

CLA04233

Using digital content in authentic curriculum P-10 contexts: what do teachers have to say?

Australian Association for Research in Education Conference

Melbourne, Australia

29 November 2004

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Abstract

Lack of easily accessible quality digital content has been identified as one reason for little sustained take-up of Information and Communication Technology (ICT) in schools (MCEETYA, 2003). The Le@rning Federation (TLF), an initiative of the Australian Government, the Australian states and territories and New Zealand has been charged with filling this void. TLF online content in the form of multimedia interactive learning objects, purpose-built for curriculum priority areas for P-10 students, are currently being released in stages. Trials and implementation reviews exploring teachers' experiences using the materials in authentic classroom contexts are underway.

This paper presents early findings from a number of reviews undertaken across Australia in 2004 in which participating teachers explain how they integrate the new Science, Mathematics and Numeracy and Literacy resources into existing curricula and their views about the contribution of the materials to teaching and learning. Qualitative and quantitative responses collected online from teachers in several education jurisdiction reviews have provided opportunities for meta-analysis. To date, teachers indicate that the new materials are highly engaging for students and relevant to their curriculum frameworks. However, challenges relating to accessing the materials and professional learning needs of teachers are also apparent.

Introduction

Despite considerable investment of resources in ICT (hardware, software and connectivity) across education systems and sectors, both in Australia and elsewhere, uses of new technologies to support teaching and learning is limited. The most commonly used applications in schools remain the use of word processing and the Internet for seeking information (Meredyth, 1999; Becker, 2001). Neither word processing nor Internet searching, however, necessarily contributes to enhanced student learning. While other applications such as spreadsheets, databases, multimedia presentation tools and communicative technologies can offer a greater range of opportunities for engaging and supporting students in the learning process, their use also is not widespread and often operates at a relatively low cognitive level. (Jonassen, 1996). Furthermore, there are equivocal findings from the vast research literature about the positive effects on learning when students do use computers (Schacter, 1999; Cuban, 2001). Reasons for the limited sustained integration of ICTs in classrooms by teachers are well documented (Meredyth, 1999; Becker 2000, Newhouse and Trinidad et al 2002). Barriers to take up include: lack of release time to learn/practice/plan ways to use ICT; lack of class time scheduled for computer use; insufficient and unreliable technology; lack of good software and other digital curriculum content; lack of both technical and curriculum support for integration; lack of administrative support.

It is not surprising then the Australian Department of Education, Science and Training (DEST) report states in *Raising the standards* (2000):

The need to better exploit the teaching and learning potential of ICT is widely accepted and supported. However, to date, this potential has not been widely realised in any significant way, particularly the power to transform how, what, where and why students learn what they do.

It was within this broad context that in 2001, the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) comprising State, Territory, Australian Government and New Zealand Ministers of Education established the ICT in Schools Taskforce. The brief of the ICT in Schools Task Force is to

- provide strategic advice on the use of information and communication technologies to support teaching and learning
- provide leadership to the Australian education community in the effective use of information and communication technologies
- advance the use of information and communication technologies that meet the needs of education
- initiate, implement and support national projects related to the use of information and communication technologies in education

- provide a forum for Australian education representatives to share information and advance collaborative initiatives in the use of information and communication technologies in education

Furthermore, in recognition that one of the barriers to take-up of ICTs in Australian schools is the lack of quality digital curriculum content, MCEETYA established The Learning Federation (TLF). In collaboration with the ICT in Schools Task Force, the TLF was charged with producing online curriculum materials to be made available free to all students in Australian and New Zealand schools with these objectives:

- produce a pool of materials in areas of high priority, namely
 - Innovation, enterprise and creativity – all year levels
 - Languages other than English (Chinese, Japanese and Indonesian) – all year levels
 - Literacy – Years 5-9
 - Numeracy and Mathematics Years P-9
 - Science Years P-6 and Years 9-10
 - Studies of Australia – all year levels
- produce the online material within a framework for distributed access to state and territory gateways
- develop online materials that:
 - represent the best education available or conceivable in the twenty-first century
 - will engage teachers and students in the construction of learning and in creative and critical thinking
- support the growing innovations, enterprise and knowledge priorities of state, territory and Commonwealth governments in Australia
- encourage a marketplace for high quality public and private online curriculum content
- engage students in learning in new ways and accessing innovative learning environments
- prepare students for a world in which online activity is critical to communication and productivity
- support teachers in developing enterprising education for the 21st century (Phase Two Plan, The Learning Federation 2003 2006).

On-line curriculum content

For The Learning Federation, 'online curriculum content' means interactive learning activities which could include text, graphics, audio, animation, which are linked to specific educational outcomes. Such materials are purposefully designed to exploit the use of information and communication technologies (ICTs) to enhance students' learning experiences. These materials, also called learning objects

- are one or more files or 'chunks' of learning material
- are reusable – a single learning object may be used in multiple contexts for multiple purposes
- can also be used as components of a topic or unit of work alongside other digital and non-digital resources and tools
- are accessible from digital repositories and are referenced, located and accessed by their metadata descriptors

The learning object model, rather than integrated learning systems, courseware, drill and practice software or Internet sites, was chosen to best match the brief given to The Learning Federation by MCEETYA (see McRae, 2000 for a discussion of the options for building online content).

Drawing on recent research on how children learn and how teachers can facilitate their learning, the TLF has established educational soundness specifications which guide the design, development and quality assurance processes throughout the construction of the suite of learning objects. The TLF's *Achieving educational soundness in the digital age* (Atkins, 2003) has four key principles:

Learner focus – this requires that the needs of all students be addressed, taking account of differences relating to gender, socio-economic conditions, ethnicity, culture, geographic location

and physical and mental well being. The learning objects are also required to address the spectrum of learner ability within specified developmental periods and year levels.

Content integrity – this requires the content (knowledge, skills and ways of communicating in a knowledge domain) be accurate, both in presentation of fact and in terms of the scaffold on which the content and user interaction which provides constructive feedback to the user is built.

Usability – the interaction design must be intuitive and consistent and allow students to be actively engaged in constructing meaning through their interaction with the content.

Accessibility – learning objects need to comply with accessibility standards for students with disabilities and for rural and remote communities; they also should provide specific language support for students whose first language is not English and appeal to those at risk of not meeting national literacy standards.

Approach to learning design

The TLF approach to learning design is informed by constructivism. Constructivism asserts that we learn through a continual process of constructing, interpreting and modifying our own representations of reality (Jonassen, 1994). The suite of TLF learning objects thus includes inquiry-based and problem-based activities representative of real-life contexts. Students are required to frame questions and hypotheses, locate, organise, evaluate, synthesise and report conclusions. Cognitive support and embedded constructive feedback to students about their learning is provided as they explore, interact, make decisions, and consider a range of perspectives offered by the content.

The learning objects produced by the TLF, are clearly focused on not only establishing instructional design values which exploit the affordances of new technologies but which are grounded in supporting student learning. Of critical interest now is to explore to what extent the new Australian-New Zealand built online content does support teaching and learning and what conditions are necessary for their successful take-up.

School trials

Between June 2003 and November 2004, the TLF has released more than 300 learning objects in key curriculum areas (P-10) for trial use in schools built to the educational soundness specifications and learning design principles described in the previous section. Online content now available includes resources for Science, Mathematics and Numeracy, Literacy for students at risk, Studies of Australia and Languages other than English. (Chinese, Japanese, Indonesian). Throughout 2004 the content has been trialled in a range of classrooms across education jurisdictions, sectors and settings in Australia. The focus of this paper is to present some of the teachers' experiences and views from these early trials. In particular, it explores how teachers incorporate the new digital content into their teaching practice and their views on its contribution to their teaching and to student learning. It will connect these teachers' experiences to the broader issues canvassed above: will the availability of pedagogically sound, interactive, multimedia learning objects increase the likelihood of more teachers' integrating ICTs into their teaching practice? Do the learning objects promote a broader range of opportunities for extending thinking in a particular domain?

Data collection

School trials conducted by individual jurisdictions, sectors and The Learning Federation have used a common online instrument *Using Learning Objects -Teacher Reflections* (see Attachment) to assist their data gathering processes. Depending on the nature of a particular trial, other data collection methods were also employed, including student surveys, classroom observations, and teacher interviews. For the purposes of this paper, only findings from teacher surveys are reported from these early trials. Each of these trials differed in purpose and scope, however they all used the common data collection tool which enabled aggregation and meta-analysis of results. The survey elicited both quantitative and qualitative data.

Responses

This paper includes 114 Teacher responses about learning objects they have used in classrooms.

Table 1: **Responses from jurisdictions**

Queensland	49%
South Australia	31%
NSW	14%
Victoria	6%

Table 2: **Responses come from sectors**

Government	74%
Independent	18%
Catholic	8%

Access to learning objects

69% accessed learning objects from a digital repository or Learning Management System
31% accessed learning objects from a CD ROM

Teacher use of data projector to screen learning objects for class

46% of teachers used a data projector; 54% did not.

Figure 1: Responses to learning objects by targeted curriculum areas

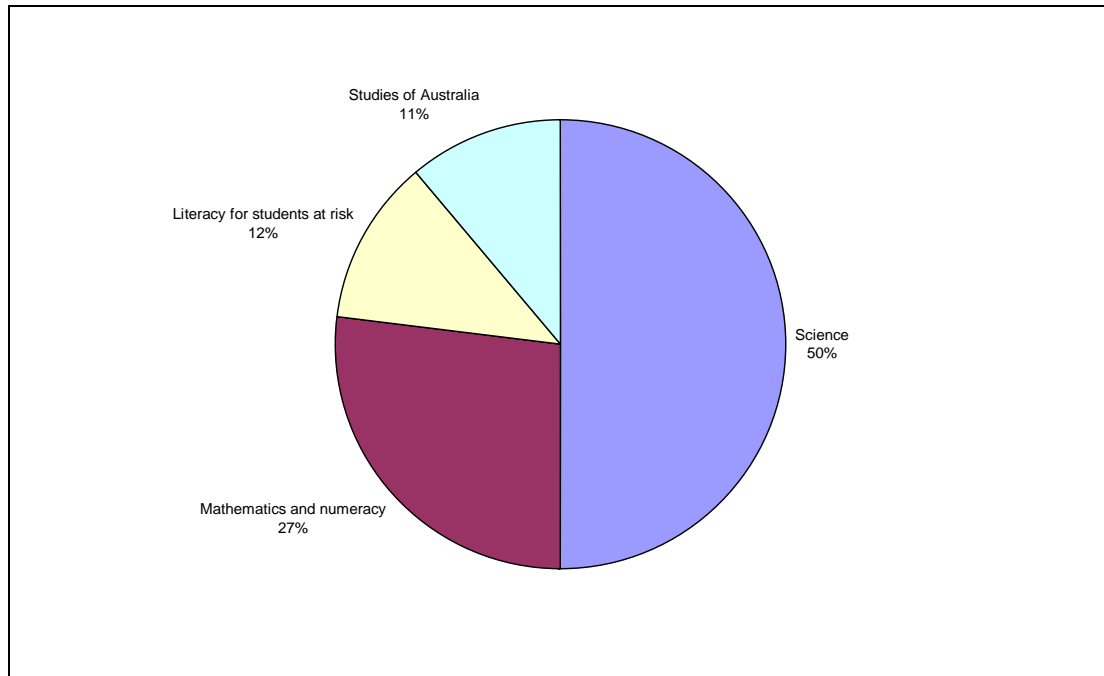


Figure 2: Teacher uses for learning objects - %

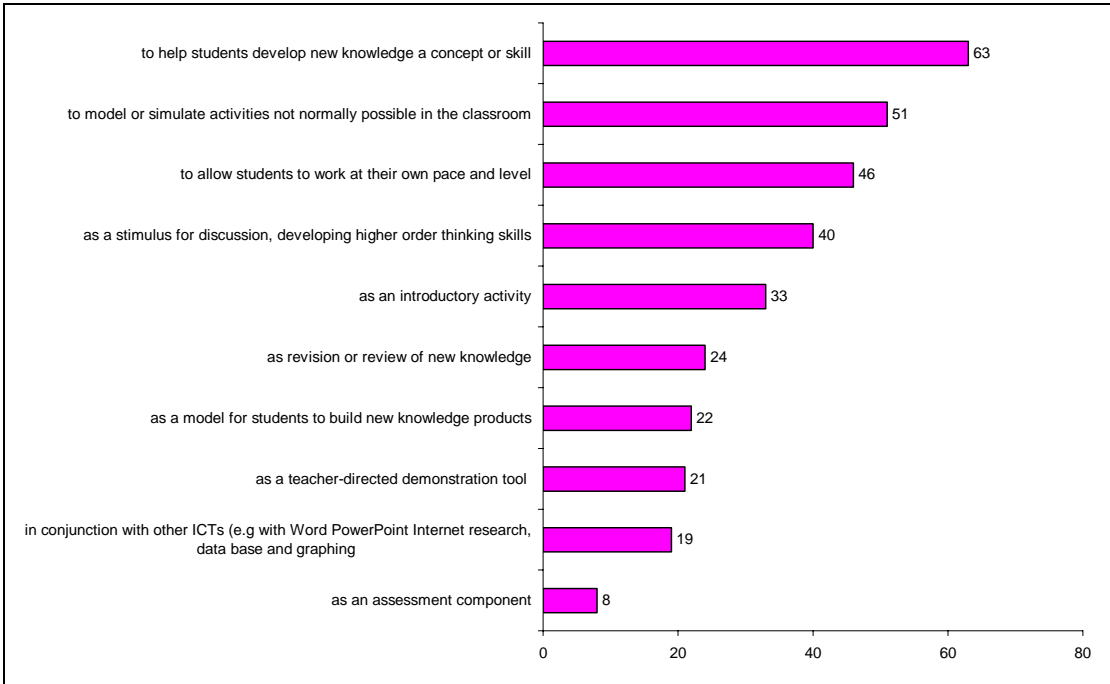


Figure 3: Computer environments for viewing learning objects - %

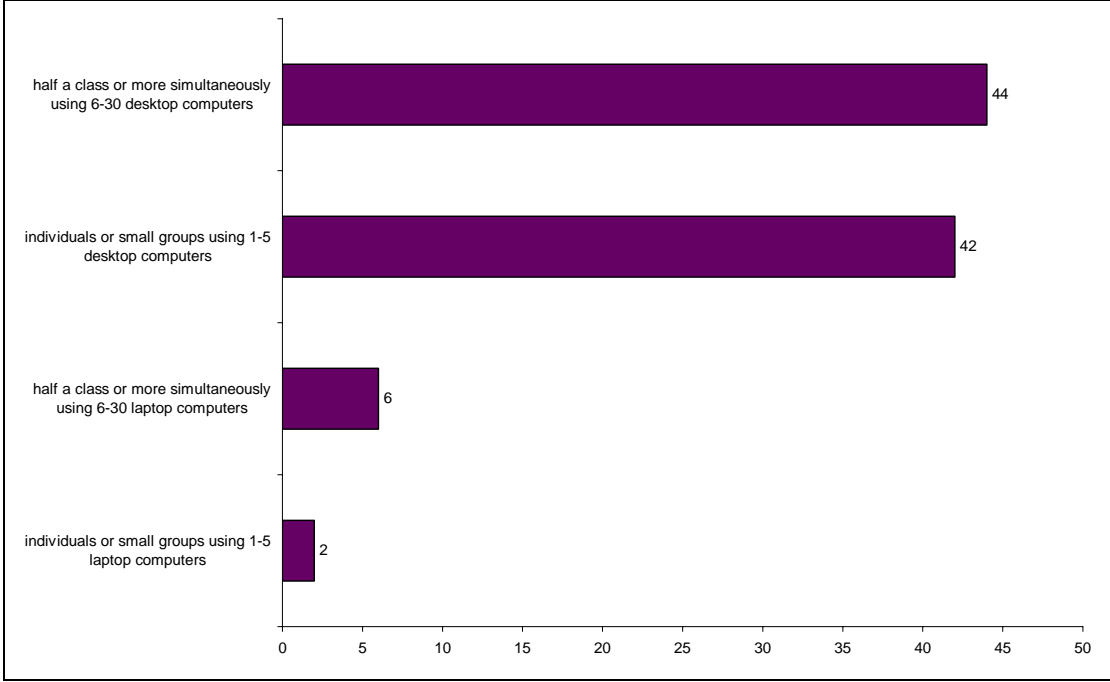
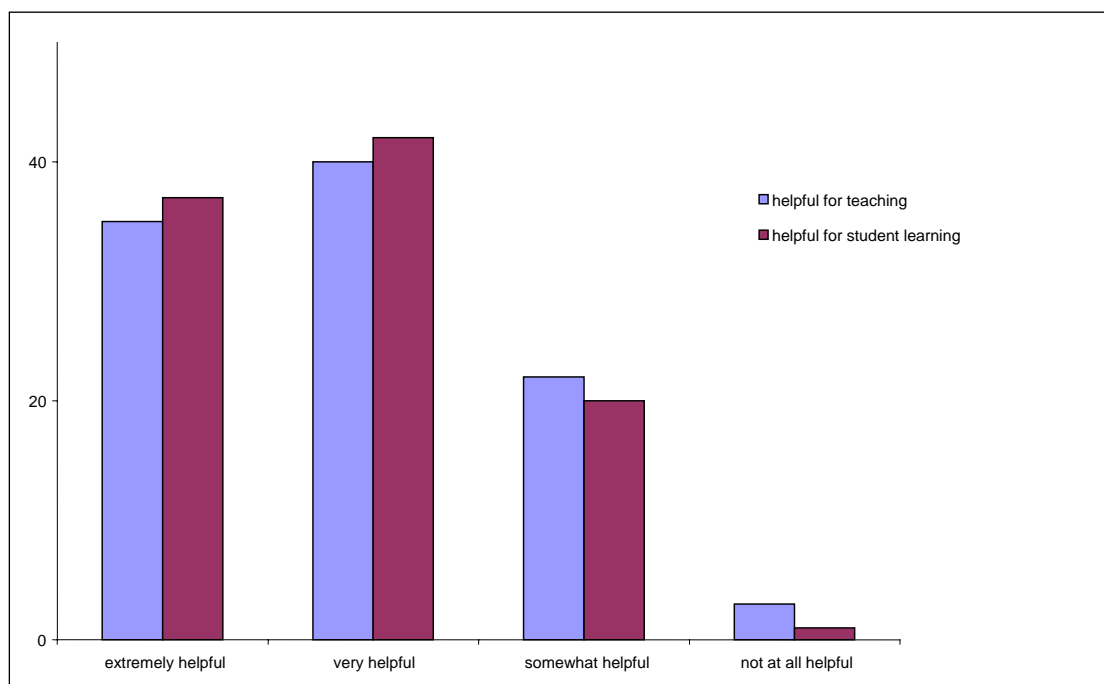


Figure 4: Helpfulness of learning object for teaching and learning - %



Summary

The 115 teacher responses come from four states with each of the school sectors (Government, Independent and Catholic) represented. 50 per cent of learning objects viewed were from the Science project; 27 percent from Mathematics and numeracy, 12 per cent from Literacy for students at risk and 11 per cent from Studies of Australia.

69% of teachers accessed the learning objects from a digital repository or Learning Management System, with 31% accessing via a CD ROM. In the classroom students viewed learning objects either in small groups at 1- 5 desk top computers (42%) or with more than half a class using between 6 and 30 desktop computers. Few laptop computers were used. 46 per cent of teachers used a data projector to demonstrate the learning objects. A small number of teachers also indicated they used an Interactive white board to screen the objects.

Teachers used the learning objects in many different ways to support their teaching program. The most common uses were to develop a new concept or skill, to model or simulate activities not possible in the classroom, to allow students to work at their own pace and level and as a stimulus for discussion. Overwhelmingly teachers indicated they found the learning objects helpful, both for supporting their teaching and for supporting student learning.

Teacher use of learning objects

The qualitative data provides a richer understanding of how teachers used the digital resources in their teaching practice and to what extent they believe the objects support teaching and learning. Some examples of teacher use of the most commonly selected learning objects from each of the curriculum areas trialled in different contexts and settings are included here:

'Give me a brake" and It's a drag' (Year 9 -10 Science); 'Catch the thief' (Years 9 -10 Literacy for students at risk), 'Fractions' (Mathematics and numeracy), 'Heroes of the air' (Studies of Australia)

'It's a drag' and 'Give me a brake' (Year 9 - 10 Science)

Teacher 1 Queensland, State secondary school:

Year 9 Science - an energy and change topic. Used the learning object to allow students to develop concepts about stopping distances. This was used in conjunction with a range of other activities where students could pursue areas of interest at their own pace.

Learning objects are very helpful in supporting teaching and learning. They can be used in a variety of ways, but allow the teacher to remain in control of student learning at all times. They focus student attention on the concept that is being taught, minimising the potential for distraction.

Teacher 2 Queensland Independent school

Topic - Road Science unit

* Stopping and braking - discussion of what could change braking distance

* used program to show how conditions can affect skid distance.

* Discussion - what else can affect how long it takes to stop? (reaction, brake conditions)

After a brief intro and demo (first time the class had seen this) let students work through up to 9 activities, skipping some steps if they felt comfortable.

The students could physically see the difference that conditions had on the car's ability to stop. They were asked to do as many trials as to show a change in just one condition can change the skid distance. In this way, the students could model the different situations and trial them. This provides a much more interactive way for the students to gain this knowledge.

Teacher 4 South Australia, state secondary school

We were doing a topic on Road Science so after we learnt the basic info we did this activity as a fun thing to build on their knowledge.

I think it is very good as it provides real life situations such as driving under different situations and how it affects what they do. Also provided info on types of tyres which was not done in class

Teacher 5 Queensland, state secondary school

We performed an experiment with the melting rate of ice to introduce the effect that different variables can have on the result of an experiment. The students then used 'It's a Drag' to demonstrate how different settings can affect the outcome in different conditions. The students then wrote a report on a selected variable, eg, type of vehicle, speed, etc, to describe how changing that particular component affected the outcome. This report was also presented as a PowerPoint, using screenshots of the LO to demonstrate their results.

It was excellent - the students were excited and engaged. Feedback from the students indicated that using the LO gave them a clear picture of how different forces affect outcomes. They loved it.

Catch the thief (Years 9-10 Literacy for students at risk)

Teacher 1, South Australia, Government primary school

in conjunction with a literacy unit on descriptive writing.

I found that the activity allowed us to get out of the classroom and participate in hands on learning. Instead of a teacher centred approach it allowed the students to work independently and at their own pace - all information was available on the screen therefore needed only limited teacher direction.

Teacher 2 ,South Australia, Government primary school

We had already looked at observation and comprehension skills - making meaning from reading and pictures, and this was used as a tool to make meaning from the information given to solve the crime.

This learning object was very useful as it was interactive, go back to revisit areas perhaps not answered correctly, clear instruction on what to do and how to move through the evidence. They found out if their comprehension and observations were correct.

Teacher 3, Victoria, Government primary school

For integrated studies throughout the term we had been learning about forensic science. this was a good way for the children to combine everything that had been learning into a lesson where they had to listen to witnesses, look at evidence and decide on a suspect.

This is a very useful tool in having the children investigate in different ways. they are given some structure and assistance when they are heading down the wrong track.

Teacher 4, Queensland, Independent school

Catch the Thief was used to demonstrate opportunities with hyperlinks, to develop an appreciation for plot development, clever clues, red herrings and characterisation

Teacher 5 South Australia, state secondary school

SCIENCE Fingerprinting - discussions about types of prints / no two people have the same print. fingerprinted ourselves - investigated print type - whorl, arch..etc. DNA - introducing concept discussion - new technologies being invented all the time to solve crimes - keep "tabs" on people.

Our class viewed the learning object using our Interactive whiteboard. This makes the objects even more effective, as we can complete them as a whole class and hold discussions as questions arise. Great for literacy development also. The students who wouldn't normally be excited by having to read, jump at the chance to participate in the learning objects.

Teacher 6, Victoria, Government primary school

Just began, normally have a computer activity in my reading rotation and used the learning objects in place of the usual research and games normally played. My conscience was telling me that my computer tasks previously were not as literacy focussed as I hoped they would be...but they are now.

The activities are sensational as the children want to read to pass the level. Their competitiveness takes over and they are reading and deducing

problems without direct pressure from a teacher. I have only given half the class the opportunity so far but they children who have tried an object are now the envy of the class.... "When is it our turn on the thief game?" is what I am continually asked.

Fractions: 'Design a farm' (Years 5-8) Mathematics and numeracy)

Teacher 1 Victoria primary school

Focus: Number strand The relationship between fraction, decimal and %. Design a farm was used as an independent small group (3 x partners) learning activity. As part of a sequence of lessons

Teacher 2 South Australia primary school

Used after initial concept has been taught. This was used as an extension for some and consolidation for others. Students worked in pairs, while the others were further consolidating in classroom activities and rotating.

A good supportive tool.

'Heroes of the Air' (Studies of Australia)

Teacher 1 Queensland, primary school

The integrated unit was "Flight". It was across two classes and two year levels. Outcomes included SOSe, Science and English. Much time was spent on the timelines of flight (4 weeks) and the mechanics of flight (2 weeks). The LO was used as a culminating activity for about half of the students while the others made "future flying machines" (students chose). I (as TL) demonstrated the use of the LO to the whole class (and teachers) and supported the ones who chose it for their Activity.

I just love being able to use a LO to demonstrate something that is not possible to replicate for students (such as Smithy's trip). The sound and variety of media used in this LO made it particularly powerful for students.

Teacher 2 Queensland secondary school

Most of the work I have done with Learning Objects has been to demonstrate their usefulness to teachers and student teachers. I mentioned Heroes of the Air because I have attempted to capitalise on the sophistication that is coming into the LO's. In using this object, we employed it as part of a webquest called What makes a hero? and used the Smithy example to outline the journey of a heroic icon of our culture. The students then researched a hero and had to report using an ICT rich method.

Teachers views on learning objects (LO)

As illustrated above teachers are selecting and choosing to use learning objects in a variety of ways consistent with their definition as 'chunks of learning material' reusable for many learning purposes. Moreover, teachers' indicate that the tasks they set their students with the learning objects sit easily with a constructivist approach to teaching and learning.

A closer analysis of all open-ended comments made by teachers indicate that teachers

- find LOs really useful as they are targeted at topics, concepts and skills they already do and required by state curriculum frameworks; they also see their value across subject domains for integrated units

- see their students motivated by engaging graphics, animation, sound enabled by digital content
- recognise that although the objects can 'stand-alone' , they need to be integrated and carefully aligned with other learning activities
- see students motivated to further explore, investigate and question ideas covered in the LO
- use the flexibility offered by the Los in classrooms in a range of ways;
 - teacher-led demonstrations and discussions using projector or Interactive Smart Board
 - small groups of students at one computer
 - individually
- hear student talk focused on ideas and challenges embedded in the LO and see them peer tutoring and problem-solving together and around the computers
- appreciate the spoken instructions and feedback, especially for younger students and those with literacy challenges
- enable learning activities not normally possible in a classroom because of time, risk and cost
- allow students to work at their own pace and to revisit and repeat activities
- can stimulate ideas for use with other ICTs eg Power Point, Excel; Claymation
- provide a safe learning environment (cf Internet)
- have a growing recognition of usefulness of LOs for students with physical disabilities

School issues

- access is good (fast and reliable) when content loaded to school network (either from a CD ROM) or Learning Management System
- technical support for class teachers is needed in initial stages, especially checking of hardware and software specifications on computers; loading CD to a school network minimal support needed after this
- teachers need time to search, discover and explore the new materials available
- teachers also need time to plan how to integrate LOs into their curricula; how they might support and enhance what they already do or consider new possibilities
- LOs need to be carefully aligned to student abilities; students don't want to be using LOs that are too easy or have graphics which are age- inappropriate
- reluctant users of ICTs find LOs easy to use
- because instructional design embedded in LOs draws on latest research on learning they offer powerful opportunities for school-based learning teams to try out, evaluate and reflect together
- digital projection and/ or interactive whiteboard for whole class demonstration is providing positive results for teachers
- using a Learning Management System (LMS) allows teachers to differentiate learning activities for different cognitive levels and interests of students
- with VPN access from home use possible for revision and reuse
- only three teachers commented on technical issues or lack of access interfering with use

Conclusions

This paper has reported on early findings from school trials of learning objects in a range of jurisdictions, sectors and levels of schooling. The findings support those of an earlier review conducted by Lake et al (2004) that teachers received the TLF objects with enthusiasm, finding them engaging and intellectually stimulating.

Barriers to take-up of technology were rarely mentioned by the teachers in these trials. Rather, these teachers who used the materials in class with their students focused on the teaching and learning possibilities afforded by the new interactive, multimedia content. Whether delivered by CD ROM or via a digital repository with all necessary hardware and software specifications to view the objects in place, teachers were very positive and enthusiastic about the pedagogical opportunities. As one Queensland secondary school teacher says:

I have used a large range of learning objects for a wide variety of learning and teaching objectives. What you can use them for is limitless. Our students seem to gain the most from the objects because they are self paced and can be done more than once. We have a very diverse student group and they need to be able to work at their own pace for success.

Appendix

Using learning objects - teacher reflections

After you have used a learning object/s with your class, please use this form to provide feedback to The Learning Federation. Please use a separate survey for each learning object you use with your class.

Your responses are highly valued.

1. Your name

2. What is the name of your school?

3. Is your school Government Independent Catholic ? *(Please circle)*

4. What is the name of the learning object you used with your class?

5. In what grade level/s did you use the learning object/s? *(Please circle)*

K – P 1 - 2 3 – 4 5 – 6 7- 8 9 -10 11-12

6. For what key learning areas did you use this learning object? Tick all that apply

- English/Literacy
- Mathematics/Numeracy
- Science
- SOSE/HSIE
- The Arts
- Integrated Unit

Other (please specify)

7. 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)

8. How did the students view the learning objects?

- on CD-ROM
- online, using a Learning Management System or digital resource repository

9. Which statement best describes the class environment in which the learning objects were 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

10. Did you use a data projector to screen the learning objects for the class? Yes No

11 Describe how you integrated the learning object into the lesson/lessons. Include topic, learning outcomes, teacher and learner activities.

12. How helpful was the learning object in supporting your teaching practice? *(Please circle)*

extremely helpful very helpful somewhat helpful not at all helpful

13. How helpful was the learning object in supporting student learning? *(Please circle)*

extremely helpful very helpful somewhat helpful not at all helpful

14. Please add any comments about the extent you believe the learning object is useful in supporting teaching and learning.

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