agreement 2006–07' (MCEETYA) and 'Australian directions in Indigenous education 2005–08' (MCEETYA).

Conduct of the study

Studies by Freebody (2005, 2006) found that teachers and students respond positively to TLF content and that use of TLF content increases students' motivation to learn and their engagement in learning. The task of the present study was to explore if that finding held true in the case of Indigenous students. The study operated within the broader context of State, Territory and national initiatives to improve the retention, participation and achievement of Indigenous students in schooling.

Selection of participating schools

To select schools that had a significant proportion of Indigenous students in their enrolment, The Le@rning Federation invited all Australian States and Territories to nominate schools within their jurisdiction that would meet that requirement. Assisted by jurisdictional personnel who work as TLF contact liaison officers and by other personnel such as those from Aboriginal Education units, 26 schools were selected by

August 2007 (see Appendix 1 for the list of schools and Appendix 2 for a map of their locations).

Participation in the study

TLF's Indigenous Projects Officer organised a series of workshops for teachers participating in the study. Jurisdictional personnel with responsibility for developing the use of ICT also attended a number of them. These workshops, conducted between May and August 2007, were designed to:

- introduce TLF content (learning objects and digital resources) to the participants

- relate use of TLF content to a school's wider learning program and to effective teaching and learning practice

- provide opportunities for teachers to use TLF content in ways that integrated it into their teaching practice and into the learning focus (skills, knowledge and understandings) of their classrooms

- examine the use of the resources in the light of previous research findings about students' and teachers' experiences with TLF content

- establish that the study would examine the effect of using TLF content on Indigenous students' motivation to learn and their engagement in learning, in order to tailor TLF content so that it would increase such motivation and engagement.

Participants in the workshops included Indigenous education workers, principals, teachers and, in some cases, education consultants. Each participant received a DVD of all TLF content published to date, catalogued by curriculum area, and supplied with a search function. Each participant also received all TLF catalogues in hard-copy format. Participants were given time to explore the content and discover which content would best suits their needs.

Possession of the DVD ensured that participants were not reliant on obtaining access to TLF content via the portal of their educational jurisdiction, facility that was unavailable to some schools and, in other cases, was associated with difficulties such as insufficient bandwidth.

A related but separate set of workshops was conducted between May and July 2007 with the specific aim of increasing the take-up of Photo Album Builder for development

of learning objects for Aboriginal languages. As well, workshop participants tested TLF content for its applicability to their local curriculum interests and needs. These workshops were run in Western Australia, Northern Territory and New South Wales. In New South Wales these workshops supported the work of the New South Wales Board of Studies in linking resources in digital format with its Aboriginal Languages K–10 syllabus.

Establishing the role of participants

The TLF's Indigenous Projects Officer negotiated with the teachers at each site to establish that participants in the study would:

- select and use TLF content with classes that had a high proportion of Indigenous students

- reflect on that experience through responding to a survey (see Appendix 3 for the survey instrument)

- administer a survey of the students participating in the study (see Appendix 4 for the survey instrument)

- work with other members of their staff to extend familiarity and uptake of TLF content

- host observations of their classrooms and take part in interviews.

Schools and teachers were able to choose the learning area, skill development areas and the TLF content that best suited their context.

Supporting the participants

To assist teachers in meeting these requirements TLF provided support for them to be released from their classroom teaching schedules when they needed time for the purposes of the study; and also provided consultancy advice on selecting the kinds of TLF content that would meet teachers' and their students' curriculum needs. In addition, TLF's Indigenous Projects Officer visited sites to interview the teachers, provide support for those who were in the earlier stages of using TLF content, and provide telephone and email support.

Contact with the schools took place mainly in the second half of 2007, with many visits to school sites occurring when teachers' involvement in the study was still quit new.

Methodology

As the latest in a series of studies to explore the effect of classroom use of TLF content, this study is based on a review of the findings of those earlier studies and other related studies (see References) and has used similar methodology so as to allow comparability across time and various school populations. The following sets of data were collected and analysed:

Surveys of participating teachers and students

For this study teachers' and students' responses to use of TLF content were collected, using the same survey instruments as those used in previous studies of TLF content (Freebody 2005, 2006; Freebody, Muspratt & McRae 2007) so as to obtain directly comparable data.

Classroom observations

Classroom use of TLF content was observed and recorded by TLF's Indigenous Projects Officer during a series of site visits (see Appendix 1 for the list of sites visited).

Interviews with participating teachers

During her site visits, TLF's Indigenous Projects Officer recorded interviews with school participants as well as teachers' reflections on the workshops that were held for participants in this study.

Surveys

The survey questionnaires used for the study were the same as those designed for previous evaluations of TLF digital content by Freebody (2005, 2006) and Freebody, Muspratt & McRae (2007). Teachers and students were asked 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 Appendixes 3 and 4) were available online and in hard copy to all participating schools. Of the 26 schools participating in the study, 17 returned completed surveys.

Below, selected survey data is analysed to reveal significant aspects of:

- contexts of the participating schools
- students' responses
- teachers' responses

Contexts of the participating schools

Enrolments

Figure 1 displays the enrolment figures for the schools participating in this study.
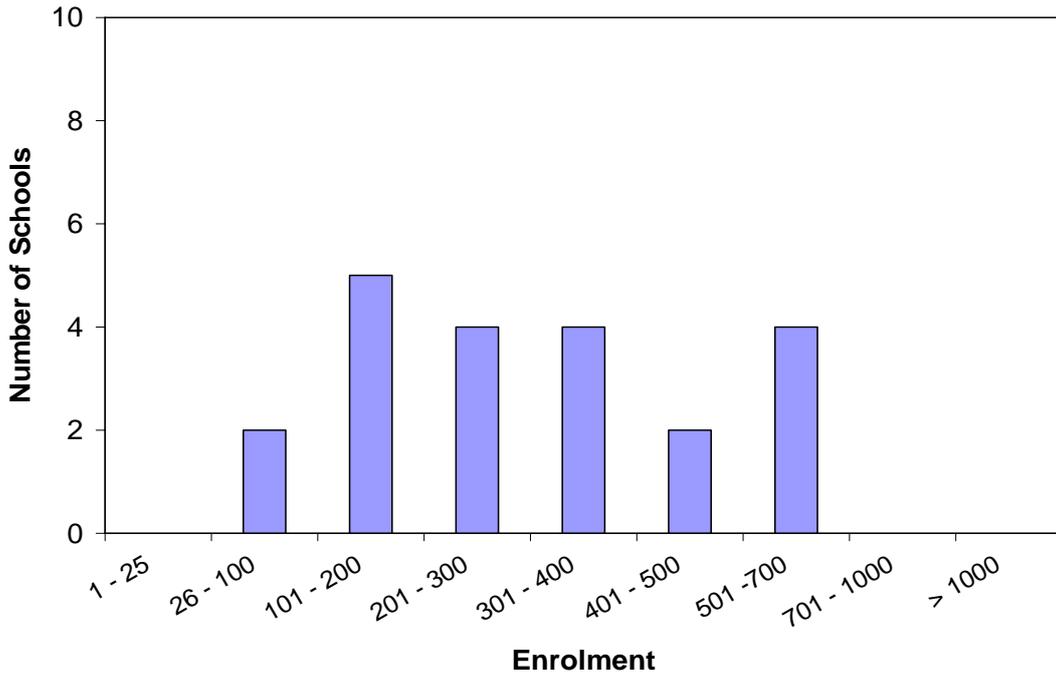
Figure 1

Language background other than English

Figure 2 shows the proportion of students in the participating schools whose language background is other than English.
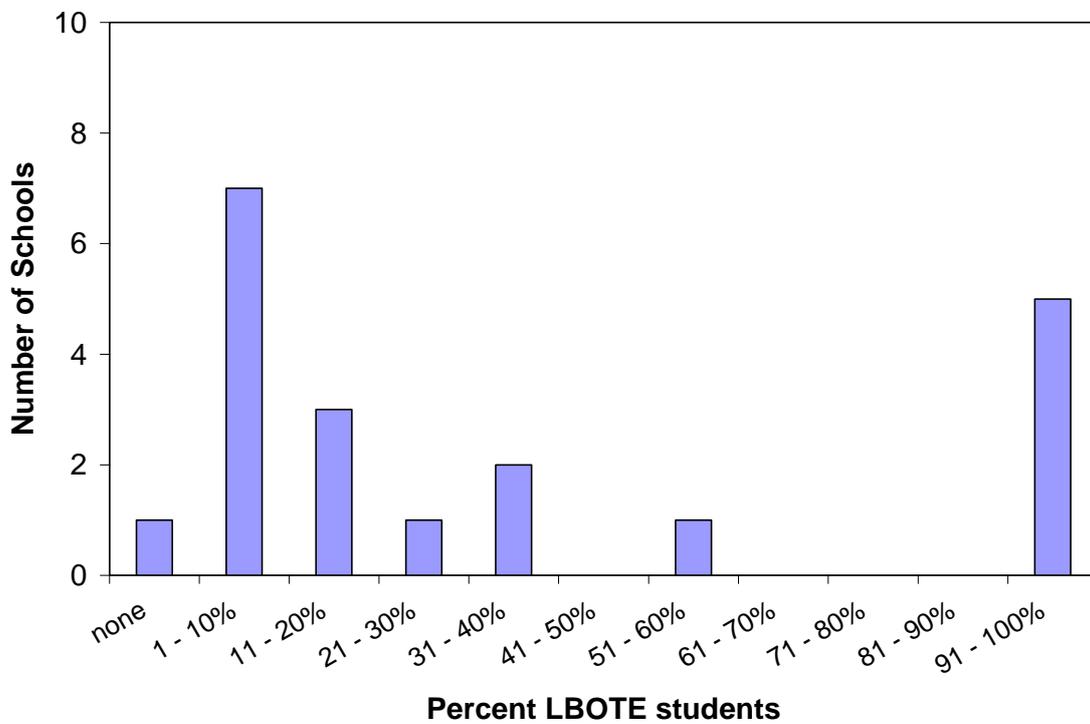
Figure 2

Socioeconomic status of students

Figure 3 shows the proportion of students in the participating schools whose families are of low socioeconomic status.
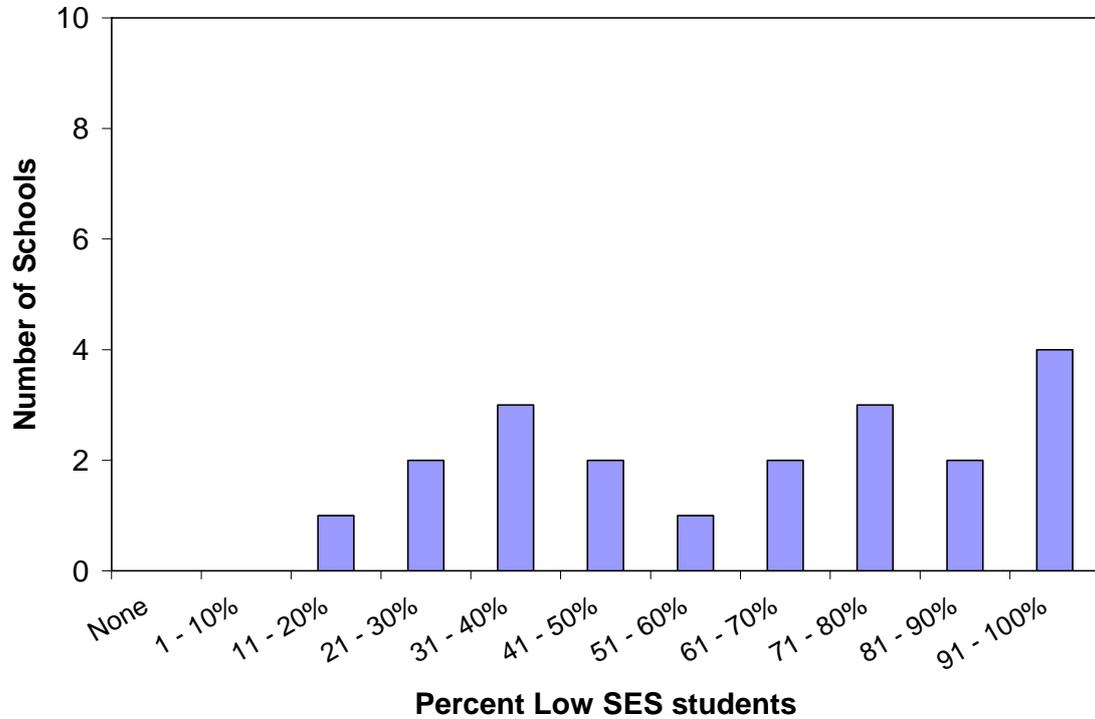
Figure 3

Note: In figures 1–3 above, if teachers from the same school disagreed about any of the school's characteristics, their responses were averaged.

Students' responses

Of the 442 students who returned surveys, just over half were Indigenous and just under half were female. They lived in a variety of settings, including remote communities, town camps and regional and urban centres. Some Indigenous students were boarding in regional centres, away from their communities. The students were in classes that ranged from kindergarten to year 12.

Figure 4 shows the distribution of the 442 responding students according to the State or Territory location of their school.
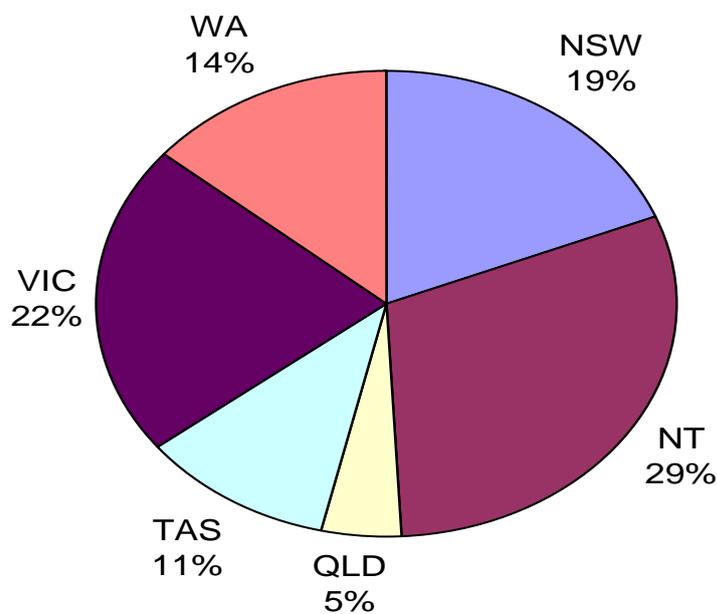
Figure 4

Figure 5 shows students' responses to the following series of statements:

- The learning object was interesting and fun.

- The learning object was easy to work through.

- The learning object helped me to think about new ideas.

- It helped when I worked with a partner.

- I needed a lot of help from my teacher.

The star (*) indicates a statistically significant difference between the responses of Indigenous and non-Indigenous students.
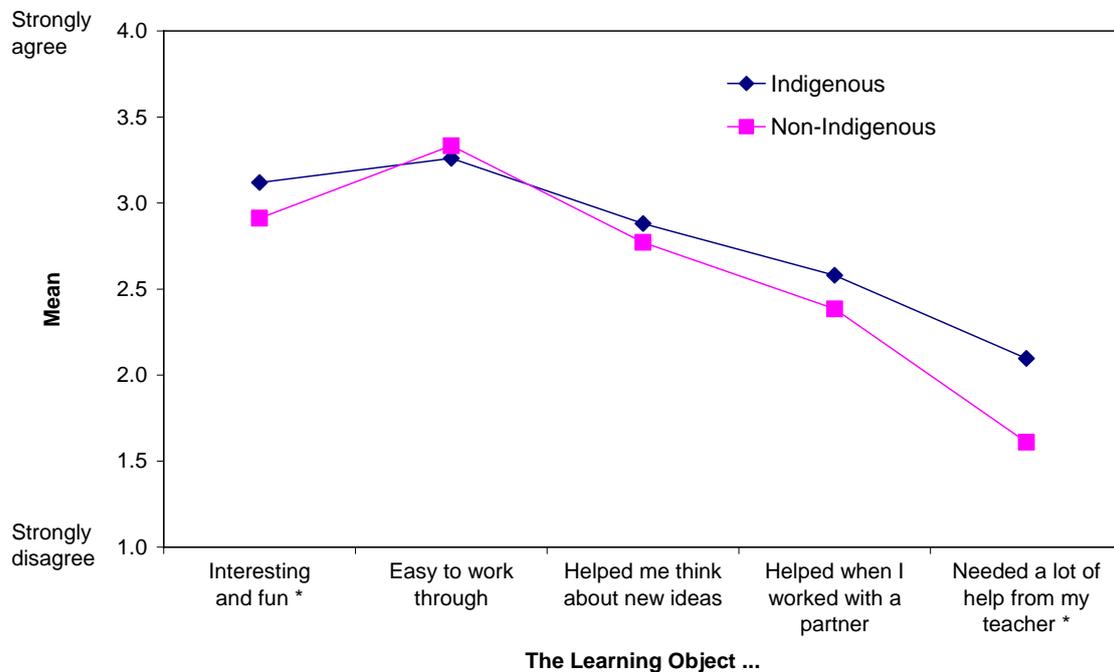
Figure 5

These responses indicate that both Indigenous and non-Indigenous students find that using learning objects is motivating and engaging. The responses follow a similar pattern to those of previous studies (Freebody 2006; Freebody, Muspratt & McRae 2007), in which the 'easy to work through' characteristic also received the highest rating. On the whole, students found that the learning objects helped them think about new ideas. A higher proportion of Indigenous students, compared with their non-Indigenous peers, reported 'I needed a lot of help from my teacher', and that 'the learning object was interesting and fun'.

Figure 6 shows students' responses to how helpful they had found the following aspects of learning objects they had used:

- 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.
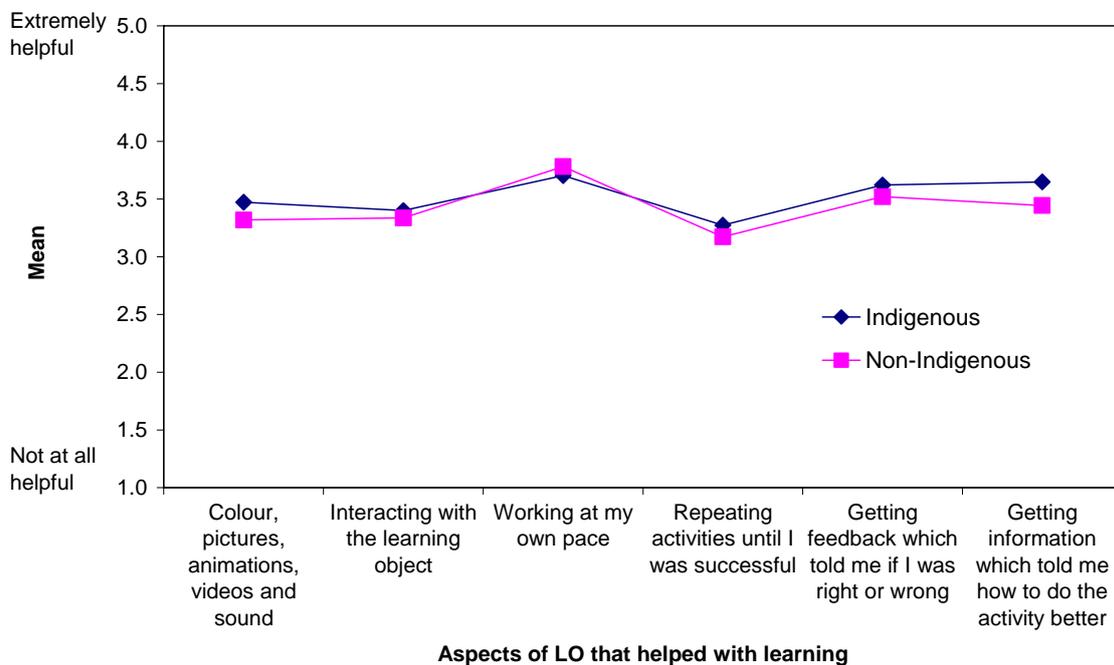
Figure 6

Students' views on the level of helpfulness of each of these aspects of the learning object closely match those reported by Freebody, Muspratt & McRae (2007) and follow the same pattern in that all rankings are above the midpoint. In the current study, differences between the views of Indigenous and non-Indigenous students are generally not distinguishable; and both sets of students gave the highest ranking to 'working at my own pace'.

Figure 7, however, shows a clear difference between Indigenous and non-Indigenous students in their access to computers outside the school ($\chi^2_{(1)} = 33.87$, p < 0.001). While 78.3 per cent of all students who returned the survey had access to computers outside

the school, 90.3 per cent of non-Indigenous students had such access compared with 67.3 per cent of Indigenous students.
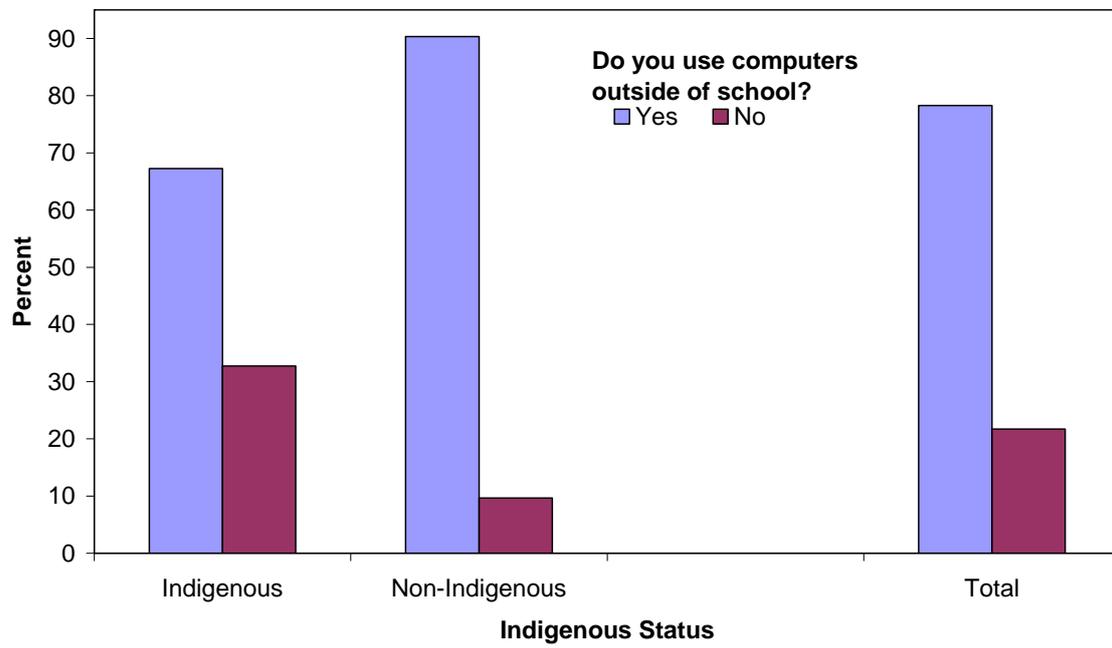
Figure 7

Figure 8 shows an even more marked difference between Indigenous and non-Indigenous students in their access to the Internet outside the school ($\chi^2_{(1)} = 39.92$, p < 0.001). While 70.1 per cent of all students who returned the survey had access to the Internet outside the school, 84.5 per cent of non-Indigenous students had such access compared with 56.6 per cent of Indigenous students.
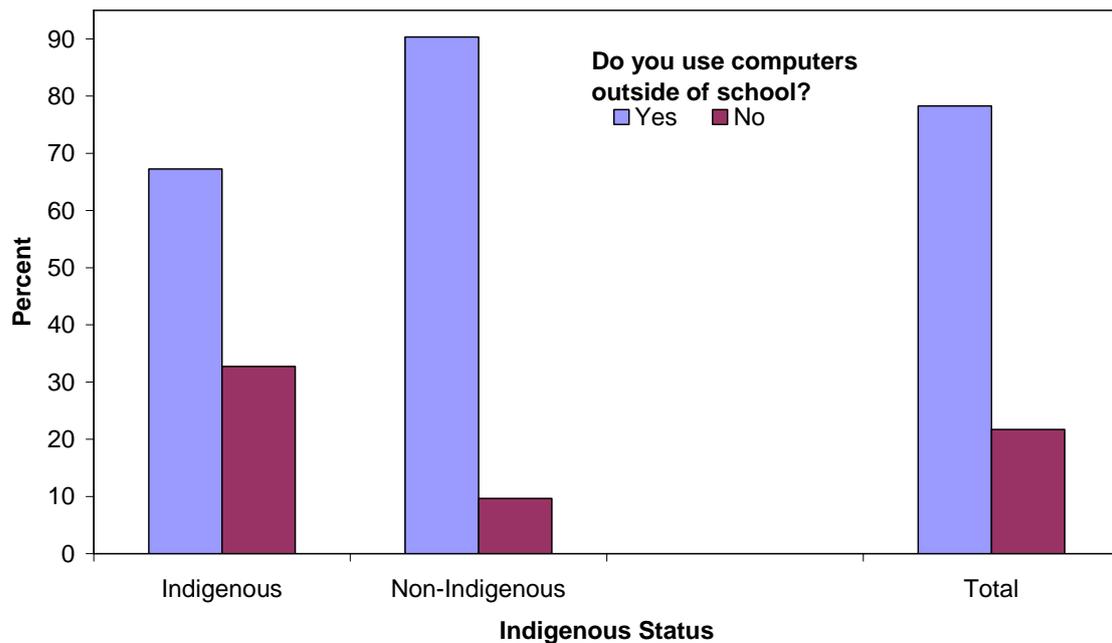
Figure 8

Of all students who completed the survey, non-Indigenous students reported that they had access to computers and the Internet at home, through their parents' workplaces, the library and at their friends' houses. Indigenous students reported that their access was through the library, at parents' or other relatives' workplaces or homes, at an Internet café, or at a youth centre or club (for example, a facility for Indigenous young people established in a youth centre).

Teachers' responses

Of the 57 teachers who returned surveys, 78 per cent were female.

Figure 9 shows that teachers who responded to this survey rated the level of helpfulness of the learning objects for their students' learning above the neutral mid-point of 4 for all five variables, a result that is consistent with the findings of Freebody (2006), although the ratings are a little lower in the present study.
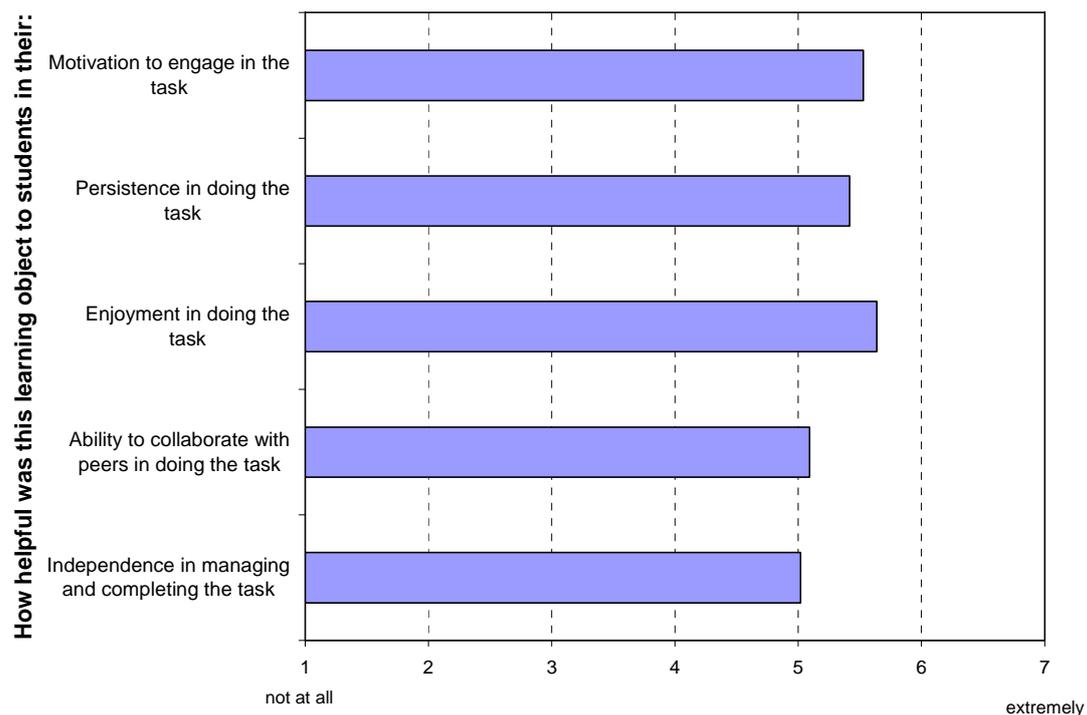
Figure 9

Figure 10 shows that teachers rate the learning outcomes of use of learning objects well above the midpoint for all the variables, a result that again is consistent with those of Freebody, Muspratt & McRae (2007) in which:

> The three composite scores have very close mean values, indicating strong overall and consistent endorsement that the leaning objects supported all 11 types of learning listed in the survey. (p 26)
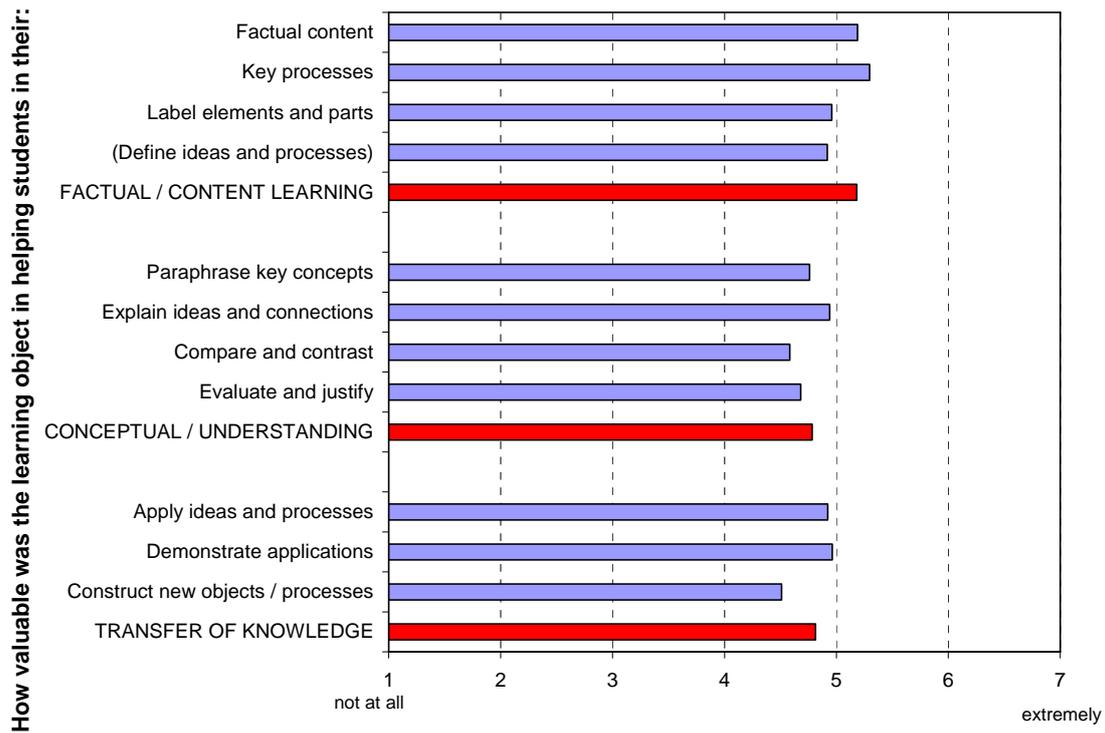
Figure 10

Figure 11 shows teachers' ratings of the usefulness of learning objects in four of the TLF curriculum domains. Again, teachers have rated each of them above the midpoint.
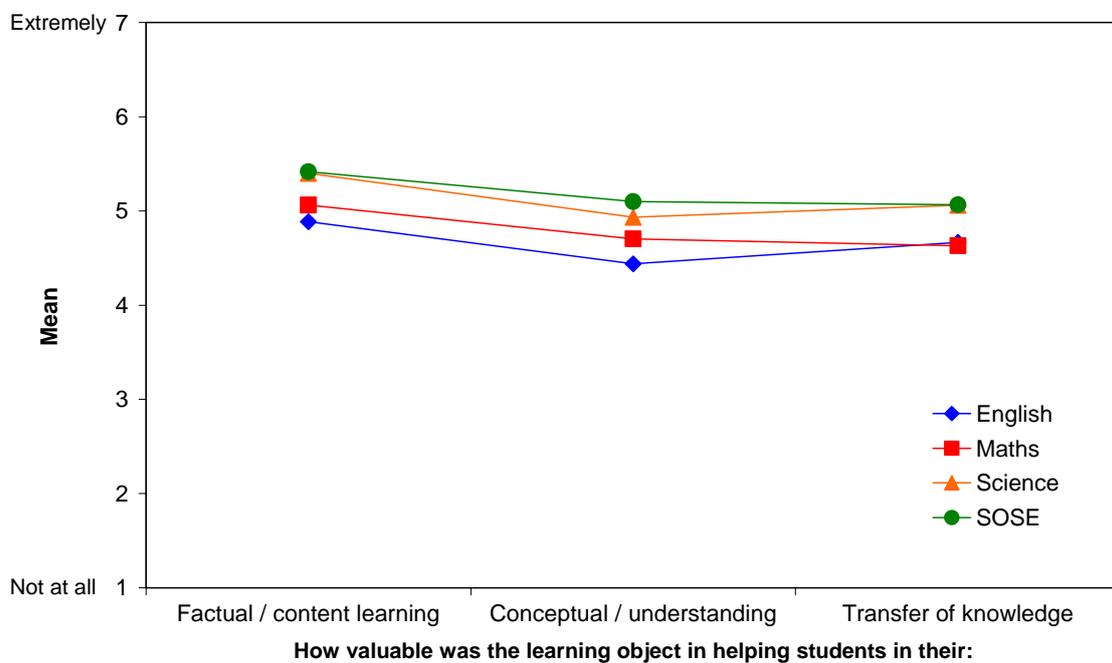
Figure 11

Teachers' ratings of the motivational aspects of the learning objects are shown in Figure 12. On average, teachers assigned the motivational value of the learning objects above the neutral mid-point of four, for each of the TLF curriculum domains. These findings are consistent with other TLF studies (Freebody 2006; Freebody, Muspratt & McRae 2007).
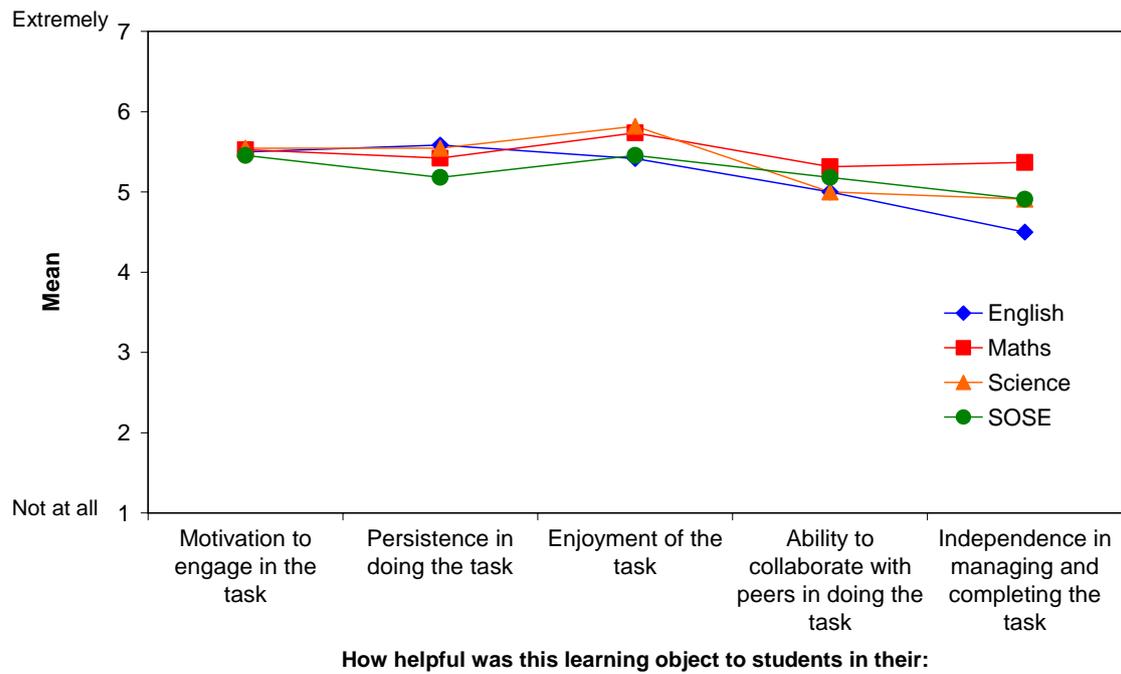
Figure 12

Figure 13 shows that the strongest reasons for using TLF learning objects reported by the responding teachers was to help students develop new knowledge, concepts and skills, and to allow students to work at their own pace and level. They reported little use of learning objects for assessment purposes. This pattern is not very different from the findings of Freebody (2006) and Freebody, Muspratt & McRae (2007).
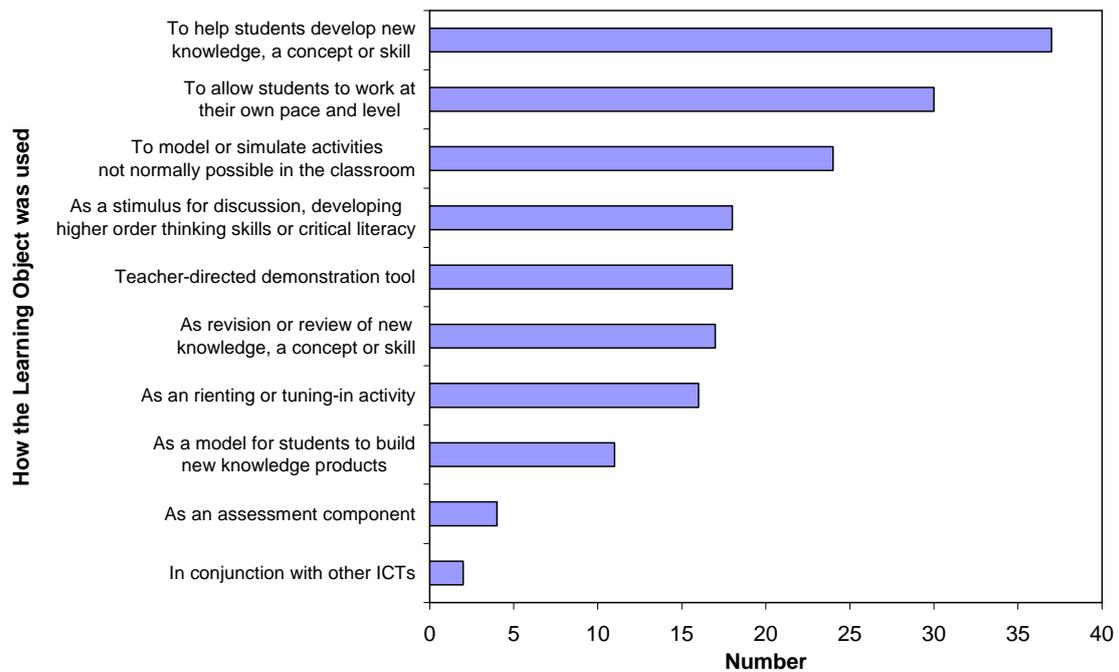
Figure 13

Site visits

During visits to participating schools the TLF Indigenous Projects Officer and the principal investigator conducted interviews with school leaders and with teachers who were taking part in the study, and recorded observations of classroom lessons.

Interviews with participating teachers

Teachers interviewed for this study were asked about the impact of TLF content on the motivation and engagement of their Indigenous students. All of them believe that using learning objects and other digital materials contributes to improved motivation and engagement among Indigenous students. They described 'motivation' and 'engagement' in terms of how students behaved while using TLF content (and ICT more generally): students concentrating, being better behaved, of (uncharacteristically) joining in the learning experience, of working independently of the teacher, and of their helping each other. The teachers regarded these aspects of their students' behaviour as indicators of their engagement in learning and motivation to complete their learning tasks.

Teachers' views on the learning objects

The characteristics of TLF content that most teachers saw as supporting Indigenous students' learning and engagement, were:

- the high level of visual communication (The teachers described their Indigenous students as visual learners.)

- the active and interactive nature of the materials. (The teachers described their Indigenous students as 'hands on' learners for whom manipulation of the mouse and the keyboard, and the rapid response to their actions, maintains attention.)

While the bracketed comments above are frequently made in relation to Indigenous students' learning styles and preferences, it is the case that *all* students can benefit from learning through a variety of approaches and techniques that prove useful for different purposes. For a description of similarities and differences in the learning preferences of Indigenous and non-Indigenous students, see the *ICTs and Learning* (2004).

Relevant, too, is the claim by Munns and Martin (2005, p 3) that, for all students, 'e'ngaging experiences' are those that make them 'think hard', 'feel good' and 'actively participate'.

A small tutorial group of three secondary-school Indigenous students were observed working with their teacher on 'Cassowary fractions' (designed for (Years 4–6). This learning object introduces the idea of equivalent fractions in the context of a Cassowary sanctuary. Through using the learning object, students develop their understanding of common fractions. The teacher was using the learning object to consolidate previous work on fractions.

These students knew the techniques of navigation, sought help from others and read aloud, without teacher intervention. The students thought that they learnt well using the learning object because:

- 'the sounds tell you when you're right' ('think hard')

- 'when you're happy, you learn things more easily' ('feel good')

- 'you have to match things' ('actively participate').

The teacher thought the students enjoyed it because:

- the experience is non-threatening and less formal

- there was an inbuilt urgency to the task – working against the clock

- the students feel free to 'call out and have a go'

- it is a motor as well as a mental process.

The students showed all three of Munns and Martin's characteristics of engagement, and did so for a sustained period of time. Teachers widely attribute improvement in students' engagement in their learning to TLF content, noting that it extends the students' time on task.

Strengths of TLF content

Teachers who were interviewed identified the following strengths of TLF content for Indigenous students:

The learning objects reinforce learning, using different processes to revisit the same content or concepts.

> I use them for consolidating learning.

Because each learning object uses a variety of activities to practise similar skills, teachers in several schools used TLF learning objects as part of a 'circuit' during which students rotated through different activities, often in mixed-ability groupings that the teachers describe as a form of peer tutoring.

Teachers of students in the early years said that the learning objects were helpful because the 'repetition improves their skills'.

Most of the teachers who had worked with TLF materials said that the learning objects encouraged students to develop skills in working cooperatively in small groups. Classroom use of digital materials can support increased collaborative and socially based learning, according to a number of teachers:

> I enjoy the sharing aspect where children discuss their findings and work together on a learning object.

When Indigenous students were observed using a learning object, whether in a small group or in whole-class activity, they gave each other suggestions, help and encouragement to work through the learning object when they were not using it themselves.

However, the learning objects were also described as **helpful in developing independent learning skills**:

> Learning objects are self-contained units that the kids can run through and work on independently.

> Students have more independence. The children were self-contained.

A number of the teachers interviewed spoke of **the capacity of TLF content to bridge the literacy gap between Indigenous and non-Indigenous students and to enhance the engagement of Indigenous students in the standard curriculum areas and frameworks**.

Many of the Indigenous students at the schools visited were learning English as their second language. Many of the schools participating in the study were giving high priority to improving Indigenous students' proficiency in English language and literacy, for which they were finding TLF content particularly helpful, especially because it is presented in audio *and* written modes. Some teachers suggested that the use of

headphones also improves the students' engagement in English language development, partly because using headphones helps the hearing of those who have long-term hearing impairment as a result of otitis media.

Many teachers commented on the value of TLF content having simultaneous audio and written modes of presenting information or instructions, as it reinforces learning for students of all ages. They also argue that students working individually and reading aloud as they use learning objects, are more ready to 'give it a go' because they can avoid any embarrassment and failure that students might experience when they are reading in front of the whole group.

One teacher said that, in contrast to many other presentations, the inbuilt language scaffolding of TLF content enables Indigenous students to 'have a meaningful educational experience', even if they are not very proficient in English language and literacy.

Teachers' views on other digital resources

Some teachers described how digital technologies could provide a powerful mechanism for Indigenous students to produce and report knowledge drawn from their own experience. The examples below give some indication of the capacity of the digital environment to motivate and engage Indigenous students. They also provide insights into the ways student production using digital technologies can bring the experiences of Indigenous students into the classroom and into their learning program. This is one way of legitimising the lived experience of the students and thereby of making connections between 'school knowledge' and the knowledge held by Indigenous students.

1   Several teachers used digital processes to get their students telling and recording their own traditional and contemporary stories with photos, text and music. They would use, for example, the Windows product Photo Story 3.

> [The students] make connections in a really visible way.

One group of Indigenous boys in a secondary-school setting showed an example of the work that they had created in their personal student file. Each student, while using the same ICT program, had created his own perspective on a commonly experienced event (a camp). The students wrote about the event and illustrated their story with digital photos. They designed the layout for their work and formatted it,

using the variety of options available to them. The files were saved and used for assessment.

This methodology makes the students' experience central to the business of schooling and some teachers argued that this was an important factor in improving Indigenous students' attendance, motivation and engagement.

2 Teachers who were experienced users of digital materials (including TLF content) for learning, presented the view that there is powerful value in using them as a routine part of teaching and learning because students create curriculum that is 'happening in real time'. They argue that the interactivity that is possible when using digital technologies, including TLF content, means that students are actively involved. For example, when they are watching each other work, they are watching someone they know, and the experience is real. Extending this to using film and photos and bringing that into the classroom is another powerful element of the immediacy that the technology can provide. For example, students used digital film of themselves playing tennis to deconstruct a player's technique. These teachers argued that while this approach was helpful for all students, it was particularly useful for Indigenous students, because it connects, in 'real time', their experience with their learning.

3 One of the schools that participated in this study is planning to extend access to its servers so that parents can receive broadcasts of, for example, sports day. This is intended to strengthen the connections between the community and the school and in particular with the parents of Indigenous students. This is seen by the staff as a positive outcome of the school's focus on ICT and learning, and also a sea change in the focus of the jurisdiction's security measures that, in the past, would have precluded this option.

4 A student who is not proficient in English language took the observer on a journey from the town where his school is located, to his country, using Google Earth. He swooped from the town along the roads that take him home for holidays. He showed the houses of his extended family where he lives in his community. He showed the sites of significance to him and his community. Apart from demonstrating his skill in manipulating this program, he was able to describe an important part of his life, without using much English language. He transferred this skill to navigating a

journey to the observer's hometown and house in a southern city. He asked questions about features he identified from the aerial perspective. He then went back to another feature in his country, sparked by noticing the city parks, and wanting to contrast them with the dry oval in his town.

5   One of the strands of the study was a limited trial of Photo Album Builder, being developed by TLF. While it has a range of uses, it was seen as potentially useful by teachers in the study as a tool for developing learning objects relevant to local Indigenous languages and contexts. TLF has provided an online guide to using the tool, the capabilities of which were well received at the workshops conducted for the schools participating in the study. Photo Album Builder, now refined through subsequent trialing, was seen by those teachers who used it as having potential to support the creation of locally relevant and up-to-the-minute learning objects.

Observations of classroom lessons: Integration of TLF content into classroom learning programs

In all participating schools, TLF content had been selected to serve the established teaching and learning program, and particularly to match the students' capacities and the teachers' goals for students in areas in which they needed further development or consolidation. The following examples describe various ways in which TLF content was observed to be well integrated into classroom learning programs.

Some innovatory measures observed, such as students in one of the primary schools using a class blog, are not described here. Further attention could be directed to scoping the various ways in which teachers use TLF content to integrate TLF content and ICT to into the fabric of their contextualised teaching and learning programs for Indigenous students.

1   Secondary Science

At a middle school in a remote regional centre the 240 students, 46 per cent of whom are Indigenous, live in the local community or in nearby Indigenous communities. On the school's staff are a Home Liaison Officer and an Aboriginal and Islander Education Worker. This school offers a Football Academy for young Indigenous male students and an Indigenous Student Leadership and Mentorship program. It also runs the Duke of Edinburgh Award program.

In a secondary years Science class, a group of all-Indigenous students (6 girls and 5 boys, all with language backgrounds other than English) were observed working with 'Tectonic investigator: Earth's structure' (designed for years 7–10). The learning object allowed the students to investigate aspects of tectonic plate theory by viewing animations and manipulating models. It formed part of an ongoing classroom program about the Earth. In this learning object, understanding and interpretation is tested through multiple-choice questions.

An Indigenous teacher aide worked in the group with the teacher. The class took place in the library, where there is a network of computers and an interactive whiteboard.

The teacher used the learning object to revisit concepts and language that the students had learnt in earlier lessons. The students could recall the meaning of the terms that they

had encountered in their previous lessons and could apply them to the current task. The teacher commented:

> You have remembered so much about magma, the composition of the Earth's core, the Earth's crust and how molten rock can turn into volcanoes.

Then, using the whiteboard, the teacher demonstrated how to navigate the particular learning object and read the instructions. During this introduction to the learning object, the students were reading from the whiteboard, calling instructions to the teacher and offering suggestions. The teacher worked quickly through any questions so that the students could move into the activity without delay. About half the students logged on immediately to the learning object while the others needed help from the staff. Students also gave each other help.

Students used the learning object's jigsaw activity, fitting the Earth's tectonic plates together and identifying the characteristics of the plates. When they had completed the learning object, the students moved to a paper-and-card version of Gondwanaland; colouring, cutting and pasting the component tectonic plates that they had manipulated in digital form. The students had to apply the knowledge that they had used in the digital activity to do this task correctly. The completed paper puzzles were placed in the student workbooks, and would be used as the basis for the next lesson and for assessment.

This teacher, who sees English language literacy as part of the work to be done in Science, used the language of the computer when assisting the students, for example, 'you need to rotate that image', and the students used their understanding of these sorts of instructions to carry on with their learning tasks.

> I demonstrate the need to read. Some of the language [in this learning object] is pretty scientific. I always use the scientific term and start using the language, scaffolding the scientific language.

This teacher commented on the following attributes of TLF learning objects:

> They are good because the students do get engaged, using methods other than pen and paper and relying on the teacher. They have built up the students' knowledge and have built their confidence in their knowledge.

2   Studies of Society and Environment in a primary school

A remote primary school of 400 students, of whom 35 per cent are Indigenous, runs an Indigenous Transition Unit for years 1 to 3, for the many students who have had no kindergarten or formal pre-school experience. This school had also made ICT a focus of curriculum and professional development in the 18 months prior to participating in the study.

As part of a broader topic of 'The Changing Community' and a sub-theme of 'How transport has changed' the teacher of a years 3–4 class had selected the 'Cobb & Co coach' learning object. The students worked in pairs, with each pair having one student with higher ability in English language literacy and one with lower literacy levels. The teacher used the learning object to integrate the Studies of Society and Environment topic with literacy development, using the learning object within 'literacy time' (90 minutes a day).

The 'Cobb & Co coach' learning object (designed for years P–2) was loaded on to the computers in the classroom, as one of several literacy activities. In this learning object, students examine a genuine horse-drawn Cobb & Co coach made in the 1860s. Images and narration explain the parts of the coach and compare the travelling experience with a similar experience today. Students load the luggage and people onto the coach, then trace the journey of coach passengers, including rest stops, on a mail delivery trip through country New South Wales. Students compare the travel experience with a similar trip on a modern bus, and then see how much faster travel is today when using transport such as trains, cars and planes.

The pairs of students talked about what they were doing, pointing at the screen, discussing what they were doing in their Indigenous language as well as in English, and gave every sign of being involved and interacting in their learning.

3   Early years Science

At a remote regional primary school of 400 students, 34 per cent of whom are Indigenous, a Transition class was operating to support Indigenous students who had no experience of kindergarten or formal pre-school prior to their joining mainstream classes. Some of the students in this class had been at school for a very short time. The

focus of the Transition class is English language literacy, numeracy and familiarity with school norms.

The teacher had selected the learning object 'Explore the weather' (designed for years P–2) to form part of a study of seasons. In the learning object, students help 'Frog' explore elements of particular types of weather, for example, wind, snow and sun, and match weather conditions (for example, sunny) with the kinds of clothing that the animated character Frog would wear. This was the first time some of the students had used any learning object.

The students worked individually on the activity on computers located in the classroom, as one of a round of activities all going on at the same time. The students showed their amusement at the cartoons. They navigated the learning object, some first-time users doing so by exploring all the options, rather then directly following the instructions. Written language is not a prerequisite for using the object, as students can navigate the object using the audio features and headphones. They used whole-word recognition when supported by the teacher. The students had fun using the object as they were listening and repeating the language. They appeared confident using the computer.

> The learning objects are good, because [the students] find that they *can* do it. The repetition is good too, because it improves their skills.

4 Secondary Science

A remote coeducational Catholic school of 200 students of whom 50 per cent are Indigenous, runs an intensive literacy and numeracy program supporting students to obtain accreditation towards mainstream vocational training. This school has a high turnover of staff. Many of the teachers taking part in this study reported themselves as confident users of technology

In a secondary-level Transition class to support Indigenous students who had little previous experience of formal schooling, the teacher used the learning object 'Create a creature' (designed for years 5–6). In this learning object, students explore the different body parts of many creatures, such as wolf, spider, cricket, scorpion, and dragonfly. Students discover the identity of a creature by matching each of its body parts with corresponding elements from the palette of body parts and by reading the descriptions.

This learning object was used as part of wider study of classification, which was contextualised by using locally well-known creatures, for example, the crocodile.

The classroom was equipped with a fixed overhead data projector and a fixed interactive whiteboard. The teacher stood on the side of the classroom, stepping forward only to underline, emphasise or illuminate a point. In each case, the teacher did this to make a connection with previous learning (for example, using concepts from previous lessons, such as 'food chain'), to reinforce a point or to highlight newly learned language (such as 'nocturnal' and 'arachnid').

The students then used the language in their ongoing engagement with the learning object, working through it as a whole group. Individual students took on the role of navigating and leading the activity on the whiteboard, illustrating what had been previously demonstrated by the teacher, for example, underlining important concepts and identifying new words for other class members. Students also read aloud, practising their English language skills. The students' findings from using the learning object were then integrated into a classification system in their own workbooks. The workbooks were used for assessment.

It is noteworthy that one of the characteristics of classrooms where students are working with teachers who are confident users of digital curriculum materials and interactive whiteboards is the shift in focus of the learning group. In primary and secondary classrooms where an interactive whiteboard was used in conjunction with TLF content, the learning object, rather than the teacher, became the focus of the students' attention. The teacher's role changed from the 'authority' to the person who acted as a point of reference, clarification and help on the side of the classroom.

5 Studies of Society and Environment in a primary school

At a remote regional primary school that serves families from the surrounding area, including some town camps, 34 per cent of the 400 students are Indigenous. A teacher of a years 3–5 class was working on a theme of 'Antarctica', using the following TLF digital resources:

- 'The Mawson Australasian Antarctic Exploration'

- 'The Albatross'

- 'The iceberg'

- 'Eskimo dogs'

which she had accessed using the DVD of TLF material supplied to all participants in the study. The digital resources were displayed to the whole class, using a data projector, after which the students then participated in a teacher-led discussion.

> I have used TLF digital resources for a study of Antarctica and for the first explorers. They were very useful. The kids are fascinated: they watched really quietly, then talked and gave their personal opinions about what they saw: what people do, what they wear and the different jobs that they do. Then they made comparisons with then and now. I promote this because the kids can't get access to an historical perspective any other way, especially in a remote school [that has] no access to museums.

> I think the kids were engaged and gained extra knowledge. When I have worked with the blackboard only, not all the students made the connections. All of them made connections after I used the TLF content. Their comprehension was evident. I also think that we are at the beginning stage [of integrating TLF content]. We need to measure the impact over a long time.

6 Primary Maths

At a primary school in a rural setting on the edge of a city's industrial area, there is an enrolment of 300 students of whom four are Indigenous. The school has developed a focus on literacy and numeracy, and also on exploring and improving students' engagement in their learning.

One of the teachers is a TLF 'champion', having used TLF content extensively across a range of key learning areas and also introduced other teachers in the region to TLF content. He demonstrates use of TLF content to teachers within his own school, at neighbouring schools through forums such as professional learning teams and also provides advice to individual teachers at times.

The use of TLF content in his teaching has dramatically influenced his classroom organisation:

> [TLF content is] the reason I am doing Maths the way I am now. It has driven my teaching. Initially I started using TLF content as an integral part of the literacy rotation activities and the learning objects proved an effective way to cater to the needs of varied ability levels. Each week I hyperlink different learning objects that enhance planned literacy activities and are directly linked with the weekly topic and language theme. Learning objects are used as extension activities for revision of skills and for presenting information in different ways.

This teacher reported that students responded enthusiastically to the learning objects and requested that he restructure the Maths program in a similar format to the literacy program. He reorganised the Maths groups to include a variety of activities that would incorporate TLF content as an integral part of the required tasks.

> The students wanted to do [Maths] like reading groups in the literacy hour.

The new structure of the Maths lessons involves:

> … more independence. The children are self-contained. Two small groups are directed by the teacher and the other children take part in a Digilearn[1] activity using a learning centre to reinforce the Maths concepts visually.

This structure included a weekly review of 'how they were doing' and involved student feedback on what they had learnt from the learning object. Students demonstrated what they had learnt through using language learnt directly from the learning object, such as 'profit and loss'.

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[1] Digilearn is an online tool that gives teachers access to digital learning resources. All Victorian government schools can now access The Le@rning Federation's online curriculum content through the Office of Learning and Teaching's new portal.

Digilearn.http://education.vic.gov.au/studentslearning/teaching resources/elearning/digilearn.htm

This teacher made this comment on his weekly planning sessions:

> I select an activity, preview it and link it to key learning areas. I print out
> information on the learning object, and cut and paste it into my program. It's
> one stop shopping!

The students take a screenshot from the learning object and write comments about what they have learnt. This is pasted into their journal, which is used for assessment purposes and is shared with parents as a means of documenting learning.

7 Structured literacy and numeracy program

At a small and very remote community school where two first languages other than English are spoken, there is a focus on integrating ICT into teaching and learning programs. The thirty students, all Indigenous, can access a satellite connection, five networked wireless laptops and eight networked stand-alone computers. The school has a scanner and is seeking funding for an interactive whiteboard.

As part of the school's high priority to community involvement, Aboriginal teacher aides who are also community members joined the principal in participating in the TLF workshop. They were particularly interested in exploring the learning objects they could use with their students, for example, 'Number trains'. The Aboriginal teacher aides and the principal plan curriculum together. Each of the aides has had ICT training (to Certificate 1 at least) and are continuing their training on a needs basis. The old school computers were put into the community, so every family has a computer at home, although they do not have Internet access. Community members and Council members can access the Internet through the school.

The principal put the DVD of all TLF content onto the school server and created hyperlinks to the appropriate learning objects on each student's class page. Each student could use their individual password to independently log on and access a variety of computer programs and tasks located on their student page. The principal reported that the learning objects are chosen on the basis of their fit with the school's structured program.

> I have set up shortcuts to learning objects on the desktop. This makes it easy for the children to access the selected learning objects. I might have four learning objects but give them choices so that they become better independent learners. [They gain] confidence using TLF content.

The block of time from the beginning of the school day until lunchtime is allocated to literacy and numeracy. Each student has scheduled time on the computers every day as part of planned activity in specific learning areas.

> All the students have 20 minutes in every hour on a computer.

This school uses TLF content and other digital materials during the block of time scheduled daily for literacy and numeracy. The principal reported that pre-school and year 1 students use the learning objects, in particular in Maths at the moment, as this is the regional focus area for targeted improvement.

> TLF Maths content is a great incentive. It's used as a reward. They don't know it is part of the Maths program. The children's grasp of number facts improved dramatically over 10 weeks using TLF content as an extension activity.

> I haven't found one yet that they can't do. I keep reminding them to read the questions and instructions. [Originally] the amount of reading was a concern but they get the older kids to help them.

8 TLF content comes to Kulkarriya Community School

See Appendix 6 for a case study of how a student-teacher integrated TLF content into a teaching program and introduced TLF to some of her colleagues during her placement for teaching practice.

Findings

Consistent with previous research (Freebody, Muspratt & McRae 2007), five common features were found to characterise those schools that were well advanced in their adoption and application of ICT, and in the integration of ICT and TLF content into teaching and learning. These features have also been noted as characterising successful approaches to implementing change in education and other social arenas by well-known researchers such as Fullan, Hargreaves and Mulgan.

Freebody, Muspratt and McRae (2007, pp 31–2) list these five features as:

- committed leadership

- a champion of the cause

- a working plan

- well-directed and high-quality resources

- a substantial and effective program of professional learning.

While the schools in this study were at various points along the continuum of implementing ICT and TLF content, they all exhibited these features to some extent. The findings of the study are discussed below in terms of these five features.

Committed leadership

Principals and other school leaders interviewed for this project regard TLF content and ICT as critical components of today's education. They value TLF content for its contribution to increased motivation to learn, engagement in learning and improved learning outcomes of their Indigenous students. One principal said:

> TLF is really good for Indigenous kids. It captures their enthusiasm. It really works for them. Often Indigenous students don't work well in groups. They can be shy and lacking in confidence. TLF is not threatening. They can experiment, have fun and succeed. They can work with others to push themselves further, to go further. There are no discipline problems and they all work well, either alone or in a group. TLF is an important part of the curriculum. It is real work. It contributes to meeting the outcomes in the Essential Learnings, for example, setting goals and targets. TLF covers so

much and it is at the teachers' fingertips. When we get the new technology, we will be pushing even further.

In 2008 we are going to interactive whiteboards and to using data projectors. [Because of the work we have already done] it won't be completely alien. It will be fantastic. The school council, which includes two Indigenous members, is very enthusiastic.

The two staff [who are driving this] are very important.

School leaders described the importance of making it easier for staff members to access digital materials for their own or for use by colleagues.

You've got to get [TLF content] on to your class webpage – so we have showed other staff how to do that.

We downloaded the TLF DVD onto the school intranet with hyperlinks, so that teachers can search for topics, can link them and then put them into their own assignment.

Champions of the cause

In some schools that participated in this study, uptake of TLF content is being led by champions of its cause, some of whom are teacher–librarians.

I see my role as teacher–librarian as resourcing the curriculum process. I have presented four times at staff meetings about TLF, given a TLF DVD to each teacher, and placed TLF DVD on the server. We are doing a curriculum map and I see that TLF resources are listed as part of the process. We have two trolleys of 10 wireless laptops as well as the computers in the library and there has been some professional development. But there are still technical difficulties – one reason for the slow take-up. I informally promote the materials with the teachers and put them on our internal infrastructure.

Teachers who championed digital teaching and learning were confident users and had some years of experience using TLF content and digital technologies. They reported that they access digital content from a variety of sites, Australian and international. They were familiar with TLF content and were developing applications that would assist with the changed pedagogies afforded by a digital environment.

Another of the champions described how she approached her work. As well as visiting other teachers' classrooms to demonstrate use of TLF content, she makes suggestions to

teachers who are on the brink of using the content and provides support to access it. She links her content suggestions to the teacher's planned program. She also works with the IT coordinator to ensure that the curriculum software and the hardware 'work'. She will focus on a particular learning area, such as Mathematics and numeracy, for placing particular TLF online curriculum on the school server.

Champions valued the high profile given to TLF content and ICT by their school leadership.

A working plan and ICT resources

The schools had varying levels of ICT provision and computer hardware. Figure 13 demonstrates that the bulk of the computers in these schools were in computer labs/libraries and this is where the majority of students accessed them. This may reflect the historical deployment of ICT in schools, but is now under challenge given the flexibilities afforded by new and emerging technologies.
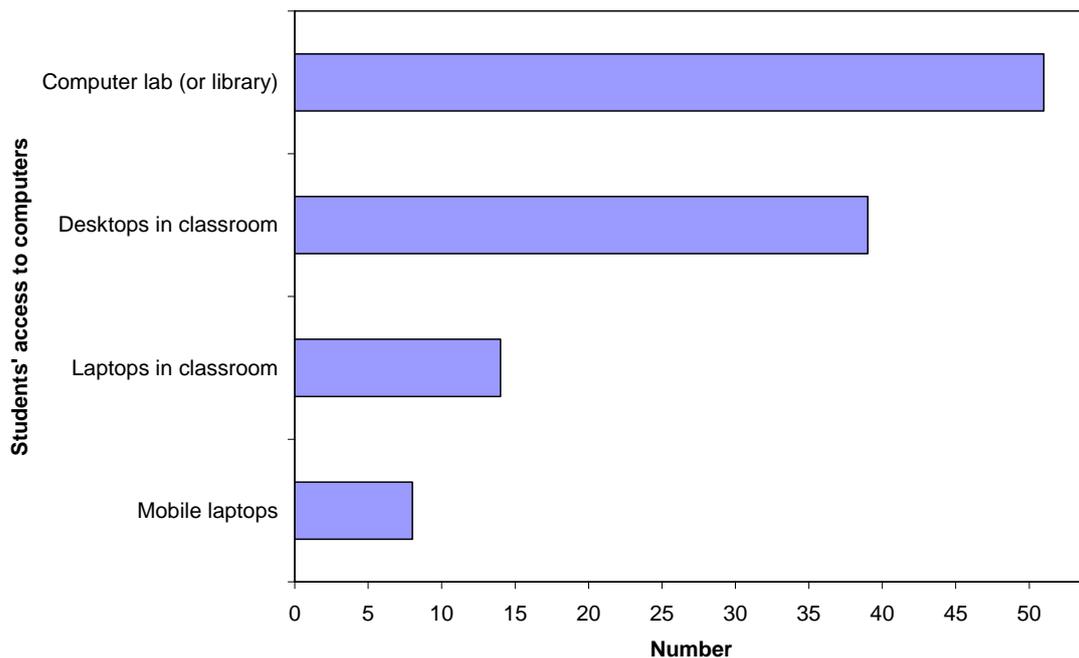
One teacher did not respond to any of the options
Figure 13

The schools participating in this study were at various stages of planning their use of TLF content and ICT in learning. Some were well advanced to the extent of having linked the roll-out of ICT to a focus on using the TLF content to deliver new ways of teaching and learning.

School leaders in this study took the view that successful integration of TLF content into teaching and learning programs relied on teachers' competence and confidence in use of ICT generally, and their access to laptops, interactive whiteboards and/or data projectors. Teachers, too, described their use of ICT and TLF content with their students as relying on 'well-maintained computers and good access'.

One secondary school leader reported that the school had increased its level of professional development in ICT as part of its three-year plan to acquire ICT resources, including interactive whiteboards. Two staff members led the integration of ICT and TLF content into the curriculum while at the same time providing technical support for the development of the school's ICT infrastructure. These teachers also provided direct support to colleagues in their classrooms or in other learning spaces. The positive impact of the plan was evident in the way the school had deployed its resources, in the way in which ICT and TLF content were integrated into the school's systems, and in the classroom practice of an increasing number of teachers.

In those schools that had not yet developed a plan, or were not yet well-equipped, school leaders talked of the need to link hardware acquisition to professional development and to increased expectations about teachers' capacity to use the technologies more seamlessly in their work.

One principal described the current state of the school's hardware as the 'major obstacle to the take up of [TLF] digital learning materials'. In developing an ICT plan for improving its computer hardware and infrastructure, this school is paying attention to integrating ICT into the curriculum. The school leadership has made ICT planing its focus for 2008 onwards. Part of the school's plan is that the two staff members who are experienced users of ICT and TLF content will play an important role in supporting the take-up of TLF content by other teachers,.

Teachers in the more remote schools in this study reported that their Internet access was limited by the technology available in their region; that speeds were slow, even when connections could be maintained. Some reported that their jurisdiction's portals did not overcome these factors.

Technical difficulties were also described as a barrier to using the school's computers regularly – barriers such as getting the network working straightaway or getting all the networked machines working at the same time. These circumstances affect teachers'

capacity to have successful experiences with TLF content and other digital learning technologies and are a factor in school leaders' planning for infrastructure improvement.

Some teachers in the study said that they would have been denied access to the TLF content they were using if they had not received the DVD of all TLF content.

Some schools were in the process of installing fixed interactive whiteboards and fixed data projectors, in classrooms and common learning areas including the library. In the schools that were using portable whiteboards and data projectors, school leaders reported their intention to change to fixed items. School leaders reported that the technical requirements of getting portable equipment in place, and ensuring that whiteboards and data projectors were synchronised, was a barrier to teachers using them.

Several of the principals linked provision of ICT resources to stated expectations of ICT use by staff members.

> Here, the staff have no option. ICT is a given, and providing teachers with their own laptops has really encouraged people to use it.

Professional development

Teachers reported varying levels of competence and confidence in ICT use, including TLF content. Some teachers reported that they used TLF content routinely, as part of their regular work with students, while others reported that they were uneasy about moving into using teaching and learning processes that were unfamiliar to them. In one school in which one group of teachers use TLF content routinely, another group of less confident users stated that they understood the opportunities TLF content could offer, admired the teachers who use digital materials, and planned to concentrate on developing their skills in 2008. In another school, the confident users of TLF content formed a 'quality teaching' group so that they could exchange ideas and experiences and thereby develop their practice, and also provide support to other teachers in the school.

This study covered all year levels of schooling from kindergarten to year 12. Of the teachers who completed the survey, there was one cluster at kindergarten (preparatory/reception) to year 4 and another cluster at years 8 and 9, while those who

reported teaching at senior secondary level were the least represented. Figure 14 shows the extent to which teachers surveyed in this study reported the frequency of their access to computers.

Frequency of Access to Computers
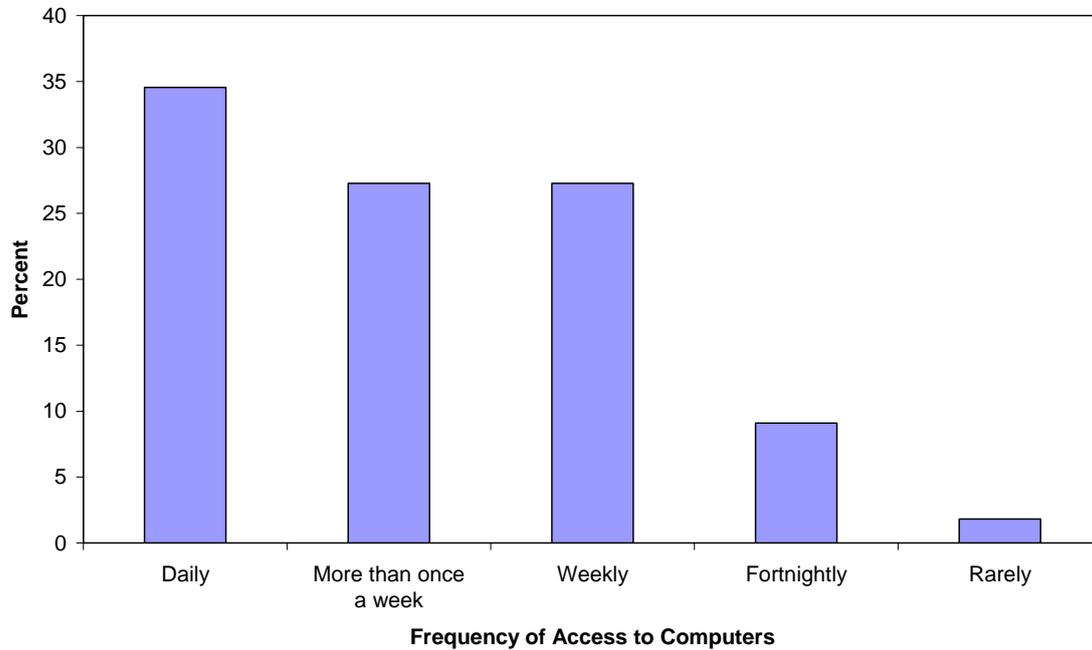
Two teachers did not respond

Figure 14

Figure 15 shows teachers' reported levels of familiarity with ICT, digital online resources and TLF learning objects, and also their reported levels of professional development in these areas. While Figure 15 shows a different pattern from that in the study by Freebody, Muspratt and McRae (2007), perhaps due to the higher proportion of quite isolated schools in the present study, teachers' levels of familiarity with ICT, online digital resources, TLF learning objects and professional development was still at the midpoint or higher.

Very familiar 7 ──────────────────────────────── 7 Extensive PD

Not familiar 1 ──────────────────────────────── 1 No PD

Standard ICTs   Digital online resources   Learning Objects
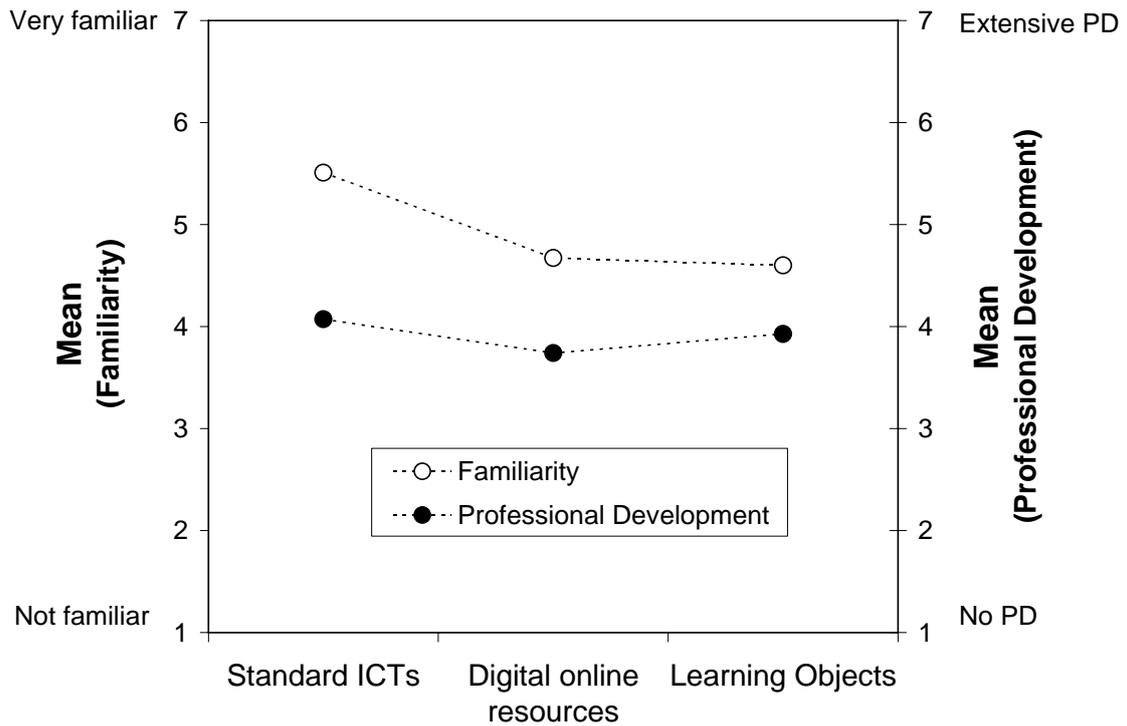
Two teachers did not respond

Figure 15

Figure 16 shows that most of the teachers responding to the survey were in their first five years of teaching and that a very high proportion of them were in their first five years at their current school.
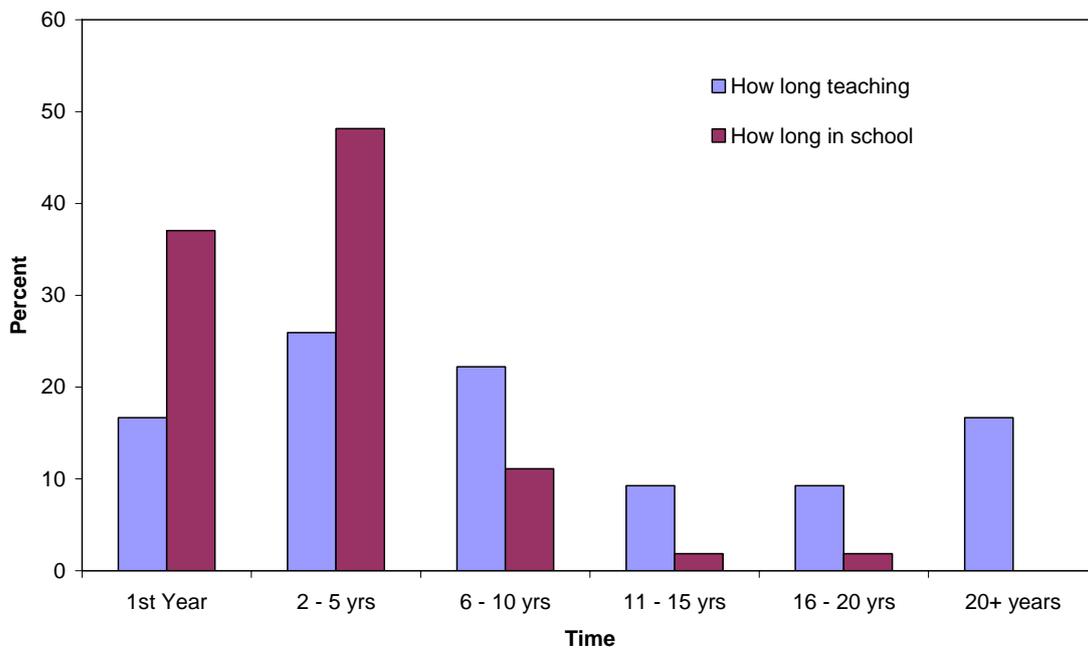
No response from 3 teachers

Figure 16

About two-thirds of the teachers responding to the survey had been teaching for fewer than 10 years. However, it is noteworthy that a number of the teachers interviewed were of mature age, although they had been teachers for fewer than five years. Three of the teachers in this study had completed postgraduate qualifications in ICT.

It is also noteworthy that the younger respondents were not necessarily familiar with integrating ICT into the curriculum or with using ICT; and that while some older teachers were not confident users of ICT or TLF content, others were. The frequent assumption that younger teachers are 'digital natives' and can apply that experience seamlessly to their teaching is open to challenge – as is the view that older teachers do not readily take up the opportunities that ICT and TLF content can provide. This, along with the data on teachers' familiarity with TLF content ICT presented in Figure 15, supports the case for undertaking explicit exposure to both operational and curriculum aspects of integrating TLF content and ICT into teaching and learning as part of both pre-service training *and* in-service professional development.

In a remote regional centre, a primary school participating in the study had developed an approach to the take-up of TLF content that the principal described as integrating its planning, leadership and professional development functions.

> The staff members have had high support with workshops and professional development. The believers [champions] then work with the others. Teachers are developing their skills. We have developed some collegiate relationships with other schools, including a lighthouse school for ICT. We have formed a professional development team [in this school] to build confidence in the [team members'] own practice.

> The team reports once a month to the staff meeting and showcases the strategies they are using. This will increase the use of technology in classrooms. We are fundraising to get an interactive whiteboard in every classroom.

> One of the staff has been involved in a program Action Learning and Learning Objects (ALLO), run by the Northern Territory department. This teacher devises programs, which use TLF learning objects, and then mentors another teacher. So we are developing a learning community.

> One teacher is a TLF User Focus Group member and [through her participation] the evaluations include Indigenous perspectives. She also has a mentor role in the school.

Of note in this example is the way in which the school had set up processes for working relationships within and beyond the school to support teachers as they increasingly take advantage of the opportunities and benefits that TLF content and digital learning environments provide to their students.

From teachers' survey responses regarding their confidence and familiarity with ICT in general (10 per cent reported that they were 'very familiar') and with TLF learning objects in particular (4.3 per cent reported that they were 'very familiar') – and also from their comments during interviews – it is clear that they see that further professional development is necessary for increasing the uptake of TLF content.

An aspect of professional development that emerged in this study as one requiring further exploration relates to use of TLF content for Indigenous education. In their knowledge of indigenous education, the teachers who participated in the study ranged from those who were highly expert to those who were tentatively grappling with the complexities. Using TLF content for the benefit of Indigenous education demands a further layer of complexity. Given this study's findings that TLF content and other forms of digital learning can increase Indigenous students' motivation to learn and engagement in learning, there is a need for more attention, within research and program areas of professional development, to developing stronger links between ICT development and the principles and practice of Indigenous education.

Many of the schools that participated in this study are located in very demanding environments, experience high turnover of staff and changes in responsibility, and are without developed infrastructures. One of the intentions of the present study was to support learning communities in the effective use of TLF content. Some examples of emerging learning communities have been referred to earlier in this report.

Based on earlier research by Vrasidas and Glass (2005), Hedberg and Freebody (2007, p 7) argue that successful integration of digital materials into classroom teaching and learning requires that ICT be integrated into teacher preparation programs. They also argue that successful implementation of ICT in classrooms requires not only access to the technologies, but also three other factors:

> It requires a careful process of collaboration between teachers and experts, successful experience in teaching with the technologies and participation in a community that provides continuous support. (p 7)

This study provides support for that position. Teachers serving the needs of Indigenous students need access to those three conditions of successful integration of TLF content into classroom teaching and learning.

Contextual factors affecting use of TLF content by Indigenous students

The following factors were identified from analysis of observations conducted and recorded on visits to school sites.

Role of Indigenous education workers

In many of the classrooms observed, Indigenous staff members worked alongside the teacher as part of a team. The extent of their engagement in using TLF content and ICT in students' learning, varied. In some schools, they supported students in using the technology as well as in the learning task, while in other schools they worked at a remove from the teaching and learning process related to using digital materials. In the schools that involved the Indigenous staff members in the integration of ICT into learning, the school leaders saw benefits for the Indigenous students and for the community.

Internet research

Many teachers reported that once technical difficulties were overcome, Indigenous students' use of the Internet for open research (for example, to find out about their favoured AFL team) proved difficult because use of search functions relies on spelling and reading proficiency in English. Teachers who had tried students on unmediated access to the Internet, so that they could learn how to use search engines and follow their own interests, described the experience as frustrating. Some teachers retreated from using the Internet in this way.

Age-appropriateness of TLF materials for Indigenous students

Teachers selected learning objects which, in their view, would meet the students at their current skill level. For students who do not have well developed numeracy and literacy skills, this frequently involved using materials designed for younger students. In some

cases this is not an issue and the students do not even notice, because the object itself provides challenges or because students have no other reference points.

> [My students] thought it was fun and they had a sense of achievement when they completed it.

In other situations, however, the students can see the topic treatment as 'babyish' for them. This highlights the need for teachers to have sufficient familiarity with the TLF content to ensure that the materials match the skills, knowledge and understandings required by the learning area, the students' capacities, and that they are also appropriate for the age group. The exercise of professional judgements is as critical to selecting TLF content as it is in other arenas of teaching and learning.

School attendance

The relationship of students' school attendance and participation to their achievement is well documented elsewhere. Teachers interviewed in this study see the use of ICT, including TLF content, as helping to increase Indigenous students' level of school attendance, because the students:

- respond well to the immediacy of working in a digital environment

- increase their confidence and proficiency in ICT literacy and in other knowledge

- have pride in the presentation of their work

- work in an environment that supports social and individual learning

- are engaged in what they are doing.

The teachers see these factors as providing an important countervailing force to those that act to exclude Indigenous students from schooling.

ICT equity and Indigenous students

Most teachers managed to select TLF content that could be used whether or not the students had high-level ICT skills. The report of the 2005 National Assessment Program for ICT Literacy at years 6 and 10 (MCEETYA 2005) [2] shows the following gaps in ICT proficiency between Indigenous and non-Indigenous students.

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[2] The Year 6 proficient standard is between level 2 and 3. The Year 10 proficient standard is between level 3 and 4. (MCEETYA 2005, p 18)

- At year 6, 11 per cent of the non-Indigenous cohort were performing at level 1 (the lowest level), while 25 per cent of Indigenous students were performing at that level. At year 10, 21 per cent of Indigenous students were still performing at level 1, compared with only 6 per cent of non-Indigenous students.

- At year 6, 50 per cent of the non-Indigenous cohort were performing at the 'proficient' level, while only 30 per cent of Indigenous students were performing at that level. At year 10, 62 per cent of the non-Indigenous cohort were performing at the 'proficient' level, compared with only 35 per cent of Indigenous students.

In this study, the responses of students to survey questions about their access to computers outside the school are supported by information from the teachers interviewed, most of whom believe that Indigenous students access PlayStation and MP3 technology, but not other ICT applications. Some teachers believe this adds to Indigenous students' high levels of engagement with the TLF content.

> My Indigenous students are more excited than my non-Indigenous students, perhaps because they have less access. They love using computers, something they might only get to do at school.

Another perspective on differences between Indigenous and non-Indigenous students' access to home computers and the Internet is provided in analysis of the 2001 census, which shows that Indigenous Australians, along with others living in remote areas and those with low English language skills, were much less likely to have access to home computers (Daly 2005). The data also showed that the proportion of the Indigenous population with Internet access at home was 'particularly low – less than 5 per cent in South Australia, Western Australia and the Northern Territory' (Daly 2005, p 4)

The only significant differences in survey responses between Indigenous and non-Indigenous students regarding the learning objects were that Indigenous students reported that they 'needed help from their teacher' and that the TLF content was 'interesting and fun' more frequently than did non-Indigenous students. The relationships between Indigenous students' need for help with TLF content, their evident enjoyment in using TLF content to learn, their poor access to computers and the Internet out of school, and their low ICT and literacy proficiency present a significant issue for the jurisdictions to manage, in the interests of improving Indigenous students' motivation to learn and their engagement in learning.

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Appendix 1: Schools participating in the study

* Indicates the schools observed during site visits.

Australian Capital Territory

Jervis Bay School (see Freebody 2007)

New South Wales

Dubbo College – Delroy Campus

Dubbo North Public School

Dubbo West Public School

Northern Territory

Alice Springs High School*

Amoonguna Community School*

Braitling Primary School*

Centralian Senior Secondary College

Gillen Primary School*

Wallace Rock Hole School

Yirara College

Queensland

Balaclava State School

Northern Peninsula Area College
(Bamaga)

Woree State High School

South Australia

Indulkana Anangu School

Tasmania

Bridgewater High School

Table Cape Primary School

Victoria

Bundarra Primary School

Portland Primary School

Portland North Primary School

Portland Secondary College

St Peter's Primary School

Western Australia

Broome Senior High School*

Kulkarriya Community School*

Djarindjin Lombadina Catholic School

St Mary's Primary School*

St Mary's Secondary College*

Wulungarra Community School

**Schools participating in Photo Album
Builder trial/workshops**

Brewarinna Central School

Bourke High School

Bourke Public School

Bowraville Central School

Nambucca Heads High School

Wilcannia Central School

Yipirinya School

Wulungarra Community School

Kulkarriya Community School

Appendix 2: Location of schools participating in the study

Schools participating in TLF trial of published content with Indigenous students

Tasmania
1. Bridgewater High School
2. Table Cape Primary School

Victoria
3. St Peters Primary School
4. Portland Primary School
4. Portland North Primary School
4. Bundarra Primary School
4. Portland Secondary College

New South Wales
5. Dubbo West Public School
5. Dubbo North Public School
5. Dubbo College – Delroy Campus

ACT
A. Jervis Bay School - 2007 Freebody case study

Queensland
6. Northern Peninsula Area College (Bamaga)
7. Balaclava State School
8. Woree State High School

Northern Territory
8. Wallace Rock Hole School
8. Alice Springs High School
9. Braitling Primary School
9. Gillen Primary School
9. Centralian Senior Secondary College
9. Yirara College
9. Amoonguna Community School

South Australia
10. Indulkana Anangu School

Western Australia
11. Kulkarriya Community School
11. Wulungarra Community School
12. Broome Senior High School
12. St Mary's Secondary College
12. St Mary's Primary School
13. Djarindjin Lombadina Catholic School

Total 26 Schools

Schools participating in trial of Photo Album Builder tool

1. Brewarrina Central School
2. Bourke High School
2. Bourke Public School
3. Wilcannia Central School
3. Hillston Central School
3. Bowraville Central School
3. Nambucca Heads High School
3. Yipirinya School
4. Wulungarra Community School
4. Kulkarriya Community School
5. ISSU Indigenous School Support Unit

Appendix 3: Survey instrument for teachers' responses

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.

Sue Thomas
Indigenous Projects Officer
03 9207 9648
sue.thomas@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   **Very familiar**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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 encyclopedia, websites, in general in the classroom?

Not at all familiar   **Very familiar**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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

No PD   **Extensive PD**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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

Not at all familiar   **Very familiar**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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

No PD   **Extensive PD**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Indigenous

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%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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:

	Not at all 1	2	3	4	5	6	Extremely 7	N/A
To know the key factual content of the topic?	☐	☐	☐	☐	☐	☐	☐	☐
To know the key processes involved in the topic?	☐	☐	☐	☐	☐	☐	☐	☐
To label elements and parts?	☐	☐	☐	☐	☐	☐	☐	☐
To state and define ideas and processes?	☐	☐	☐	☐	☐	☐	☐	☐

2. Conceptual / understanding

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

	Not at all 1	2	3	4	5	6	Extremely 7	N/A
To summarise and paraphrase key concepts?	☐	☐	☐	☐	☐	☐	☐	☐
To explain ideas and connections among key concepts?	☐	☐	☐	☐	☐	☐	☐	☐
To compare and contrast among key concepts?	☐	☐	☐	☐	☐	☐	☐	☐
To evaluate and justify key concepts?	☐	☐	☐	☐	☐	☐	☐	☐

3. Transfer of knowledge

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

	Not at all 1	2	3	4	5	6	Extremely 7	N/A
To apply key ideas and processes to new settings or problems?	☐	☐	☐	☐	☐	☐	☐	☐
To demonstrate applications to new settings or problems?	☐	☐	☐	☐	☐	☐	☐	☐
To design and or construct new objects or processes through the application of key concepts?	☐	☐	☐	☐	☐	☐	☐	☐

General

1. The learning object helped students to increase their:
Motivation to engage in the task

Not at all   **Extremely**

    1   2   3   4   5   6   7

☐   ☐   ☐   ☐   ☐   ☐   ☐

2. The learning object helped students to increase their:
Persistence in doing the task?

Not at all   **Extremely**

    1   2   3   4   5   6   7

☐   ☐   ☐   ☐   ☐   ☐   ☐

3. The learning object helped students to increase their:
Enjoyment of doing the task?

Not at all   **Extremely**

    1   2   3   4   5   6   7

☐   ☐   ☐   ☐   ☐   ☐   ☐

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 4: Survey instrument for students' responses

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)

	strongly disagree ☹☹	disagree ☹	not sure	agree ☺	strongly agree ☺☺
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?

	not at all helpful ☹☹	not very helpful ☹	not sure	very helpful ☺	extremely helpful ☺☺
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?

Not good for learning   **Good for learning**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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

**Does not make
me want to learn**   **Makes me want
to learn**

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

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

Appendix 5: Questions for interviews at school sites

1 How did you go about setting up for your use of TLF content at the school, including selecting classes that have significant numbers of Indigenous students?

   (Scope, process and deliverables for the site)

   (Support and resources from TLF for the project?)

2 Which TLF content have you used with your students?

3 What processes were established in your school to assess the impact of TLF curriculum content on your students' engagement in learning and their learning outcomes?

   What results can you report?

4 How did you embed TLF curriculum content into your program?

   (Processes of curriculum planning and delivery and related selection of materials)

   (Relationship to pre- and post-TLF learning programs)

5 What new technologies have you used?

   How do the students employ them within the school and within the classroom?

   How did using the new technologies affect the engagement of Indigenous students in learning and their learning outcomes?

Appendix 6: TLF comes to Kulkarriya Community School

This case study of use of TLF content with Indigenous students is based on observations of classroom lessons over a two-day period, on students' responses to surveys and interviews with the principal, the supervising teacher and the student teacher in the upper-primary class at Kulkarriya Community School.

The school and its context

Kulkarriya Community School, serving the Yungngora community, is located on Noonkanbah Station on the Fitzroy River in the Western Kimberley region of Western Australia. The school is an Aboriginal Independent Community School that in 2007 had 80 Indigenous students across years K to 12. The school has a strong focus on numeracy and literacy and is part of the National Accelerated Literacy Program. The school offers agricultural vocational training for the senior secondary students through the Noonkanbah Agricultural Academy, a partnership between the station and the school.

The five classes are arranged by age group: kindergarten/pre-primary, lower primary (years 1–2), middle primary (years 3–5) upper primary (years 6–7) and secondary (years 8–10). The school's staff comprises six teachers including the principal, 10 Aboriginal Education Workers, six Indigenous support staff and an administrator. The students' first language is Kimberley Kriol while the traditional languages are Nyikina and Walmajarri. All the students are learning English as a second language.

The school day begins at 7.30 am and ends at 2.00 pm. The school year is aligned with the government-sector schools in having 40 weeks of schooling and 12 weeks of holidays.

Kulkarriya Community School uses the Western Australian Curriculum Framework as the basis for its curriculum planning and delivery.

Information and communication technology at Kulkarriya

A computer room in the school was being upgraded at the time of observation. Twelve newly acquired computers have been donated to the school via schemes that arrange for organisations to donate their used computers to worthy causes. The new computers had

more capacity than those previously in use at the school. The networking time for the previous suite of computers was reported as very slow. There were also four other computers being upgraded at the time of the visit.

The computer room included several computers suitable for desktop publishing, used at Kulkarriya for publishing books in Kimberley Kriol language.

Each classroom had two computers, each loaded with several programs including Maths 300, a variety of literacy and numeracy games, and also TLF content.

Internet access is not always available due to region-wide difficulties. Internet speeds are slow. Some students had access to satellite from home and about half the students could access this for uses other than for television.

The school's equipment includes a data projector, which was used in the case study program, but not on a regular basis at other times. Each classroom also has a digital camera used regularly by both students and teachers in classroom activities.

The principal reported that some staff members were proficient ICT users, while others were not. One of the Indigenous workers was being trained in the use of PowerPoint. The Indigenous staff who work with the school's administrator manage administrative tasks using ICT.

The regular teacher of the upper-primary class believed that there was little use of computers by her students in the classroom, the computer room or at home. She believed that the literacy demands of using computers precluded students from Internet access unless they were given high levels of support. Word processing was used mainly for transcribing existing work into a format suitable for displaying student work, rather than used routinely by the students.

While ICT was not generally used for curriculum delivery, and while there are barriers to its use, the teacher and the principal believe that ICT could expand opportunities for their students. The barriers include:

- a mismatch between the technical capacity of the school to access web-based materials

- low levels of skill among staff and students

- the high level of competence required for developing classroom curriculum that uses and integrates digital learning materials.

The searchable DVD of TLF content will improve access to and familiarity with TLF learning objects, in the view of those members of the Kulkarriya school community who participated in the information sessions run by TLF staff.

The program using TLF content

The learning program was designed for the upper-primary class, described by teachers and the principal as one that had been difficult to manage since about year 4. It was planned to soon split the class into two groups, one of boys and the other of girls, to see if this improves student engagement.

In June 2007, Brooke Smalley visited Kulkarriya Community School for her teaching practice. Brooke's students in the upper-primary class had been used to accessing the computer room once a week for word processing or research tasks that used the web. Brooke used a laptop and a data projector as part of her curriculum delivery. She used TLF learning objects as part of her numeracy work, in Science and TLF digital resources in literacy.

Three programs using TLF content were observed. Brooke had been working at the school for three weeks before the observations took place.

Program 1: Can you recall?

As part of literacy work, the teacher and students worked through the learning object 'Pop star puzzle' learning object together, with the teacher using her laptop and the data projector. As students worked through the learning object, they sorted information in chronological order and worked towards creating a structured piece of writing that retold a series of events. Once this task was completed, the whiteboard was used to demonstrate and list the headings implied in the model piece of writing. Students then applied these headings to their own writing task, which was a record of events of their previous weekend or of another activity in which they had recently taken part.

The use of two sources of information, one overlaid on the other, provided the opportunity to make sure the task's requirements were made explicit to the students.

Both the class teacher and the student teacher reported that the students' approach to their writing task exceeded their expectations, which had been based on previous writing tasks without the use of a digital resource. Most of the students completed their task and the teachers observed that they spent more time on task, over an extended period of time, than was usual.

Program 2: All aboard!

This program was developed to support the students' learning of the place value of numbers, as part of their Maths program. Flash cards were initially used to connect the students to their previous work in this area and the students did concept revision. The student teacher had prepared columns on the white board, headed hundreds, tens and ones. Students were asked to determine the number represented by wooden blocks (MAB) and to transcribe this onto the white board. Once that concept appeared to be mastered, the teacher then set up the 'Number train' learning object, using her laptop and the data projector, so that all the class could see the program on the whiteboard.

The learning object 'Number trains: numbers 90–120' includes audio instructions and a demonstration of the 'game', building a number train. This learning object is designed to provide experience in sequencing numbers correctly, as well as in number and value recognition. The teacher began by using the learning object game to question the class about the value of numbers as they were revealed in the game, as well as rehearsing the way the game worked. Each student then built their own number train in turn, using the computer, while the class engaged with the process through the data show display on the whiteboard.

The next activity involved the students writing the three columns on their individual whiteboards and transcribing the number values of three dice that were thrown: each dice represented hundreds, or tens or ones.

It was observed that the learning object increased the students' engagement with the task. Prior to using the object, the students were quiet and not very attentive. Attention to the teachers' voice and flashcards was not sustained by the whole group, and attention levels seem to fluctuate among the individuals in the class.

However, once the learning object was being used by the students, their demeanour changed. The focus of attention was not the person, but the animation projected on to

the whiteboard. As each individual participated, the whole group provided suggestions and maintained focus on completing the task correctly. If a student appeared hesitant, other class members provided support and direction. Some of the students chose to build their train using the computer screen rather than the whiteboard. In these cases, the students using the computer did not pick up the cues provided by other classmates and the activity became rather more solitary than when the whiteboard was the focus of all the students. All the students successfully demonstrated their understanding of number value through the use of the learning object.

This learning was applied in the following activity, where dice were used to create numbers. The following day, the students revisited the concepts and, according to their teacher, showed that their understanding had developed through the previous day's activities.

Program 3: It's time to react

The learning object 'Inter-galactic cook-off' was used as the link in a series of learning experiences developed around the Science stream Natural and Processed Materials, (Interactions and changes), level 3 of the Western Australian Curriculum Framework. The learning object was used to provide students with the opportunity to explore the difference between physical and chemical changes by mixing ingredients and comparing results. The aim of this learning object is to identify five reactions that cause a chemical change.

In the lesson observed, a small group of students worked together through the learning object, while the remaining students were hosting visitors in the classroom. The group of students worked together cooperatively, discussing and putting forward their ideas as they worked through the learning object together. The students used two ways of predicting the reaction process. Either they reached a consensus about the predictions, or they recorded a mix of predictions, so that everyone's voice was heard. The students then observed what happened. On several occasions, there were moments of excitement as they watched the reaction. Students recorded their observations, then explained to others what they saw and compared the results to their predictions. If the result of the reaction was a physical change, for example, 'it went bumpy, lumpy and thick', the teacher prompted the students to think about the properties of the materials they had chosen to test. When the students were correct in their predictions and achieved a

chemical change, they were excited by their achievement. The students tested seven reactions in order to find five chemical changes. A lesson plan using this learning object can be found at the end of the case study.

'Inter-galactic cook-off' was used again in a later lesson where the whole class participated. The teacher reported:

> Students who had used the learning object previously were able to take control and guide the other students through the learning object. They used their prior knowledge and experience to lead discussions about the properties of the different materials and how they would react. I refrained from providing guidance or direction, as I didn't want to deter the initiative being taken by the students guiding the discussions, but provided it when it was needed. The students maintained lengthy discussions about what would happen and they showed confidence in their reasoning, as they worked through the learning object. Their interaction and engagement was very positive and a rewarding moment as all students were motivated to participate and have their say.

'Inter-galactic cook-off' was integrated into a two-week program, with 5–7 hours a week spent on this learning area. The students undertook a range of learning activities (freezing to confirm the changed state of liquids). Other learning objects embedded in this Science program were 'Types of matter: solids, liquids and gases', 'Kitchen chemistry: experiment level 1' and 'What is the world made of: sorting matter'.

Along with the use of her laptop, data projector and learning objects, the teacher used 'flipcharts' (software that is used in conjunction with interactive whiteboards and interactive tablets) to help implement her programs. An interactive tablet was used occasionally. However, due to some technical issues, effective use was limited. The teacher said:

> Using flipcharts was very beneficial to me in my planning and in conducting my lessons. They are a great way to engage students as they are focusing on the content being projected and generally there would be an activity which required them to interact and manipulate the content (for example, searching for and uncovering pictures or words, sorting information). Not only are flipcharts good for motivation and engagement, but they allow you to easily revisit ideas from the previous lesson, then move forward to develop and deepen ideas and understandings. Anything can be recorded

> and revisited (pictures, tables, explanations, questions) rather than them
> being wiped off the whiteboard and never to be seen again.

The flipcharts were used to capture the learning as they occurred and therefore provided a scaffold from the students' existing knowledge and understanding to the new material. Students build their knowledge and see that they are building on it.

> On the last day of term, parent–teacher interviews were being conducted
> and school ran as usual. Students were given the choice of several activities
> in the classroom and this is when my laptop made its final appearance at
> Kulkarriya and the students jumped on straight on it.
>
> 'Miss, can I do the one with solids, liquids and gases?'
>
> 'I want to the number trains.'
>
> I was pleasantly surprised to see the students revisit the learning objects
> with such motivation.

One of the outcomes of Brooke's involvement in using TLF content was her development of 'How to Guide Linking Learning Objects', a document that is now available to users of TLF content. It shows teachers how to create a hyperlink to a specific learning object or digital resource.

Brooke says she finds using digital resources engaging. She believes that she leans towards these resources because she is a member of the digital generation. She finds that her students lean towards them too. She thinks that it would be helpful if universities were aware of TLF content and could support student teachers experimenting with the resources, before they have to 'start from scratch' in their first teaching placement.

Equally, Brooke found the professional exchange of experimenting with TLF content and integrating it into her practice, along with the feedback and supervision of an experienced teacher, rewarding.

Lesson plan

Year level: 6–7

Group size: 15 students

Lesson duration: 60mins

WA Curriculum Framework:

      Learning area: Science   Level: 3

      Content: Natural and Processed Materials

      Learning outcomes

      Different materials have different properties and these properties can be related to their uses > Structures, properties and uses;

      Interactions between, and changes to, materials > Interactions and changes

The students

Students in Upper Primary at Kulkarriya Community School have been learning about different states of matter and the different properties they possess. Students have been exposed to new scientific vocabulary such as 'solid', 'liquids' and 'gases' in order to classify and describe different objects found within their environment. Hands-on activities were used to introduce this concept, where students were able to hold, feel and describe a set of different objects based upon their physical characteristics. An apple, for example, is 'hard, smooth, round, shiny'.

Upper Primary has also been learning about the different ways in which particles behave within each different state and have used the learning object 'Types of matter: solids, liquids and gases' (LO ID 5821) to help develop this concept.

Students have conducted several investigations to see what happens to certain objects when they are either heated or cooled, and have related this to the way particles act. They are now starting to investigate the difference between a physical change and a chemical change.

Lesson context

Students will work with me as a whole class using a laptop computer and a data projector. A small group of students who have previously explored this learning object ('Inter-galactic cook-off'), with my support, will be asked to guide the rest of the class through the learning object. Other students will have the opportunity to operate (drive) the learning object while receiving assistance and feedback from peers.

Lesson objectives

• Students identify five reactions that cause a chemical change.

• Students explore the difference between physical and chemical changes by mixing ingredients.

• Students record predictions and results in electronic notebook.

• Students compare results in electronic notebook and produce report.

• Students describe the difference between a physical change and a chemical change.

Equipment required

• Laptop

• Data projector

• LO ID 41 'Inter-galactic cook-off'

> The learning object provides students with the opportunity to explore the difference between physical and chemical changes by mixing ingredients and comparing results. The aim of this learning object is to identify five reactions that cause a chemical change that can be entered in the competition to become 'Grand Celebrity Chef'. Students will use the following skills: predicting, observing, analysing and comparing.

Introduction

Play game: How will you move?

This game is used as a warm-up activity and to revisit prior knowledge. All students in the class are standing in a large open space and will act as particles. The teacher calls out different objects (a solid, liquid or gas) and students must form different particle

structures to resemble that of the object named. For example, when the object 'apple' is called, students will stand close together and bounce in one spot to represent how particles behave in a solid structure.

This concept of different particle structures was introduced in 'Types of matter: solids, liquids and gases' (LO ID 5821), a learning object that provides visual representations of the structure in ways that enable students to transfer their understandings to this game.

Main activity

Inter-galactic cook-off

1   Identify five reactions that cause a chemical change.

2   Select different cooking materials to test. Test selected material by adding another material.

3   Record prediction of what will happen when the two selected materials are mixed together. Discuss the properties of the materials selected and what might happen. What will you see?

4   Observe what happens, and record what was seen when the two selected materials were mixed together.

5   Record an explanation of why you think this happened. Repeat steps 2–5 to identify five reactions that cause a chemical change. Print a report, showing five chemical changes.

6   Discuss why some materials reacted with certain things and why others did not.

Assessment

Once students have identified five reactions that caused a chemical they are able to print their report. These printed reports can be used as a stimulus for further discussion and assessment purposes.

Assessment criteria	0 Not evident	1 Low	2 Medium	3 High
Ability to describe properties of materials selected.				
Ability to classify materials as a solid, liquid or gas.				
Ability to use appropriate language to describe and record predictions.				
Ability to use the properties of materials to justify and explain their prediction				
Ability to use appropriate language to explain and record what was observed during experiment.				
Ability to explain why a reaction did/did not occur, using materials properties to justify explanation.				
Ability to define the difference between a physical change and a chemical change.				
Ability to produce a report that describes 5 reactions that cause a chemical change.				

General comments

Links to future lessons

Students will have the opportunity to participate in hands-on activities to further investigate the difference between a physical change and a chemical change. They will model their investigations on those they conducted in 'Inter-galactic cook-off'. Cooking activities will provide opportunities for reinforcement of these important conceptual understandings.