DELIVERING THE PROMISE

The case for rapidly expanding the digital curriculum resources
available in Australian classrooms
and for developing the digital content industry.

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Executive Summary

This report is about delivering the promise that information and communications technology (ICT) will dramatically improve:

- educational outcomes for all Australian school children; and
- educational opportunities in rural and regional areas.

It is about developing properly structured and sequenced Australian digital curriculum resources for each year level, specifically tailored to the learning outcomes set by the Australian States and Territories. It is about developing Australian content with a real teaching and learning purpose – taking students in the classroom beyond the classroom on an educationally sound guided journey through whole courses, individual course components and themes that cross course boundaries. And it is about developing a new Australian curriculum industry with the capacity to win export markets.

Australian schools are among the world leaders in providing access to high quality ICT in their classrooms. Much of the basic infrastructure is already in place. Local and wide area networks have been established to link schools to each other and to the world although bandwidth remains an issue. We are well on the way to having adequate access to computers in classrooms, and our teachers are being trained in the best ways to use them to improve learning outcomes. All States and Territories have seen the opportunities ICT offers as a new and powerful tool to help children learn more, and have committed substantial sums to the cause.

The challenge now is to capitalise on this very large investment in hardware and professional development by making ICT a basic tool in the day-by-day, lesson-by-lesson learning process in our classrooms. To achieve this the focus must turn to content. Currently there is a critical shortage of digital curriculum resources for use in the classroom. Of the $200 million Australian Governments directly spend on ICT in schools each year only 5 per cent is spent on software.

Further, most of what is available comes from overseas. Much of it is 'edu-tainment', developed to appeal to parents rather than educate children. Very little of it is properly structured or sequenced for use in the traditional teaching environment, nor does it contain the built-in monitoring, assessment and reporting tools needed to benchmark progress in students and instil accountability in schools.

It is these purposeful structures, sequences, and monitoring and assessment tools which distinguish high quality curriculum materials from mere access to the internet. While the internet is a valuable resource for students, especially in their

later years of study, and for teachers, general digital content is not curriculum even though some of it may be educationally useful.

Research shows that high quality digital curriculum resources increase student engagement and motivation, and help teachers to teach better – two key ingredients for improving learning outcomes. For gifted children digital content opens up new horizons; for those having difficulty it provides a means of revisiting issues and practicing their skills. For those who feel disengaged, and this can apply especially to middle school boys, it is a way of rekindling their interest and attention.

In rural and regional areas it offers special opportunities to provide courses that cannot practicably be delivered now, to redress the lower participation and retention rates that reduce the job prospects of their young people, and to retain their best teachers. As identified at the Regional Australia Summit, improving educational opportunities in country Australia is essential to stemming the drain of talented young people to the cities, and to attracting and retaining business investment.

Unless Australia develops its own digital curriculum content, others will fill the void. We will face the prospect of becoming consumers of other people's material rather than providers of our own. The risk is that content developed elsewhere will lack relevance to Australian students and the curriculums set by the Australian States and Territories, and leave us hostage to values and standards that are not our own. On the other hand, by developing our own content we stand to create a new and ground-breaking industry in this country, as well servicing our distinctive educational needs.

The report recognises that even if governments do nothing more than maintain the programs they now have underway, demand for digital curriculum resources will continue to grow and a market in them will gradually emerge. However, this kind of piecemeal development would be too slow and fragmented to benefit the current tranche of students and would do nothing to help establish a new industry in digital content.

Accordingly, the report recommends that all Australian Governments commit themselves to a four year program of working with the private sector to rapidly expand the digital curriculum resources available in our classrooms, and to help establish the market framework the new digital content industry will need.

It recommends that MCEETYA give priority to the following areas:

- in literacy
  - K to 3 literacy
  - middle years literacy (especially the transition years between primary and secondary school);

- in numeracy
  - middle years mathematics and numeracy
  - K to 3 numeracy;
- in science
  - middle years science;
- in information technology
  - secondary years technical literacy (ICT skills);
- in SOSE and civics
  - case studies on civic life and success stories in regional Australia across all years linked to values and the Discovering Democracy program
  - middle years entrepreneurship and business orientation;
- in vocational education
  - secondary years vocational literacy
  - career education; and
- in languages
  - build on existed funded programs.

The report also spells out the technical and other arrangements required to kick start a critical mass of digital curriculum resources for Australian classrooms. These arrangements build on the strong cooperation between the Commonwealth, States and Territories which has underpinned the work of Education.au and the Curriculum Corporation, and the national consensus that already exists on key policy issues.

As a result, the cost of adopting the report's recommendations is relatively modest. Detailed estimates show $13.65 million is required in the first year and between $12.25 million and $19.56 million in each of the next three years. The costs would be shared between the Commonwealth and the States and Territories on a 50:50 basis. This is consistent with similar initiatives in the past. To make sure resources are ready for the beginning of the 2001 school year, $384,000 is required during the remainder of this financial year.

To sum up, the commitment being made by Governments across the nation to ICT in schools and in the professional development of teachers to effectively harness it, brings a powerful new teaching and learning tool into classrooms. The task now is to match it with an equally strong commitment to providing Australian content. The benefits of doing so will flow to all students and every school, and especially those in rural and regional communities.

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Background to report

When originally conceived, this project was intended to develop a detailed business plan to demonstrate the viability and sustainability of the market in digital curriculum resources in Australia.

Soon after our involvement two things became very clear to us.

First, we found an urgent need to develop digital curriculum resources to:

- improve the learning outcomes of all K-10 school children and the educational opportunities for those in rural and regional areas;
- capitalise on the substantial investment that has already been made in information and communications technology (ICT) in schools; and
- develop distinctively Australian content relevant to Australian students and the curricula set by the Australian States and Territories.

Second, we found that the very small market for digital curriculum resources that currently exists is very immature and fragmented. It is too early in its development cycle to meaningfully apply to it the kind of detailed analysis originally envisaged. It is even too early to say whether the market can be self-sustaining without a publicly funded fee for service base. This is not unusual in the education industry. It has been the case with textbooks for many years.

What we can say, however, is that developing a structured market framework and providing a public sector kick start will establish the critical mass of digital curriculum resources needed for a viable market to develop and provide the best opportunity for it to do so. It will also give new entrants valuable experience they can apply to their efforts to enter the much larger online interactive publishing market.

Acknowledgements

This report builds on the very substantial amount of work on digital curriculum resources already undertaken by the Commonwealth, States and Territories, the Curriculum Corporation and Education.au.

The cooperation and assistance provided to us by the senior officers of these bodies has been unstinting. We found universal commitment to the vision of increasing the educational outcomes of all Australian students by using digital curriculum and a tremendous enthusiasm to do so. In our long experience in government, it is rare to find such commitment, enthusiasm and willingness to work together to achieve a shared objective.

While many people contributed ideas and comment to the project, we would like to acknowledge Susan Mann in particular for her work in guiding and overseeing the preparation of this report.

Scope of report

For the purposes of this report we have taken curriculum to have the following attributes:

- it is scoped to cover specified learning outcomes;
- teaching and learning structures are built in;
- it is sequenced, taking into account the levels at which topics are introduced and the level of difficulty;
- its content is directed to students achieving the learning outcomes; and
- assessment and monitoring are built in.

Traditionally, curriculum content has often been structured on year levels and subject areas. However, increasingly the same content is being used simultaneously to achieve a number of learning outcomes, sometimes at different year levels. For example, a study of dinosaurs may be used to achieve learning outcomes in Year 5 across literacy, numeracy and SOSE. It could also be used for Year 6 science, and be a theme in Year 7 drama and art.

For many, the concept of digital curriculum resources is new. Digital curriculum resources support the same attributes of specified scope, structure, sequence, content, and assessment and monitoring as traditional curriculum content. However, it is important to distinguish it from general digital content which may have some educational value but is not curricula.

We are talking about	We are not talking about
Structured, sequenced curriculum materials specifically tailored to the learning outcomes set by Australian States and Territories	Edu-tainment
An additional tool for teachers	Superceding teachers and traditional classroom strategies, or teachers losing control of their learning strategies

Teachers being able to create and customise their own courses and materials	Online text books
Curriculum content	Other digital content, for example, placing encyclopaedias online. An encyclopaedia may be a useful learning resource but it is not curriculum
Quality assured content developed by or in conjunction with educationalists	General multi media material that is not developed as curriculum resources
A safe, controlled learning environment	Letting students wander around the internet as they like
A guided educational journey	Leaving students to sink or swim in the vast amount of unstructured information available online
Assessing, monitoring and reporting on student progress	Abandoning students to computer screens and programmed learning

Demographics and market description

Schools, teachers and students

In August 1998 Australia had 9,589 schools attended by 3,198,755 school students. They were taught by 209,177 full-time equivalent (FTE) teachers.

	Government	Non-government
Schools	7000 (73%)	2589 (27%)
Teachers (FTE)	146129 (70%)	63048 (30%)
Students	2239375 (70%)	959380 (30%)

(Source: ABS Cat. No. 4221.0, 1998)

Table 1: Number of schools, teachers and students, Australia, 1998

Schools – number, growth and segmentation

Table 2 shows for 1997 the number of Australian schools in each level of education and whether they were government or non-government schools. Over the three years to 1997 the number of government schools reduced by 93 (1.3 per cent) while the number of non-government schools increased by 54 (2.1 per cent).

Schools	Government	Non-government
Primary	5199	1574
Secondary	1099	418
Combined	408	534
Special	323	54
TOTAL 1997	7029	2580
TOTAL 1996	7088	2542
TOTAL 1995	7122	2526

(Source: ABS Cat. No. 4221.0, 1997)

Table 2: Number of schools by level of education and category, Australia, 1997

Teachers – number, growth and segmentation

In 1997 there were 206,400 primary and secondary school teachers in government and non-government schools. The combined employment of primary and secondary school teachers has remained fairly steady during the 1990s.

	Government	Non-government
Primary	76,700	61,500 (both primary & secondary)
Secondary	68,200	

(Source: ABS Cat. No. 4221.0, 1997)

Table 3: Number of teachers by level of education and category, 1997

For the period 1997 – 2001 the number of teachers in government primary and secondary schools is forecast to increase by 1.7 per cent and 0.6 per cent respectively (MCEETYA, 1998). Forecasts are unavailable for the non-government sector. This sector grew by 13.5 per cent in the 5 years to 1997 (ibid).

Students – numbers, growth and segmentation

Table 4 gives details of the number of students in Australia by level of education and by category of school.

Level / year of education	Government schools	Non-government schools	All schools
Pre-year 1	138254	51646	189900
Year 1	198047	69677	267724
Year 2	193698	68209	261907
Year 3	190785	67629	258414
Year 4	187126	66935	254061
Year 5	185012	98297	253309
Year 6	186571	69270	255841
Year 7 (Qld, SA, WA, NT)	74413	24730	99143
Ungraded	13101	2389	15490
TOTAL PRIMARY	1387007	488782	1855789

Year 7 (NSW, Vic, Tas)	103078	54708	157786
Year 8	169750	86693	256443
Year 9	170239	86176	256415
Year 10	161698	83755	245453
Year 11	135029	73687	208716
Year 12	107308	65464	172772
Ungraded	15943	2307	18250
TOTAL SECONDARY	863045	445790	1315835
TOTAL PRIMARY & SECONDARY	2230052	941572	3171624

(Source: ABS, Cat. No. 4221.0, 1997)

Table 4: Number of students by level of education and category, Australia, 1997

According to MCEETYA (1998), over the five years to 2002 the population in both the primary age group and the secondary age group is projected to grow at 2.6 per cent, with strongest growth forecast in the secondary school non-government sector (9.3 per cent for the 5 years to 2002).

ICT in Australian K-12 education

Investment in information and communications technology (ICT)

Investment in ICT in schools has been the focus of many State, Territory and Commonwealth Government programs over the past five years. On the basis of information provided to the Curriculum Corporation, we estimate that State and Territory governments spend approximately $200 million per annum on ICT in schools. This amount includes only specific ICT programs. It does not include expenditure on other programs that cross into ICT or may have an ICT component. Nor does it include expenditure from school operating budgets.

When this data is aggregated on an Australia-wide basis, two important points emerge.

First, despite the substantial commitment made by governments to ICT in schools, it represents only 1.5 per cent of overall government expenditure on school education annually – total Government outlays on school education in 1995/96 was estimated at $13.2 billion (ABS Cat. No. 5510.0 in Burke, 1998). This

indicates that the benefits ICT brings are being achieved for a relatively small investment when compared with total spending on school education.

The estimate that 1.5 per cent of total school education expenditure is directed to ICT is corroborated by research conducted by the Brotherhood of St Laurence (McClelland et. al., 1998). Based on McClelland's estimates, ICT expenditure represented 1.58 per cent of the total cost per student per annum.

The average total cost of education per student in government schools was $33,250 for primary schooling, $21,686 for junior secondary schooling and a further $16,090 for senior secondary schooling. On this basis, the total cost of Government K-12 education was $71,026, or an average of $5,682 per student per year (see Tables 5 to 8 below).

	Primary schooling	Junior secondary	Senior secondary
Years of course	7	3.6	2
Public $ per full-time year	4750	6024	8045
Total public $ for course	33250	21686	16090

(Source: McClelland et. al., 1998)

Table 5: Public outlays on government school education, $ per student, Australia

	1989/90 $ billion	1995/96 $ billion
Consumption	7.0	9.0
Capital	0.6	0.6
Student benefits	0.5	0.7
Other	1.8	2.8
Total schools	10.0	13.2
Education outlays as % of GDP ALL SECTORS	4.7%	4.9%

(Source: ABS Cat No 5510.0 in Burke, 1998)

Table 6: Government outlays on school education, A$ billion, Australia 1989/90 and 1995/96

	Primary $	All secondary $	Total $	Junior secondary $	Senior secondary $
Expenditure per student excluding superannuation and building & grounds	4145	5749	4761	5230	7086

(Source: derived from MCEETYA 1997 in Burke, 1998)

Table 7: Public expenditure on government schools, $ per student, Australia, 1995/96

	Catholic $	Independent $
Primary schools	3418	4488
Combined primary-secondary	4437	7452
Secondary schools	5690	8124

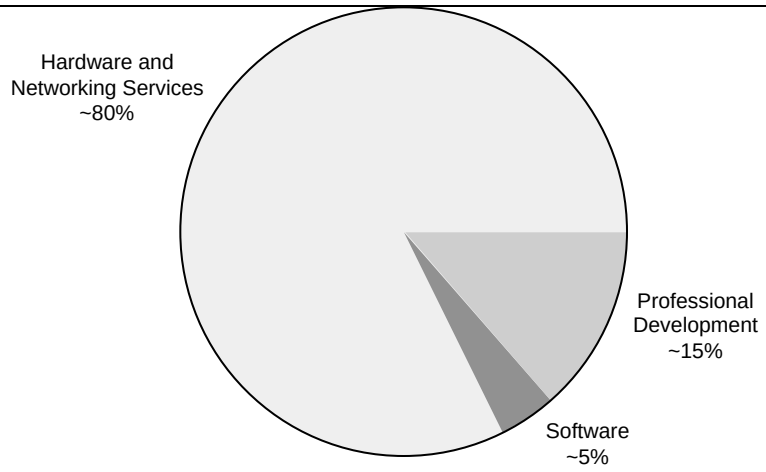
(Source: derived from MCEETYA 1997a, in Burke, 1998)

Table 8: Expenditure in non-government schools, $ per student, Australia, 1995

In 1997 there were 2,230,052 students enrolled in Government primary and secondary schools (ABS, Cat. No. 4221.0). Using the average annual estimated ICT investment of $200 million, ICT expenditure per student based on 1997 government school enrolment numbers is $89.68 per student, or 1.58 per cent of the total cost per student per annum based on McClelland's estimates.

The second point emerging from the figures is that the commitment made by the States and Territories to ICT in schools to date has been focused largely on computers and networking. The basis for this has been the need to get a critical mass of infrastructure in place.

Figure 1 shows the three main segments of ICT investment in schools – hardware and networking, professional development, and software and content. Hardware and networking have received 80 per cent of the funding. In Figure 1, software and content are bundled together as there is no reliable way to separate them using the available data.



Total - $200 million per annum

* This figure does not include ICT expenditure made by schools out if their general operating budgets - the total of such expenditure may in fact be greater than the total of direct centralised ICT expenditure and grants.

Source: Data supplied by Curriculum Corporation

Figure 1: Approximate direct State and Territory Government spending on ICT in education per annum by segment

The investment made by the States and Territories has positioned the Australian K-12 sector as one of the most hardware and network rich school environments in the world. This is shown in the Figures 2 to 5 which compare selected indicators for a range of nations:

- the ratio of computers to 8th grade students;
- the percentage of primary schools with access to the internet; and
- the percentage of secondary schools with access to the internet.

In each case Australia ranks either second or third among the nations listed. Maintaining and improving this relative position will require ongoing efforts.

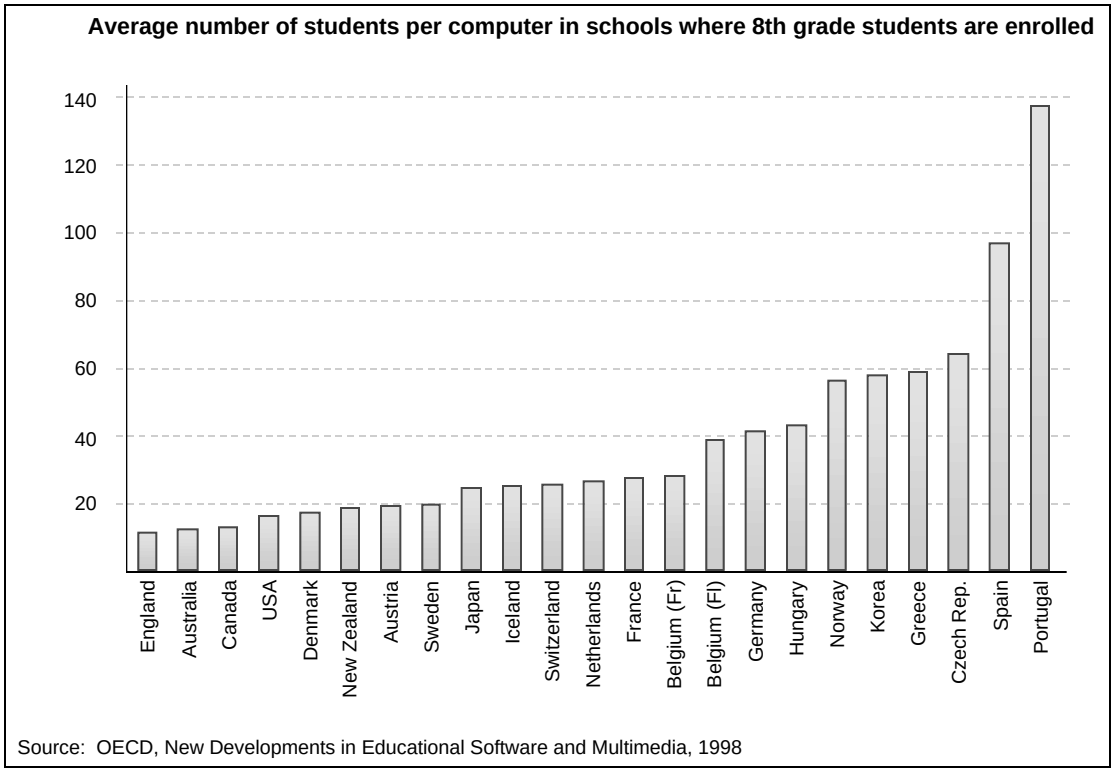
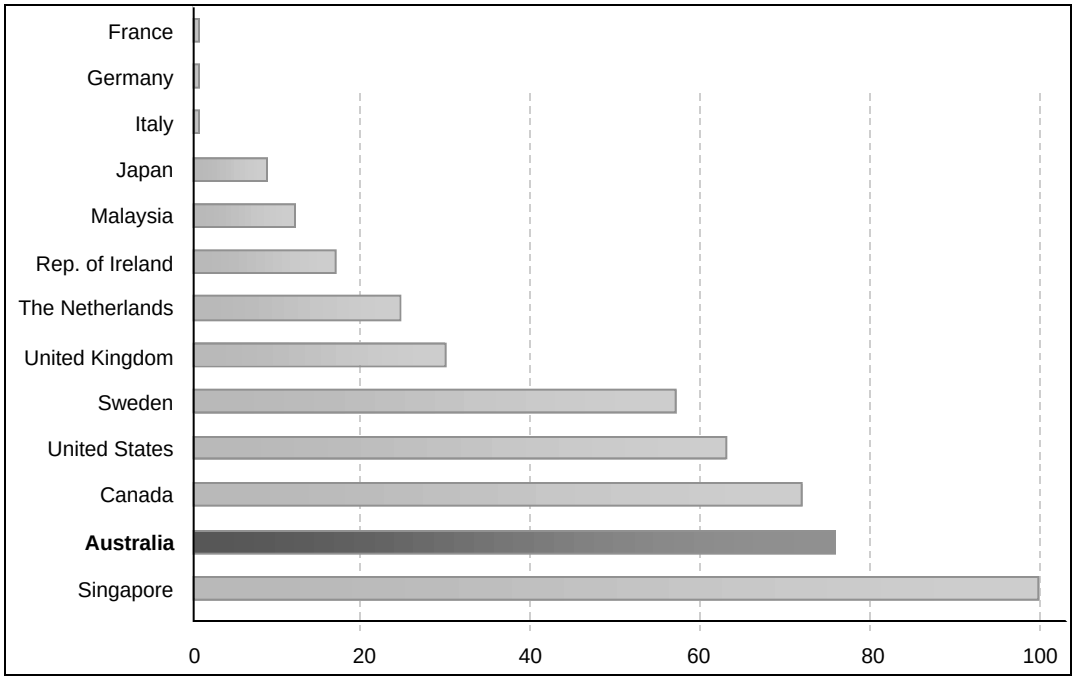
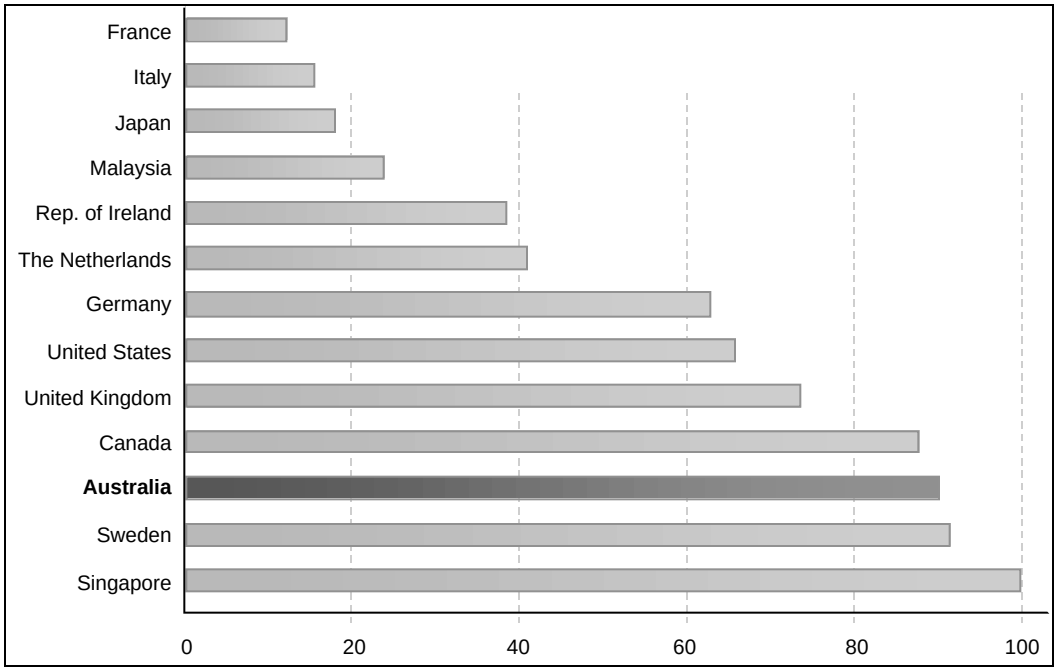


Figure 2: Student: computer ratios, selected nations



(Source: RM G7 Report, *ICT provision in schools*, 1998)

Figure 3: Percentage of primary schools with internet access, selected nations



(Source: RM G7 Report, *ICT provision in schools*, 1998))

Figure 4: Percentage of secondary schools with internet access, selected nations

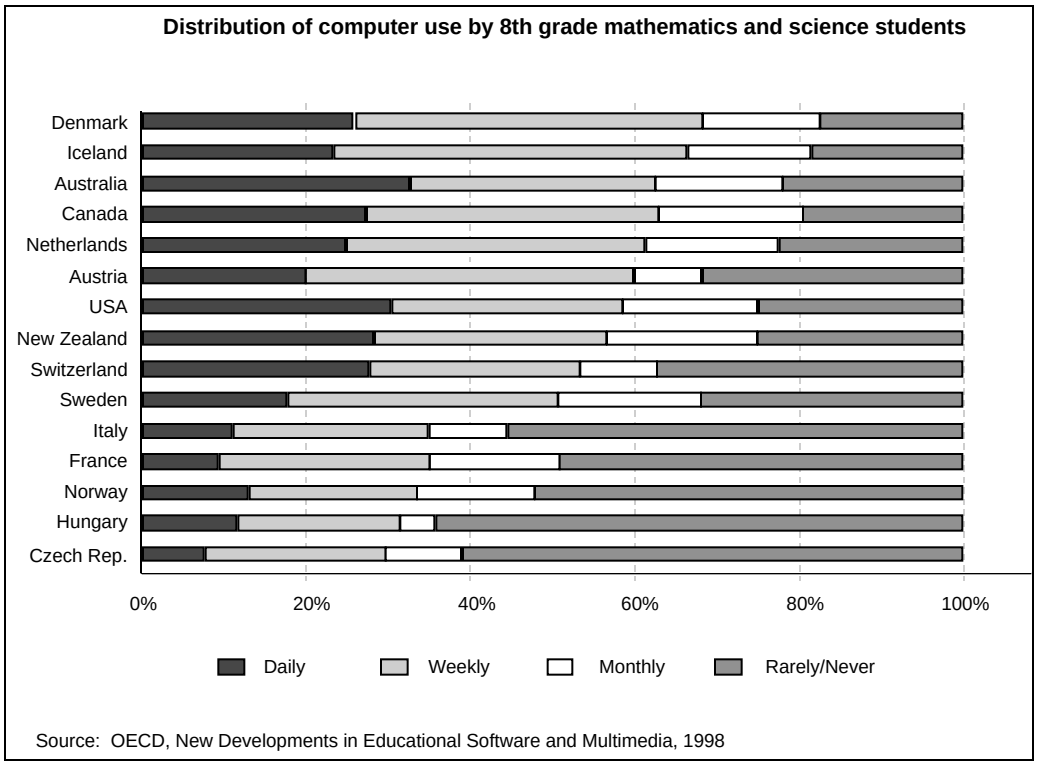


Figure 5: Frequency of student computer use, selected countries

Further, Australian jurisdictions plan to increase the number of computers in their schools. The following Table shows the targets set by the States and Territories where data is available.

State / territory, year	Primary	Secondary	Total
ACT, 2001	1:4	1:2	
NSW, June 1999			1:11
Victoria, 2000			1:5
SA, 2001			1:5
WA, 2002	1:10	1:5	
Tasmania, 2000			1:7
Northern Territory			1:7.5
Queensland, 2001			1:7.5

(Source: Cutler & Company analysis of data provided by States and Territories, www.edna.edu.au)

Table 9: Target student: computer ratios, Australian states, selected years

The need to shift the focus from technology to content

There are three key requirements for effective teaching and learning using digital curriculum resources:

- computers and connectivity;
- professional development; and
- the content itself.

The evidence shows that as a result of the investments being made by the Commonwealth, States and Territories, Australian schools are well on the way to having adequate levels of access to computers and connectivity. Bandwidth remains a significant issue, especially in rural and regional areas, but is beyond the scope of this report.

Professional development is proceeding, and this effort needs to be maintained and extended. Student-teacher training for new entrants and professional development programs for practicing teachers are addressing the need for

informed, technologically competent and knowledgable educators who are both prepared and able to use digital resources to improve teaching and learning.

The need now is to turn the focus to providing properly structured, sequenced Australian curriculum content which is specifically tailored to the learning outcomes set by the States and Territories. While there is a significant amount of general digital content available, some of which has educational value, there is only a limited amount of relevant digital curriculum resources. Teachers see this as both a structural and personal barrier to use. The scarcity of curriculum content has now become the most significant barrier to gaining the benefits from ICT in schools (see Figure 6).

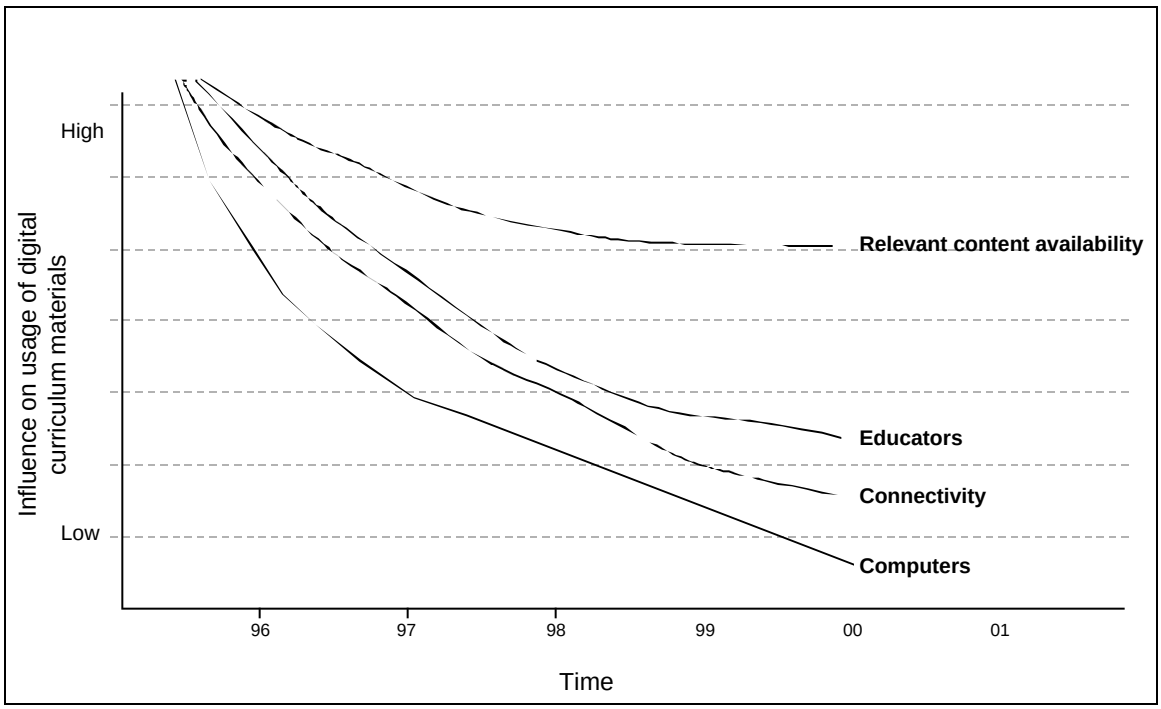


Figure 6: Summary of the relative contribution of structural barriers to the use of ICT in teaching and learning

Appendix A lists some of the major digital curriculum resources being used in Australian schools in 1999. While there is also a growing body of teacher developed materials, the appendix shows how little structured content is available for teachers to use.

This shift of focus will stimulate usage and maximise the return on investment in K-12 ICT initiatives to date. Figure 7 describes the relative contribution over time of the various components of ICT to growth.

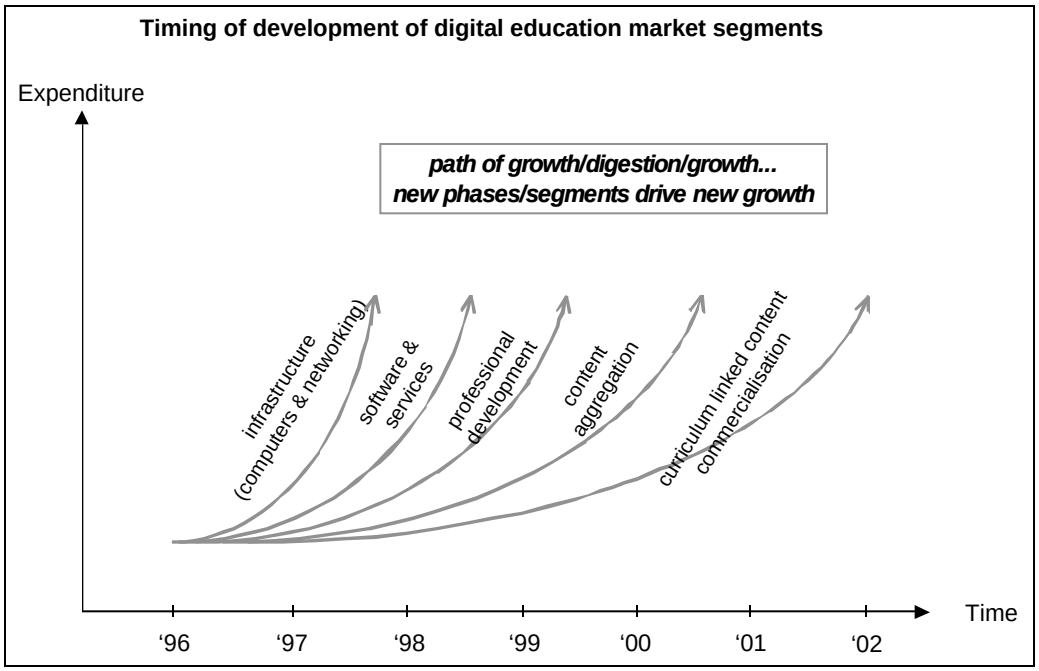
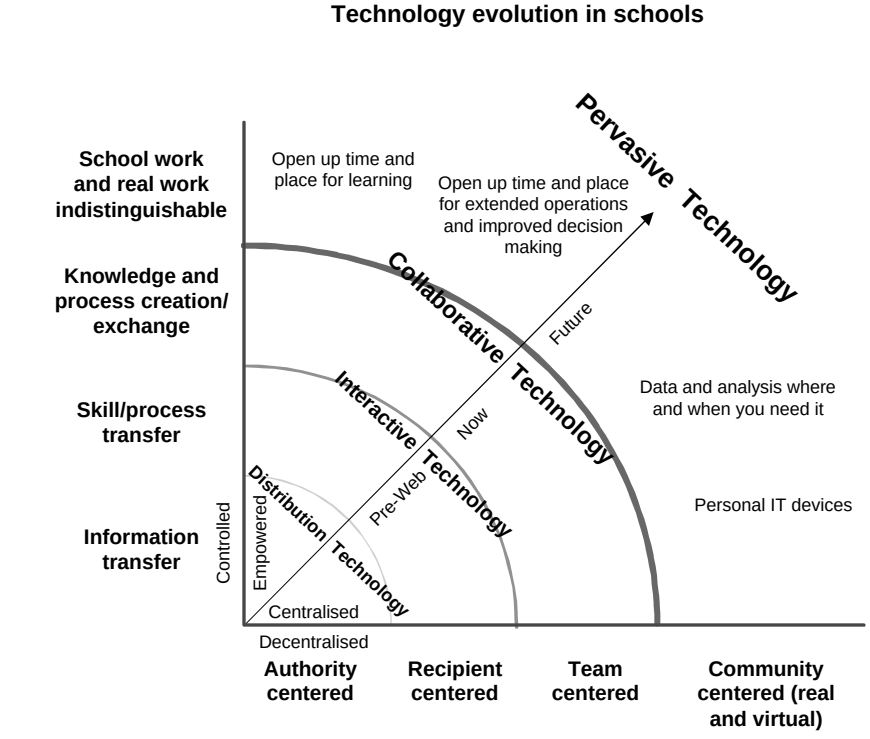


Figure 7: Timing and focus of government expenditure on ICT in education, 1996 – 2002

This pathway to growth is consistent with work on the evolution of ICT in schools such as the model of virtual schooling developed by IBM.



Source: IBM, Models of Virtual Schooling

Figure 8: IBM model of technology evolution in schools

Current trends in education

The policy direction

Recent developments in Australian education policy have been characterised by:

- increased emphasis on standards and learning outcomes – setting goals and measuring progress towards them;
- increased focus on literacy and numeracy;
- greater emphasis on the differing needs of students as they progress through their schooling – the early years, the middle years and the later years;
- greater priority to civics, and the vocational and other skills needed to be full and productive members of the community; and
- the impact of ICT on learning, and on schools and classrooms.

These developments are reflected in the 1999 *Adelaide Declaration on National Goals for Schooling in the Twenty-first Century*. The National Goals affirm the role of Governments in setting clear, high level direction in education policy, and provide a coherent framework for the future of school education in Australia. It emphasises improving student learning outcomes and improving equity. In particular, it commits all jurisdictions to collaborating to:

- "develop curriculum and related systems of assessment, accreditation and credentialling that promote quality and are nationally recognised and valued
- [increase] public confidence in school education through explicit and defensible standards that guide improvement in students' levels of educational achievement and through which the effectiveness, efficiency and equity of schooling can be measured and evaluated."

Trends in education

In recent years a great deal of research has been done on the factors that influence student achievement. The evidence is that schools need to provide work that students find engaging, that they will persist with, and which satisfies them.

One US commentator (Schechty, 1997) has summarised the attributes of such work as:

- the work or activity is focussed on a product that is significant to students;
- the standards for assessing what students produce are clear to the students, and the students find them compelling;
- students are provided with opportunities to fall short of standards on initial tries without suffering adverse consequences;
- the work is designed so that student performance is affirmed;
- the work is designed so that affiliation with others is encouraged and supported;
- novelty and variety is present in the task structure. For example, computers need to provide students with new forms of work to do and new things to produce, as well as new ways to do existing work;
- the work is designed so that students have a choice in what they do, although this does not mean choice in what they learn;
- the tasks have a sense of realness and authenticity about them;
- knowledge and information are arranged in such a way that they can be focused on products and problems; and
- the content is rich and significant as opposed to pallid and trivial.

Good quality digital content meets all these criteria. Further, it allows teachers to use the full suite of teaching approaches depending upon what they are trying to achieve.

An effective market in digital curriculum resources must directly support the National Goals. It must also produce materials that students find compelling and engaging, and that teachers find easy to integrate into their classroom.

Current curriculum industry – national and international

"There is an urgent need for both policy makers and market operators to deal with the new opportunities for trading different types of content in digital form, and to reach a common re-definition of goods and services in a new global trading environment … Education is recognised by OECD member states as a fundamental key to wealth creation and competitiveness in the current global information economy. Yet, the changing educational market is poorly understood, particularly in the context of electronic commerce, and little has been done to define the route to prosperity in this sector." (OECD, 1998)

K-12 digital curriculum materials market – Australia

There is very limited data available about the size, growth and segmentation of the digital curriculum resources market in Australia. This is mainly because the market is still emerging and is immature. Further, there has not been a consistent definition of digital curriculum resources as opposed to other types of digital educational content. Education is a dynamic area where subjects, curriculum standards, year levels, purchasing methods, and curriculum content changes frequently.

This makes it difficult to accurately size the digital curriculum resources market. Nonetheless, some broad observations about the market and the availability of materials can be made. Due to the scarcity of segmented information, the analysis is based on the K to 12 market, rather than the K to 10 target group discussed elsewhere in this report.

We have estimated the market's potential size and growth prospects based on the information that is available and on experience in other related publishing industries. We recognise there are limitations associated with this method, largely because it is based on old business models which are currently undergoing transformation. It may also omit important variables and carry forward distortions that are not relevant to the emerging market in digital curriculum resources.

Market identification

Earlier in this report, we discuss the definition of digital curriculum we have adopted and compared this with other digital materials. The digital curriculum resources market is defined as the market for digital content and tools that have or support the characteristics outlined there.

No ANZSIC code applies to this market, however its activities span those referenced in the book publishing, communications, information and computing services industries.

Appendix B lists examples of Australian online curriculum resource providers in the public and private sectors. The examples are not intended to reflect a comprehensive analysis of the market, but have been highlighted to illustrate the various attributes of public and private sector developers.

Appendix C provides information about major existing or planned online content development by the States and Territories. It also details school system web sites that have curriculum content.

While some for-profit entrants have announced plans for 2000 including Encyclopaedia Britannica and ISIS Information Systems, the market remains dominated by public sector / not-for profit players.

Market size

Expenditure data on digital curriculum resources is not collected by the Australian Bureau of Statistics, government educational organisations, or traditional and new media publishers. In the absence of historical market information, we have used sales of traditional and new media educational materials to size the market.

Market size using traditional and new educational media and publishing market metrics

We estimate that annual expenditure on commercial digital curriculum resources in Australia averages less than $5 per student in 1997/98 dollars. This amount should not be seen as a precise estimate. However, compared with direct expenditure by States and Territories on ICT in schools of almost $90 per student, it confirms the position taken in this report that significant additional investment in digital curriculum resources is required. The estimate of less than $5 per student was derived as follows.

First, we segmented the K-12 educational materials market into its principal delivery platforms – books, videos, CD-ROM's and online content – and estimated annual sales in each segment. These estimates are based on published data and our own enquiries, and revealed a total K-12 educational materials market of $202,575,100.

Not all of this expenditure relates to curriculum materials. It includes purchases of reference materials and software applications which, while used in an educational context, are not curriculum resources. Therefore to arrive at a market size for the K-12 curriculum resources component, we estimated the percentage of each segment which could feasibly relate to curriculum. These percentages are a 'best guess' based on wide discussions with the publishing industry. The

percentages were multiplied by annual sales, deriving an amount of $116,714,970.

We then multiplied this amount by the percentage of each segment which is digital (again a 'best guess' based on industry consultation), and arrived at an estimated size of the digital curriculum resources market of $15,324,000 in 1997/98 annual sales. Our calculations are outlined below in Table 10.

	Basis of estimate	Total annual K-12 sales $	Curriculum specific (% of total; $)	Digital Curriculum (% of curriculum specific; $)
Books	Domestic book sales 97/98 (DCITA, 1999)	146,000,000	65% 94,900,000	0% 0
Video hire & purchase	$900 per school	8,630,100	75% 6,472,575	0% 0
CD-ROM sales	$3,000 per school	28,767,000	30% 8,630,100	100% 8,630,100
Online 'content'	$2,000 per school	19,178,000	35% 6,712,300	100% 6,712,300
TOTAL		**202,575,100**	**116,714,970**	**15,324,000**

(Source: DCITA, 1999; Cutler & Company research and analysis)

Table 10: Estimated K-12 educational media market size, A$, 1997/98

We then expressed total annual sales for each segment in terms of $ per student per annum in 1997/98 dollars, as illustrated in Table 11 below.

	Basis of estimate	Educational materials per student $	Curriculum specific materials per student $	Digital Curriculum materials per student $
Books	Total number of students in all primary and secondary school, 1997/98, 3,171,624	46.03	29.92	
Video hire & purchase		2.72	2.04	
CD-ROM sales		9.07	2.72	2.72
Online 'content'		6.05		2.12
TOTAL		63.87	36.79	4.84

Table 11: Estimated K-12 educational materials market per student per annum, A$, 1997/98

Market growth potential, 1997/98 - 2002/03

Interactive multimedia and information services have experienced strong overall growth since 1992, with annual growth rates exceeding 25 per cent per annum. Continued growth of 18 per cent per annum is forecast for the information services segment to 2001/02 (IBIS, 1998). There are no official or industry forecasts of expected growth in Australian educational multimedia expenditure although it is likely to follow a similar pattern.

We have estimated the growth potential of the digital curriculum resources market over the next five years at between $24 and $57 million in 1997/98 dollars. The methodology for deriving these estimates is set out below.

Forces affecting growth estimates

These growth forecasts do not take account of changes in the forces that drive market development such as the public sector kick start investment recommended by this report. Nor do they take account of changes in the number of students and teachers.

The size of the market will be influenced by other forces, some of which will tend to drive market development while other will tend to limit it. The forces driving market development include:

- decreasing hardware and connection costs;
- more flexible ICT solutions for educational application;
- greater emphasis on acquiring and developing information literacy skills;
- better market information;
- greater recognition that learning outcomes can be improved by using ICT;
- increasing demand from isolated or disadvantaged students for equitable access to educational opportunity;
- competitive pressures; and
- public policy incentives to reduce cost, increase accessibility and increase use.

The forces tending to limit market development include:

- bandwidth and network access availability and cost, especially in rural and regional areas;
- copyright restrictions;
- high front-end costs of development; and
- teacher resistance to inappropriate resources.

Estimates of market growth potential using cumulative annual growth approach

To estimate the growth potential of the digital curriculum resources market over the next five years, we used its estimated size in 1997/98 as a base and applied a range of cumulative rates of annual growth of between 10 and 25 per cent. On this basis, the digital curriculum resources market would generate between $24 million and $47 million in annual sales by 2002/03. This method does not distinguish between fixed-platform and online delivery systems and does not accommodate a shift from CD-ROM to web delivery in the digital segments.

97 / 98	CAGR	98 / 99	1999 / 00	00 / 01	01 / 02	02 / 03
$15,342,400	10%	$16,876,640	$18,564,304	$20,420,734	$22,462,808	$24,709,089
$15,342,400	15%	$17,643,760	$20,290,324	$23,333,872	$26,833,953	$30,859,046
$15,342,400	20%	$18,410,880	$22,093,056	$26,511,667	$31,814,001	$38,176,801
$15,342,400	25%	$19,178,000	$23,972,500	$29,965,625	$37,457,031	$46,821,289

Table 12: Digital curriculum materials market growth forecasts, 1997/98 - 2002/03 (cumulative annual growth rate)

Figure 9 graphs these calculations.

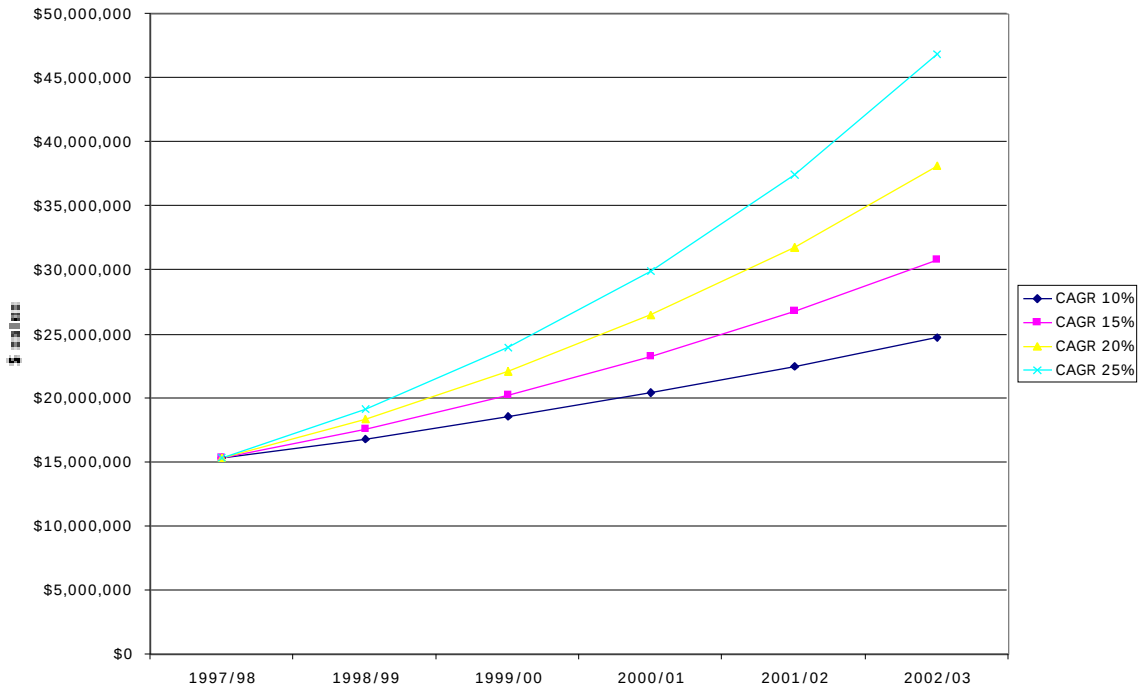


Figure 9: Digital curriculum materials market growth forecasts, 1997/98 - 2002/03 (cumulative annual growth rate)

Estimates of market growth potential using conversion approach

In order to test the validity of the estimate based on the cumulative annual growth approach, we estimated the conversion of books, videos and CD-ROM-based curriculum materials to online format over the same period, assuming no growth in the size of the total curriculum resources market. Using a conservative

annual conversion rate of 10 per cent, we estimated the total size of the digital curriculum resources market in 2002/03 to be $56,855,483. Over 90 per cent of this ($51,759,495) is attributable to online materials.

The calculations in Table 13 demonstrate that if each segment loses market share of 10 per cent per annum to online delivery systems, by 2002/03 online curriculum resources will represent 44.3 per cent of the total curriculum resources market, up from an estimated 5.75 per cent in 1997/98.

	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03
Books	$94,900,000	$85,410,000	$76,869,000	$69,182,100	$62,263,890	$56,037,501
(-10% pa)						
Videos	$6,472,575	$5,825,318	$5,242,786	$4,718,507	$4,246,656	$3,821,991
(-10%pa)						
CD-ROM	$8,630,100	$7,767,090	$6,990,381	$6,291,343	$5,662,209	$5,095,988
(-10% pa)						
Online content (growth from conversions)	$6,712,300	$17,712,568	$27,612,808	$36,523,025	$44,542,220	$51,759,495

Table 13: Digital curriculum materials market growth forecasts, 1997/98 - 2002/03 (growth to online by conversion)

Figure 10 graphs these calculations.

Appendix D lists the main Australian private sector traditional and new media developers, publishers and distributors, and identifies some non-traditional players who have publicly expressed business objectives that could attract them to the digital curriculum market.

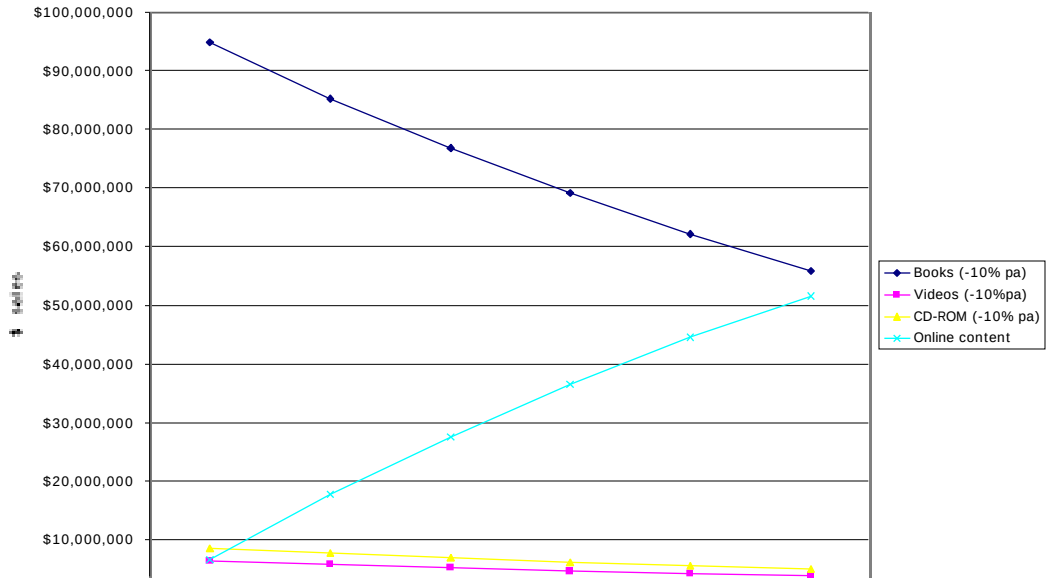


Figure 10: Digital curriculum materials market growth forecasts, 1997/98 - 2002/03 (growth to online by conversion)

K-12 digital curriculum materials market – International

Market opportunities

The experience in other areas of digital publishing indicates that the United States is unlikely to become a major international market opportunity for Australian producers. They already have many players, their school systems are highly fragmented, the entry cost into the online environment is very high and, like Australia, they will want material that is relevant to them.

Little published information is available about market opportunities in the Asian and Pacific regions. However, New Zealand is an obvious potential market, and contact between the Curriculum Corporation and relevant educational authorities in nations such as Singapore, Japan, China including Hong Kong, and Korea indicate a strong demand for high quality, English language digital curriculum resources. A number of these authorities have expressed significant interest in obtaining those materials from Australia.

There are two reasons for this. First, Australia is well regarded as a regional leader in education, able to produce educational products that are culturally sensitive to Asian values. Second, the market in these countries is thin. While the population density is high, English language students tend to be spread throughout the countries, and they face significant barriers of network access, bandwidth, professional development and content.

The Australian digital curriculum resources market is also thin and has many of the same barriers, albeit for different reasons.

Further, Australia has some significant competitive advantages in the education sector that can be built on by developing a critical mass of digital curriculum resources including:

- cooperative structures in curriculum development and access that work. Education.au and the Curriculum Corporation are recognised as leaders in the field, and the cooperative structures that underpin them are seen as models;

- a large body of teachers who are already well trained and comfortable in the use of digital curriculum resources in the classroom;

- a school education system with expertise in distance education that is widely acknowledged; and

- universities that are recognised to have unique expertise in distance education.

There are also possibilities for non-English language partnerships if Australia's technical and educational skill base in producing digital curriculum resources is developed. The modular approach recommended by this report would allow templates, interactives and other building blocks to be reused in languages other than English.

Appendix E lists examples of international online curriculum resource providers in the public and private sectors. The examples are not intended to reflect a comprehensive analysis of the market, but have been highlighted to illustrate the various attributes of public and private sector developers.

Digital broadcasting

The provision of digital curriculum materials is not limited to the internet – it extends to other delivery platforms including digital television. With the introduction of digital broadcasting to commence shortly, and full conversion from analogue to digital TV within a decade, the method of delivery for some digital curriculum materials is likely to shift from personal computers to television. This will affect where and how teaching and learning using digital resources occurs, for example allowing greater home and family usage.

We anticipate that within the next five years existing Australian free-to-air and pay TV broadcasters and new entrants will offer some form of educational 'channel' to their viewers. A review of several international initiatives in the provision of educational materials (not all of them curriculum-specific) via digital broadcast services is set out in Appendix F.

Current market development stems from three sources:

- traditional educational channels;
- data broadcasting services; and
- new interactive TV services.

In service industries of this kind, the business and revenue models vary according to the type and mission of the provider, but can be broadly categorised as:

- free - public service broadcasters meeting their charters;
- pay per view - learning on demand;
- sponsorship – of programs from entities wishing to raise profile of their product or brand, or capture details of the participating audience;
- fee for service - course fees; or
- subscription-based.

Publishing value chain

Figure 11 shows the digital educational publishing value chain. It indicates some of the key points where public sector involvement is likely to be required or will have a significant positive effect on market development.

The extent of public sector involvement will diminish as the market grows and matures. Several stages in market development can be identified. They are set out in Figure 12.

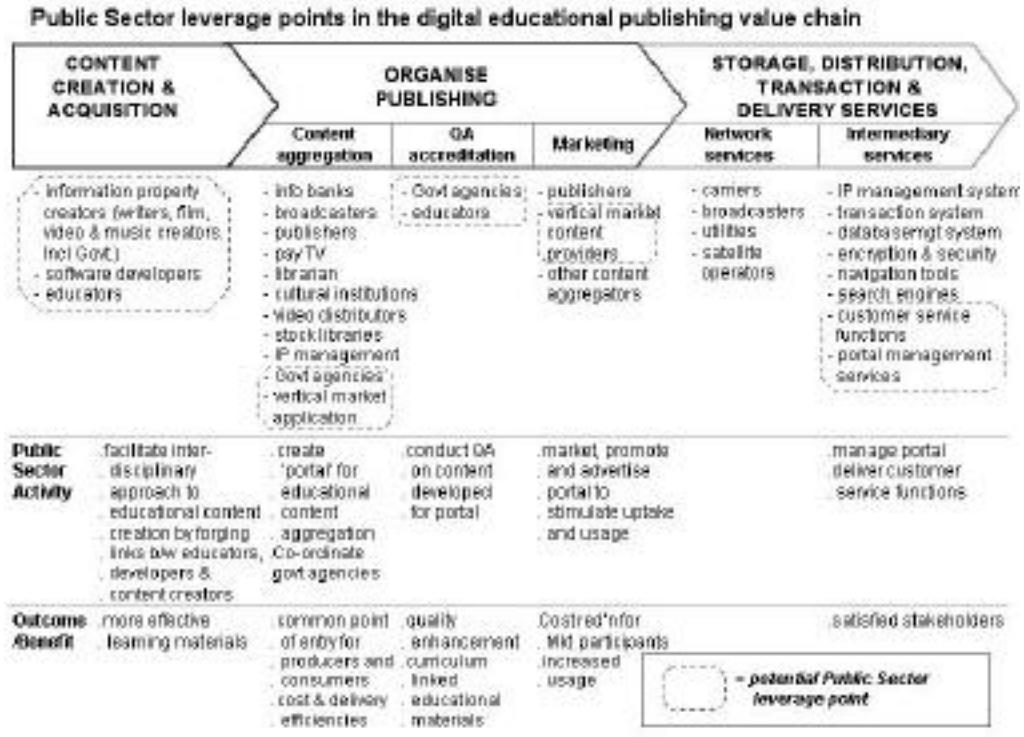
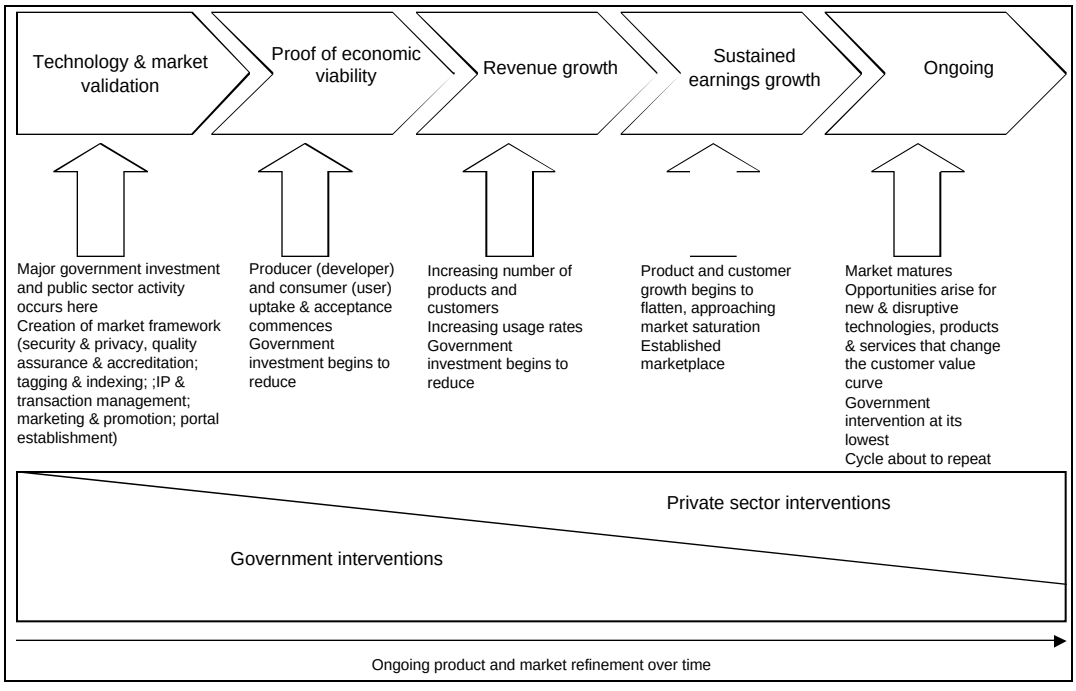


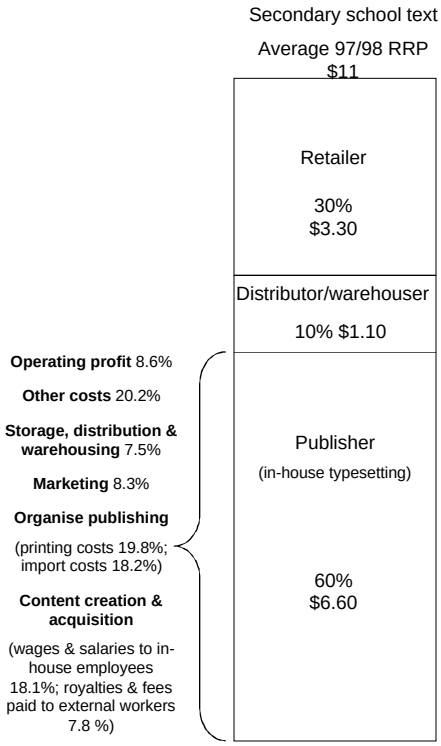
Figure 11: Public sector leverage points in the digital educational publishing value chain



(Source for Figures 11 and 12: Cutler & Company)

Figure 12: Stages in the development of a market for curriculum content

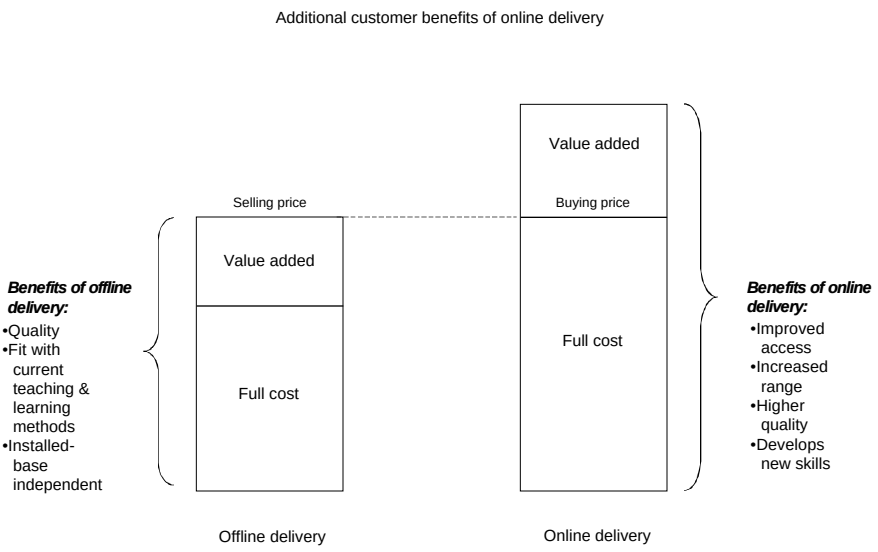
To provide a view of the curriculum market at the micro level, we examined the cost structures associated with a secondary school text book. The results of this examination are summarised in Figure 13.



Source: DICTA, 1999 & Cutler and Company following discussions with text book publishers

Figure 13: Typical cost structure of a secondary school text book

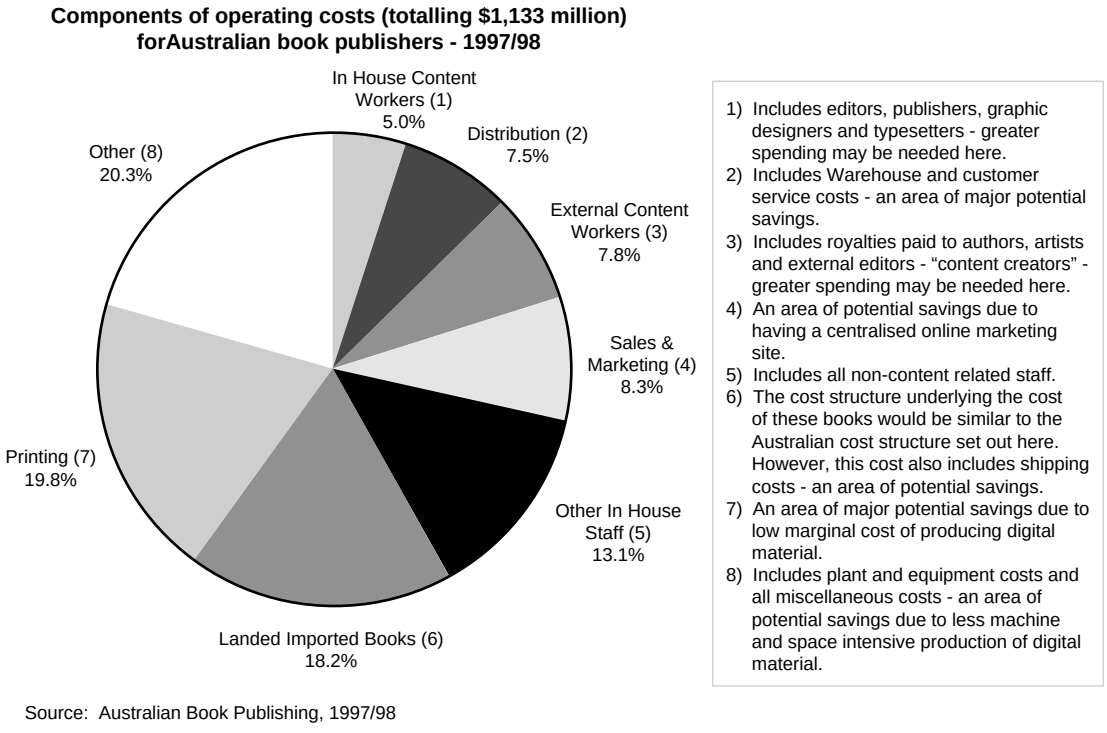
Applying a typical value model showing the increased benefit that flows from a move from traditional media to online publication and distribution, several points of potential saving on production costs can be identified. This is shown in Figures 14 and 15.



Source: Cutler & Company

Figure 14: Additional customer benefits of online delivery

A MOVE FROM PRINT TO DIGITAL CURRICULUM MATERIALS COULD RESULT IN OVERALL PRODUCTION COST SAVINGS



Source: Australian Book Publishing, 1997/98

Figure 15: Potential cost savings from move from print based to digital curriculum materials

It is not possible to identify the extent to which these potential cost savings will be offset by increased costs elsewhere in the digital publishing chain. Digital curriculum publishing involves higher authoring costs and other costs associated with hosting and access not seen in the traditional publishing market. As the market matures, these costs should diminish especially with the modular and reusable approach recommended by this report.

In deciding whether the cost savings compared with traditional publishing are sufficient to justify entry into the digital curriculum resources market, developers will consider digital publishing issues such as:

- production costs - will it make it cheaper to produce the learning materials;
- market reach - will it reach a larger number of students and result in increased revenues;
- product extension - will it make it possible to provide learning materials that were previously too costly to produce;
- educational value - is it appropriate to use this form of technology for the materials being considered;
- access - do students currently have access, or are they willing to pay for access;
- technology costs - what are the additional costs to the provider in making the technology available;
- demand - is there a demand from teachers for the material being considered; and
- social good - would it be possible to increase participation by offering this type of service?

Educational reasons

This section of the report summarises some of the educational reasons for:

- providing the market framework needed to assist the development of a digital curriculum industry; and
- the rapid and coordinated growth of Australian digital curriculum resources through providing a substantial public sector kick start.

The following three sections deal with the cultural, rural and regional, and skill base reasons for rapidly moving to develop a critical mass of digital curriculum resources for Australian school children. The report then examines the consequences of doing nothing.

The choice – wait for more data or move ahead?

Digital curriculum resources are already being used successfully in Australian schools. Some of them have been developed by State and Territory school systems, some by individual teachers, some by commercial providers in Australia and overseas, and some by the Curriculum Corporation.

Relatively few rigorous and systematic studies that investigate the direct link between ICT and improved learning outcomes have been reported. This reflects the relative immaturity of this field of research. Further, some researchers have cast doubt on whether it is possible to measure a direct link or even if this is the appropriate question to be researched given that this is not the focus in investigating other curriculum materials. For example, it would be unusual to attempt to isolate the effect of a particular textbook on learning outcomes without taking account of other factors such as student engagement and motivation, and teacher and classroom practice.

A recent review of the literature shows clearly that ICT does have a positive impact on:

- increasing and maintaining student motivation;
- making students more active and independent in their learning;
- providing new ways to represent complex or abstract concepts;
- providing more opportunities for communication and collaboration with others outside the classroom (this was seen as particularly significant for those in rural and isolated communities);

- giving students and teachers access to an increased range of information and resources; and

- helping teachers to re-examine their teaching practices and the way they think about teaching and learning (Bennett and Lockyer, 1999).

The US Software and Information Industry Association's 1999 research report, *The effectiveness of technology in schools* also suggests that educational technology has a significant positive effect on student achievement, motivation and self-concept. They cite the fact that "students felt more successful in school, were motivated to learn and had increased self-confidence and self-esteem when using computer-based instruction" (SIIA, 1999).

In summary, digital content generates increased motivation and promotes better teaching. The research clearly demonstrates that there is an identifiable link between the use of digital curriculum resources and increased student engagement and motivation. There is also a known link between the use of digital resources and better teacher and classroom practice. At the same time, research has long shown that better motivated students have better learning outcomes, and that better teacher and classroom practices improves learning outcomes.

These links are shown in the following Figure.

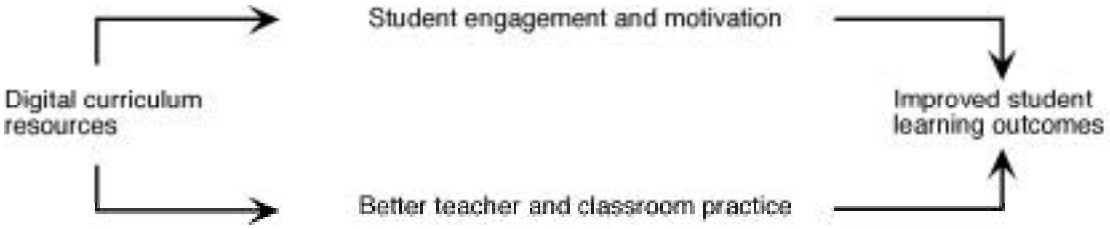


Figure 16: Links between digital resources and learning outcomes

Discussions with State and Territory education authorities presented a similar picture. They acknowledged the difficulties with researching a direct link. They were confident there was a positive outcome from digital curriculum resources. Overwhelmingly, the basis for their support was their own experience, and the practical experiences of teachers and students who have used ICT in their classrooms.

They saw ICT as a teaching tool, not an end in itself. It is effective when used in conjunction with good, 'live' teaching practice, but not as a substitute for it. In addition, they emphasised the importance of having sufficient content available and of effective quality control.

They were, without exception, decisively positive, confident and enthusiastic about the potential for properly structured digital resources to improve the quality and equity of education in Australian schools.

The current state of the research presents Governments and the community with a choice. They can either wait for more evidence to be collected, analysed and reported on – a process that would take years. Or they can move ahead, relying on the clear indirect evidence now available.

Others have already faced the same choice. In the United Kingdom, Prime Minister Blair appointed Mr Dennis Stevenson, Chairman of Pearson plc, a major publishing, media and educational content company, to conduct an independent report on the use of ICT in UK schools (Stevenson, 1997). The report concluded:

"[The] legitimate question is how and to what extent information and communication technology (ICT) presently helps learning. Evidence is now emerging on how ICT can improve learning. The evidence points to the conclusion that ICT brings considerable benefits to bear on the learning process, albeit benefits with different weight in different situations. It will be a very long time, however, before there is conclusive evidence to justify the substantial investment by the community at large that we believe to be necessary: and by the time the justification is achieved, almost certainly a generation or two will have lost out. … It seems to us a matter of common sense that the educational process in our country will gain massively as a result of using ICT wisely. If this proposition cannot be entirely proved, it has to be an act of faith. It is important that Government makes this act of faith and that we use the technology, rather than study it over the next decade".

Prime Minister Blair adopted the report and said "… we intend to lift educational standards in Britain to the level of the best in the world. This will mean making the most of technological change. Technology has revolutionised the way we work and is now set to transform education. Children cannot be effective in tomorrow's world if they are trained in yesterday's skills. Nor should teachers be denied the tools that other professionals take for granted. … However, there is a hurdle to be overcome before this vision is realised. … [Stevenson's] report identified … the need … to create a market for high quality British educational software." (ibid)

The same choice now faces Australia. In one sense it is easier for us because, since the Stevenson Committee reported, the research has strengthened the case for moving ahead.

Specific educational reasons

Improving basic skills

Digital curriculum materials are key tools in helping students reach goals in core learning areas, especially literacy and numeracy, and in providing teachers with the resources they need to achieve this.

In literacy, the National Study of English Literacy Survey (DEETYA, 1997) reported significantly better literacy achievements for students in classes that used computers extensively than for students in classes that did not – "Students in classes where teachers make greater use of school computers with their classes tend to have higher levels of literacy achievement." As discussed above, this link may not be direct, but it is real and strong.

In numeracy, the move beyond drill and practice software has opened new possibilities to increase the level of interest and engagement among students in mathematics. The early research results have been positive.

Digital curriculum resources make practical a degree of interactivity and exploration not previously possible. This means that the current highly conceptual approach to mathematics can be modified. This is especially important during the transition years between primary school, where mathematics tends to be taught as part of integrated classroom activities that span many subjects, and secondary school, where the approach to the subject has traditionally been abstract and conceptual. Groves (1996) summarised the opportunities as "... some mathematics becomes more important because technology requires it ... some mathematics becomes less important because technology replaces it ... and some mathematics becomes possible because technology allows it."

Across all learning areas, including literacy and numeracy, research supports the view expressed throughout this report that ICT is a learning tool. In the same way as other learning tools, ICT it is designed to support teachers, not to replace them. The research identifies the role of the teacher as critical to success.

Educational benefits for rural and regional students

The recent Regional Australia Summit recognised that ICT has special potential to improve learning outcomes for students in rural and regional areas. This potential includes:

- widening educational choices by bringing subjects and courses to schools where it was previously not feasible to teach them because of the small number of students involved and the lack of specialist teachers;

- providing access to more information and resources;

- allowing students in rural and regional areas to communicate and collaborate with their peers in other schools through online activities, such as discussion groups and undertaking projects together; and

- using the sequencing, content and assessment tools built into digital curriculum resources to help teachers without specialist knowledge to deliver courses, and assist and assess students taking them without having to be experts in the subjects themselves. This is not just in areas like mathematics and science. Digital materials online are now being

successfully used to help teachers in isolated communities teach courses as diverse as languages, drama and technical graphic design.

As discussed later (see page 42) there is evidence that students in rural and regional areas are significantly disadvantaged in terms of their access to courses and resources, participation and retention rates, and levels of educational attainment. Digital curriculum resources provide a realistic opportunity to help overcome this inequity quickly and at an affordable cost.

Disengagement

The problem of disengagement, especially among middle school boys, is well recognised and of growing concern. For these young people this period of their lives is characterised by low self-esteem, lack of confidence, lack of achievement, frustration and generally negative attitudes to schooling. Many resist participation in further education and, accordingly, are poorly prepared for their eventual entry into the work force. In the past, many of them would simply have left school when they turned 14 or 15. Now, with fewer jobs for unskilled young people and changes to Government benefits, they are locked into the system, effectively attending school against their will.

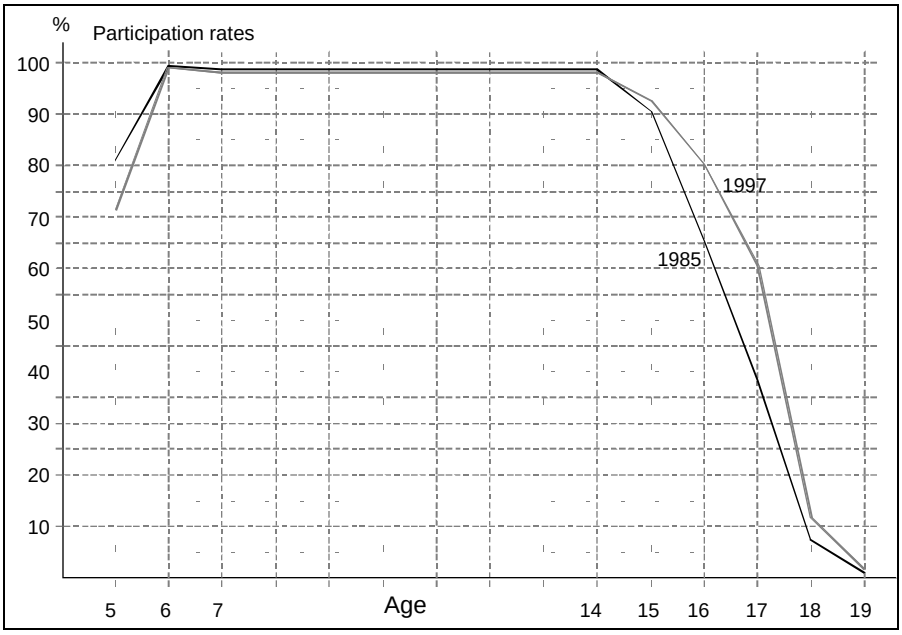
To tackle this situation, many have argued for a wider variety of teaching approaches that accommodate individual learning styles. A major focus has been on encouraging and supporting students to take a more active role in their own learning. Using ICT is an effective way to do this. Research demonstrates that using digital resources significantly increases motivation among these students and, importantly, that the increase is sustained over an extended period of time.

Participation and retention

Disengagement is part of the larger issue of participation and retention.

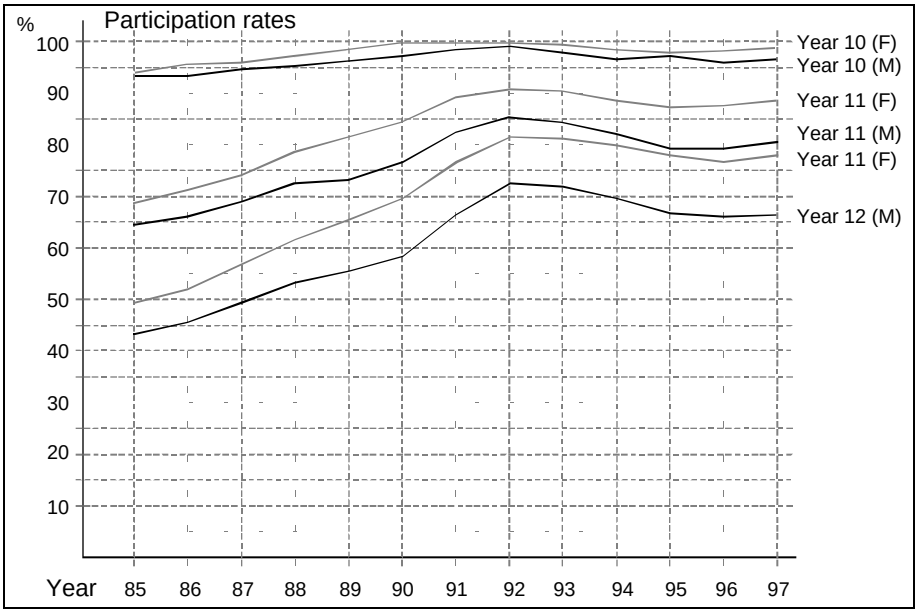
"If the unskilled worker and the young are not educated or re-educated there will be significant increases in inequality, with all the social costs that imposes. The solution is education." (DIST, 1997)

Although overall participation rates in Australian schools improved between 1985 and 1997 as illustrated in Figure 17 below, apparent retention rates have declined in key age and gender groups since 1992 (see Figure 18). Broader analyses of apparent retention rates reveal that gender, geography, ethnicity, family background and type of school all influence retention rates. The decline in participation is most apparent amongst males, rural students, students from non-English speaking backgrounds, and students in government schools.



(Source: DEETYA, *Education Participation Rates, Australia* , 1997)

Figure 17: Education participation rates in Australian schools, 1985 and 1997



(Source: DEETYA, *Education Participation Rates, Australia,* 1997)

Figure 18: School retention rates in Australia by year and sex, 1985 - 1997

Participation and retention rates have significant predictive influence on labour market outcomes for a considerable percentage of young Australians.

Keeping young people in school longer has two major advantages. First, it delays entry into the full-time job market. Second, it contributes to the provision of better-educated employees who are more flexible, trainable, and employable, and creates a more productive work force. Higher retention rates are also more likely to develop a work force that views further education at older ages as a natural part of their working lives (OECD, 1997). According to the OECD, these benefits may well "set the stage" for higher productivity and lower aggregate unemployment rates in the long term.

According to McClelland & Macdonald (1998), in 1996 there were an estimated 187,700 15 to 19 year olds (or almost 15 per cent of that age group) engaged in 'marginal activities'. A breakdown of their analysis suggests that in 1996, 5.4 per cent of the 15 to 19 year old population was not studying and in part-time work, 6.2 per cent were not studying and unemployed, and 3.3 per cent were not studying and not in the labour force. Therefore, in total for 1996, 17.9 per cent of the 15 to 19 year old population were neither in full-time education nor full-time employment.

In their paper *Restoring full employment: a discussion paper*, the Committee on Employment Opportunities states that there is a "substantial risk that 15 to 19 year olds who are not in full-time employment or full-time education will experience ongoing labour market disadvantage". This claim is supported in reports from the Dusseldorp Skills Forum, 1999, in which leaving school early is claimed to be a major contributor to young people's labour market disadvantage (*Australia's Young Adults: The Deepening Divide*, quoted in Falk & Kilpatrick, 1999).

Young people in 'marginal activities' have been influenced by a range of factors, including non-completion of twelve years of schooling, socio-economic background, ethnicity and place of residence. Participation and retention are significant in determining the life opportunities of young people at risk because of these factors. It is widely accepted that increased engagement and motivation improves participation and retention.

If the introduction of digital curriculum resources influences only 1.0 per cent of early school leavers to complete Year 12, based on 1996 figures, 1,877 young Australians would have better long term labour market prospects.

Improves girls' perception of information related careers

The IT Industry Skills Taskforce identified that a significant cause of the lack of skilled labour in the ICT industry was an extremely low participation by women in information related careers. This was not the result of barriers to the entry of women to the jobs but because girls tended to reject ICT related subject choices while at school. These findings are supported by educational research on subject

choices and the impact those choices have on pathways through higher education and in labour market opportunities (Lamb and Ball, 1999).

The industry taskforce found that girls perceived ICT subjects as 'nerdish' and unattractive because they were viewed as highly conceptual and mathematical. Integrating ICT across the whole of the curriculum and throughout all aspects of classroom practice should help overcome these perceptions.

Improves teacher effectiveness

Another area on which the research is clear is that the introduction of ICT to classrooms changes the way teachers teach. In particular it:

- supports teachers managing a wider range of learning activities simultaneously in the classroom;
- allows them to use resources that contribute to several learning outcomes;
- increases levels of interactivity between the student and the materials they are using, between the teacher and the students, and between groups of students; and
- gives teachers more control in assessment and monitoring by building these tools into the materials themselves and by providing richer feedback on student work and progress than would otherwise be feasible.

Better monitoring and assessment is a key feature of the National Goals to improve effectiveness and accountability.

Needed to achieve specific National Goals

The National Goals for Schooling in the Twenty-First Century state: "In particular, when students leave school they should … be confident, creative and productive users of new technologies, particularly information and communication technologies and understand the impact of those technologies on society". They also confirm technology as one of the eight key learning areas.

Neither of these objectives can be met without access to appropriate digital content both in ICT subject areas and more generally.

Benefits students of all abilities

The research literature has frequently noted the scope digital curriculum resources provide to teachers to personalise the curriculum to individual students or groups of students within the same classroom. The pressure for teachers in the traditional classroom environment to 'teach to the middle' is well recognised.

Digital content allows teachers to employ more of the strategies they already like to use in their classrooms. Students can learn at their own level, with some

students extending themselves with more advanced work while others are coming to grips with the core material. Teachers can take a more interactive role with individual students and small groups, moving from one group of students to another to provide guidance on the particular material each group is studying. Teachers are able to do this more when using digital curriculum resources because the technology and the digital materials themselves are inherently interactive, and they provide individual monitoring and assessment tools teachers would not otherwise have available. The result is that, for a given number of students and in a given amount of teaching time, teachers can do more of the things they have always wanted to do with their classes.

Digital curriculum materials are already being used successfully

Digital curriculum resources are already widely and successfully used in the early primary years to help students attain skills in literacy and numeracy. Other resources such as the Discovering Democracy program encourage teachers and students to work online and to use digital data and activities. All jurisdictions produce or use a range of digital educational materials, while Education.au runs the EdNA Online web site. In addition, the Curriculum Corporation runs projects to produce new digital support materials. Other tools are developed by teachers themselves for use in their own classrooms, and are being shared with their colleagues.

Figure 5 on page 10 compares the frequency with which computers are used by 8th grade mathematics and science students in selected countries. It indicates that Australian teachers are willing to incorporate ICT into their classroom practice

One jurisdiction reports that over 20 per cent of teachers are now frequent users, and this is likely to be the experience elsewhere. As discussed later in this report, further growth in the number of teachers who routinely use the technology in their classroom will depend on the availability of comprehensive digital curriculum resources.

Cultural reasons

Most of the commercially produced education related digital content available in Australia is produced overseas. Much of it comes from the United States, although the UK and others are also moving into the field.

Much of the overseas material cannot properly be classified as curriculum material. It lacks the purposeful structures, learning sequences, and built-in monitoring and assessment tools that characterise true curricula. While some of it can be useful for individual topics or sub-topics, in general it has not been designed comprehensively, and does not approach learning in the way it would be treated at school.

This is because much of the overseas material has not been produced for use in classrooms or by teachers. Rather, it is edu-tainment, a mixture of information and fun, aimed at the home market. The Disney Corporation is a leading producer of this kind of material. It can be engaging, appealing and educationally useful, but it is not curriculum. Accordingly, it is difficult to adapt to the classroom environment and is of limited use to teachers. The products are often tightly bundled in a way that is inconsistent with the modular approach to resources proposed by this report.

Further, from a marketing point of view, much of available material is aimed at parents rather than their children. One well identified market segment is the so-called 'guilt' market. The guilt market aims at parents who feel they should be doing more to help their children with their studies and who, not having time to do so, purchase edu-tainment, encyclopaedia and other packages in the belief it will benefit their children's education. Some of it may do so but, again, that does not qualify it to be regarded as curriculum material.

Nevertheless, the very large markets in the United States and the United Kingdom inevitably mean that high quality digital curriculum resources are and will be available from those countries. As discussed earlier, the United Kingdom is making a concerted push in this area. The United States has several programs that also encourage good curriculum materials development.

Because of the speed with which these markets are growing, there is a danger that unless Australia begins producing its own digital curriculum resources, we will be swamped by content from overseas. That, of course, is no reason to reject them out of hand. The trading and other advantages of making use of appropriate materials developed overseas are discussed on page 62.

However, there are significant educational, economic and cultural reasons to encourage the development and use of Australian materials. This section deals with cultural reasons and their relevance to Australian schools.

The core issue is the importance we attach to reinforcing a sense of national identity among our young people. This is not a matter of parochial nationalism. Every nation promotes the sovereignty of its own identity, the special characteristics of its land and people, and has its own history and heroes.

Young people have causes, are passionate, care openly, and want to take pride in things. Their country is something that brings together all of these emotions. We see it in sport, and in the increased interest by young people in ANZAC Day, our history and in our place in the world. Young people need to understand the special characteristics that make Australia a strong stable democracy, and a tolerant inclusive society. School is one of the first places to engage them in their culture and traditions, and to discover them afresh.

In addition to this general argument, there are a number of specific culturally related reasons for Australia to develop its own digital curriculum resources.

Relevance to the curricula of the Australian States and Territories

The States and Territories have invested a great deal of time and effort in developing their own purpose built curricula. They have been designed specifically to meet their individual needs. They cover their own and Australian history, geography, heroes, culture and traditions. The materials currently used to teach the curriculum are, likewise, their own in ethos.

Curriculum content produced overseas lacks this quality. It has not been designed with Australia in mind. State and Territory schools use few overseas textbooks because few overseas textbooks are relevant to their curricula. With the move to technology as a teaching tool, we need to develop our own purpose-built digital resources in the same way as we have developed traditional content.

Relevance to Australian students

Students learn better when they feel the work they are doing is relevant to them. Material produced overseas lacks this relevance. Typically it uses examples that are not Australian examples. When mountains are studied they are not Australian mountains. When world events are portrayed it is not from an Australian perspective. Overseas history is not our history. The nuances of Australian English are different from the United Kingdom, the United States or India.

Australian students are much more likely to feel their work is relevant to them if the materials they are working with are relevant to them too.

Promoting Australian standards and values

Over more than two centuries Australians have evolved their own unique standards and values. What we mean by a fair go, equality of opportunity, tolerance and democracy is different from what others mean.

Many of the attitudes to such concepts are formed by what young people learn and experience at school. The traditional curriculum materials students use now recognise this and promote Australian standards and values. The new digital resources need to do likewise, but this can only happen if those materials are Australian.

Australian multiculturalism and indigenous issues

Both these issues are uniquely Australian. In recent years they have become an increasingly important part of the States' and Territories' curricula, and special materials have been developed to support them. They need to have the same prominence in the new digital materials. This will only occur if those materials are produced in Australia for our own needs.

Rural & regional reasons

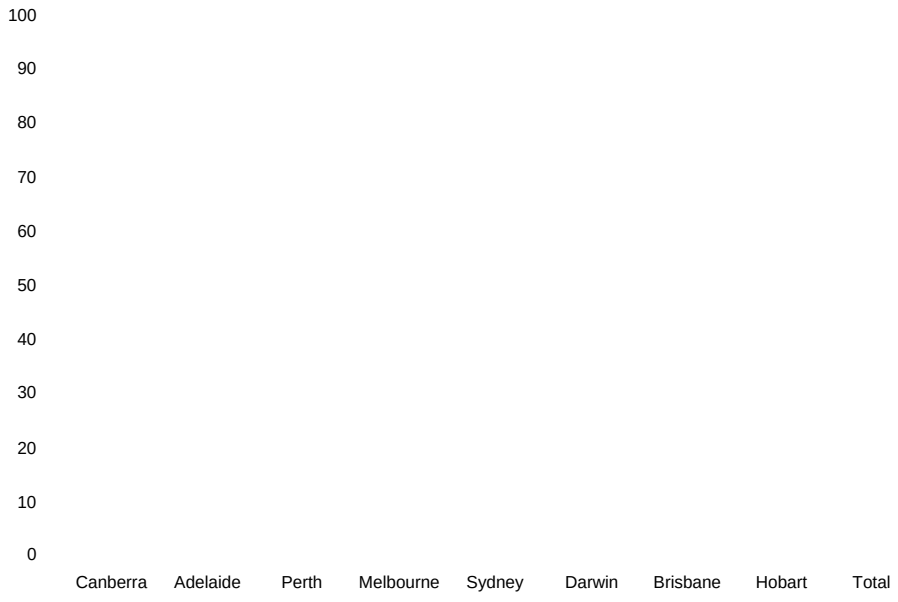
This section analyses urban and rural and regional demographics from an educational perspective. It reveals significant differences in:

- levels of access to quality educational resources – subject range, specialist teachers and other resources;
- participation and retention rates; and
- levels of educational attainment.

The statistics show that rural and regional students are disadvantaged when compared with their urban counterparts.

Demographics from an educational perspective

Australia's population is becoming increasingly urbanised. 70.2 per cent of Australians now live in the capital cites. According to KPMG Consulting, up to 200 rural shires in Australia have lost population in the last 22 years (*KPMG Population Growth Report for 1999* in *The Land*, May 6, 1999, p.23). Capital city populations clearly dominate State and Territory populations (see Figure 19).



(Source: Cutler & Company analysis of ABS data)

Figure 19: Capital city population as a percentage of State/Territory population, Australia, 1997

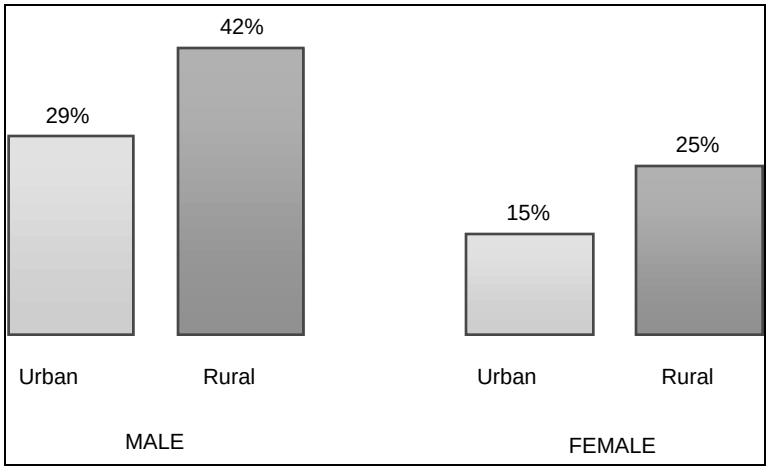
Access to educational resources

Despite lower student-teacher ratios in rural schools than in urban schools, Alston (1999) reports that more limited subject choices, fewer specialist teachers and fewer resources place rural students at a disadvantage when compared with urban students. Alston contends that the decline in educational standards is "commensurate with declining access" in rural and regional areas.

Rural and regional areas suffer particularly from difficulties in attracting experienced and specialist teachers, a problem that Alston and others associate with issues of perceived social isolation, lack of services and professional development opportunities in regional areas. Similar impediments are influential in the locational decisions of medical practitioners. It has been shown that 'quality of life' factors such as professional isolation, lack of opportunities for spouse and children, feelings of being 'trapped' in a community and lack of professional support can contribute to a reluctance by doctors to move outside metropolitan zones (*National Rural General Practice Study, 1996/97*, Centre for Rural Health, Monash University, in Strasser et.al., 1997).

Participation and retention rates

Research shows that young rural people are both less likely to stay at school beyond the compulsory education age and less likely to complete Year 12 than their urban counterparts (ACER data in Falk & Kilpatrick, 1999). Depending on location, participation rates can be up to 50% higher in urban areas (a 1999 HREOC study reported this in a study of Western Australian schools; Alston, 1999). Figure 20 shows the differences in Year 12 completion rates between urban and rural student populations.



(Source: Regional Australia Summit, 1999)

Figure 20: Percentage of young people failing to complete Year 12, rural and urban comparison

The relevance of participation and retention rate differences between rural and urban student populations is highlighted by the clear divide between the employment prospects of those who leave school early and those who complete Year 12 (for further information on this divide see Macdonald & McClelland, 1998). By the age of 24, completion of Year 12 reduces the likelihood of unemployment by 58 per cent (Burke, 1998). This makes it more likely that young rural people, and more especially young rural males, will experience unemployment more than their urban counterparts because of their lower Year 12 completion rates.

Educational attainment

Levels of educational attainment among the general population of rural and urban areas also differ widely. Falk and Kilpatrick (1999) used the *Integrated Regional Database, 1998* to show that the percentage of the population with basic qualifications reduces with increased distance from urban centres.

Special benefits to rural and regional communities

The Regional Australia Summit was held in October 1999 in response to growing concerns about the future of Australia's rural and regional communities. The communique issued following the meeting highlighted the important roles education and telecommunications must play in ensuring that regional Australians can meet the challenges and respond to the opportunities the future will bring. It also focussed on the need to develop what it called 'the human capacity' of regional Australia.

There is no doubt that many regional Australians have high expectations of the benefits technology can bring them. They see it as a way to help ensure access to quality learning opportunities for their young people, and eliminate barriers to participation. The availability of high quality digital curriculum resources in rural and regional schools is central to achieving this objective. It:

- allows rural and regional schools to increase the coverage of the courses they offer;
- ensures that the curriculum resources they use are on par with those available in the cities; and
- vastly increases the amount and variety of information available to them.

For teachers, ICT offers the scope to teach courses and topics that may otherwise not be available, and to keep up to date through online professional development. These are important factors in attracting and retaining quality young teachers to rural and regional schools. Professionally, there is little incentive for them to choose country schools if they are unable to teach the courses they would like to teach, keep abreast of developments in their profession, and access the information they need.

Further, digital curriculum resources offer scope to reduce the effects of the national shortage of maths and science teachers. This is a special problem for parents in regional Australia because they usually lack the option available to metropolitan parents of sending their children to another school which has these teachers available.

Regional development issues are also involved. Businesses will not establish in rural and regional areas if they are unable to obtain people with the skills they need. This means if education standards are lower in regional Australia than in the capital cities, business is less likely to invest there because the human capital they need is not available. Further, highly skilled city dwellers are less likely to be attracted to work in regional Australia if their children are unable to obtain an education equivalent to that they could receive in the major metropolitan areas. Failure to attract talented people to rural and regional areas makes the task of rebuilding these communities more difficult. Businesses will not invest in rural and regional communities if they cannot bring scarce high level personnel with them.

This means the quality of the education which young regional Australians receive today will play an important part in determining the future of regional Australia. Further it will be an important factor in determining whether children educated in rural and regional areas are able to find jobs there once they leave school. If they are unable to do so, the drain of young people to the cities will continue, contributing to an ongoing cycle of diminishing intellectual capital and 'depth' which many regional communities have faced in recent years.

New basic skills needed by the nation

It is now well accepted that technological development and the globalisation of economies have permanently changed the character of both work and employment.

"OECD economies have become knowledge-based economies in which knowledge in all its forms plays a crucial role in economic processes, including growth and job creation. Individuals with more knowledge get better paid jobs, firms with more knowledge are winners in their markets, and nations endowed with more knowledge are more productive. This is why individuals, firms and nations are increasingly investing in knowledge." (OECD in DIST, 1997)

Work no longer follows the old industrial model with hierarchical chains of command, narrow task divisions and a large proportion of unskilled labour. The workplace now requires flexible, task-oriented, multi-skilled, technically competent workers. "Knowledge and information are the most important resources in a flexible, high tech labor market" (OECD, 1998).

Employment too has changed. It is less stable and less certain than in the past. In OECD countries with information-based economies, the prevailing model for labour has a core work force of information-based managers, and a more fluid work force that moves between employers. Jobs at this level can be automated or out-sourced depending on market demand and labour costs (OECD, 1997).

This model is also prevalent in Australia. Flatau & Simpson (1998) report that the Australian labour market is increasingly segmented into two parts:

- a primary labour market with more secure, better-paid jobs for more highly-skilled people; and

- a secondary labour market with lower-skilled workers. This group is more and more confined to casual, low-paid employment with limited prospects of upward mobility.

Underlying this labour market segmentation is a basic divide between the increasing demand for 'information enabled' workers and the decreasing opportunities for 'information disadvantaged' workers.

The massive spread of information technologies throughout the workplace and the globalisation of the economy have created a demand for a new set of basic skills in the information age. One of these skills is information literacy, described by NBET, 1995 as "a literacy that combines information collection and analysis and management skills and systems thinking and meta-cognition skills with the ability to use information technology to express and enhance those skills. In a

society of information 'glut' the ability to detect 'signal' from 'noise' will become increasingly valued".

The importance of technical literacy and information manipulation skills across industry sectors and job growth areas is corroborated by research conducted over the past two decades. It demonstrates links between new technologies and the increasing importance of the human mind in the work process, and shows that the more broadly and deeply diffused advanced information technology is in factories and offices, the greater the requirement there is for autonomous, educated workers (OECD, 1997).

Specific demand for new ICT skills in the Australian labour force was recognised by the IT&T Skills Taskforce in its June 1999 report. It estimated that was already a shortfall of more than 30,000 ICT workers in Australia. Further, it estimated future growth in demand for skilled labour would increase from the current base of 360,000 ICT workers by:

- 29,700 in one year;
- 87,700 in three years; and
- more than 169,000 in five years.

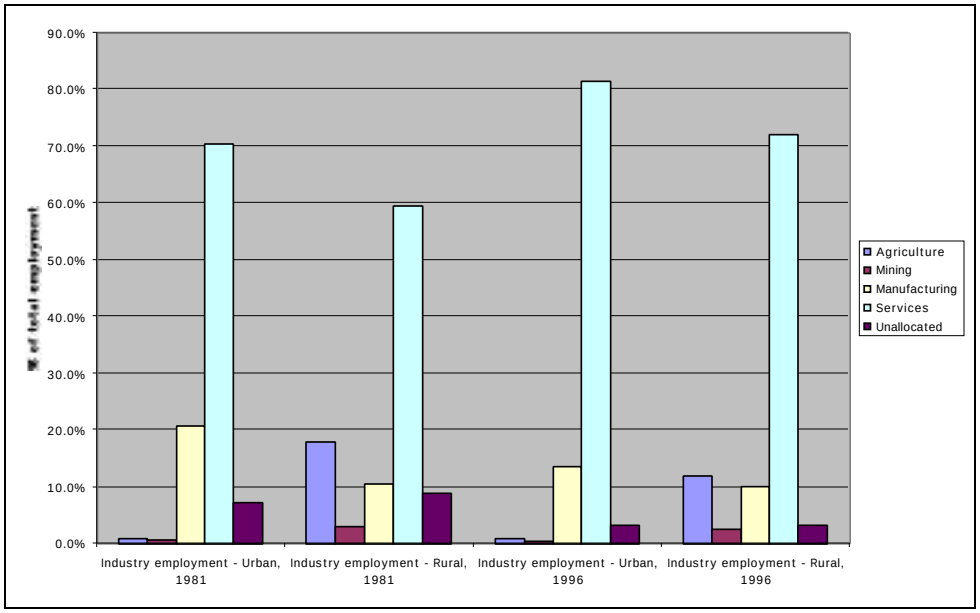
In the US, forecasters predict that by 2006 almost half (49 per cent) of the private workforce will be employed by industries that produce IT equipment or services, or by industries that are heavy users of IT equipment and services (Henry et.al., 1999).

This changing pattern of the economy has already impacted significantly on the labour force and will continue to do so. Figure 21 shows the changes that took place in both rural and urban employment between 1981 and 1996.

Figure 22 shows the changes that have occurred and are forecast to occur in employment by major occupation between 1990 and 2002.

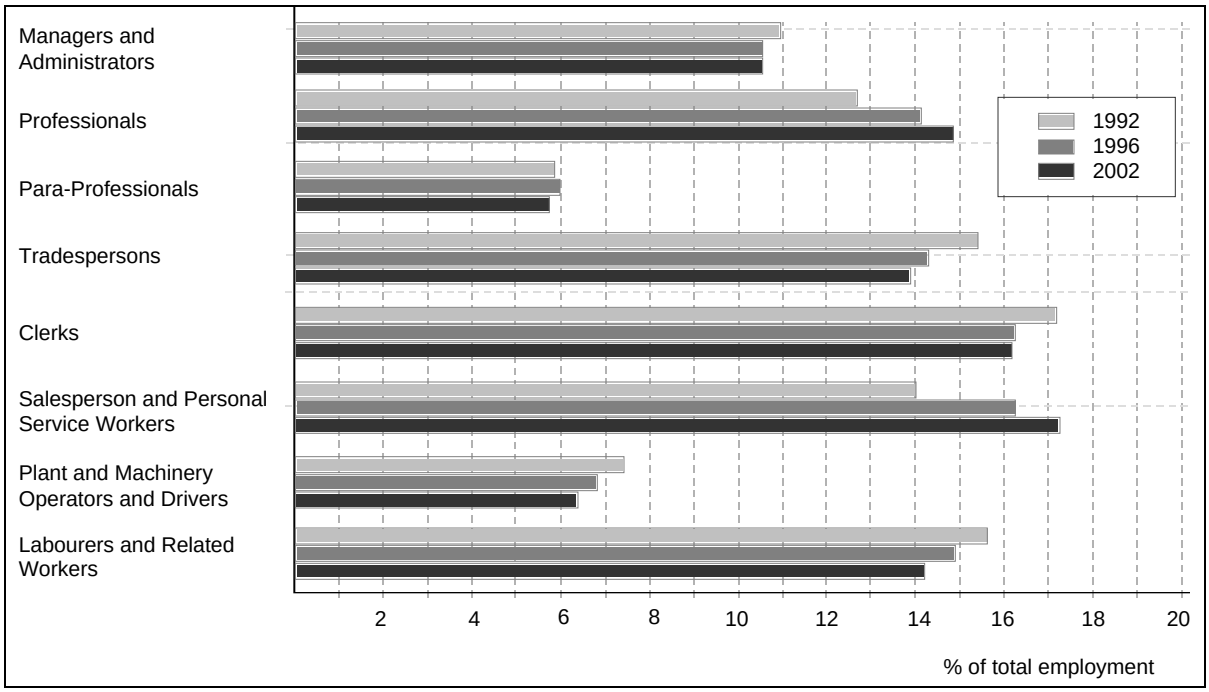
Broadly speaking, global economic change is contributing to:

- changed skill requirements in the workforce;
- higher minimum skill requirements for many lower-paid jobs; and
- increased demand for 'core' ICT workers.



(Source: Productivity Commission, 1999a, based on ABS 1996 Census data)

Figure 21: Employment in urban and country regions by industry sector, 1981 - 1996



(Source: Burke, 1998)

Figure 22: Actual and forecast employment growth by major occupation, 1990 to 2002, Australia

DIST has found that "As we move into the next century not only will Australia require more people with information and communication technology skills, the level and sophistication of the skills required will increase" (DIST, 1997).

Today many of the jobs traditionally taken by school leavers have an ICT component, whether it be operating electronic cash registers in stores or using the highly sophisticated equipment now becoming common in many traditional trades.

The need for a workforce skilled in ICT will accelerate in the years ahead, and the education system must prepare our young people for it. The OECD reports "The development of the global information society has a profound impact on the educational market and places new demands on the creation and delivery of educational materials and services" (OECD, 1998).

In a job market increasingly requiring ICT skills, the more familiar and confident young people become with technical literacy as a basic skill, the better their chances of obtaining employment. Recent research has shown a strong correlation between subject choices and employment prospects, and that subject choices are influenced by gender, early school achievement and other factors (Lamb & Ball, 1999). As discussed in the section on educational reasons, the IT&T Skills Taskforce has identified that girls reject ICT related choices at school because the choices are seen as relating only to special interests. It is also well recognised that school achievement is influenced by teacher effectiveness and student engagement, both of which respond positively to the use of ICT in classrooms.

In summary, "Investment in and promotion of high quality education and training is one of the most important contributions that can be made to Australia's future. The availability of skilled workers is a key to attracting investment, advancing the take-up of new technology, undertaking innovation and creating sustainable competitive advantage" (DIST, 1997).

Increasing the use of ICT in school is essential to create the kind of labour force that Australia will need. In turn, this report argues that the use of ICT as an educational tool depends on increasing the availability of digital curriculum resources.

Disadvantages of the continue-as-is option

This report recommends that all Australian Governments commit themselves to:

- developing the market framework needed to assist the future development of the digital curriculum industry; and
- the rapid and coordinated growth of Australian digital curriculum resources through providing a substantial public sector kick start investment.

Even if governments did nothing more than maintain the programs they now have under way, the market would continue to emerge and some digital curriculum resources would be developed. Private sector developers would continue to produce and market their products. Teachers would still prepare material for their own use, and share it with their colleagues. School systems and other organisations such as Education.au and the Curriculum Corporation would press ahead to the extent their resources allowed.

However, there are a number of problems with a piecemeal approach.

It would be too slow.

It would take years to provide the quantity and quality of digital curriculum resources needed. In the meantime, Australian students would miss out, or be left to rely on material prepared overseas which lacks relevance to them, is not tailored to the learning outcomes set by Australian States and Territories, and which is likely to embody standards and values that are not our own. Each year of delay would be a lost learning opportunity for a whole tranche of Australian students. Further, delay would erode Australia's regional comparative advantage in education. This would not only affect the education market, but our ability to compete in a global information and knowledge based economy.

It would not be comprehensive in and across subjects and years.

A piecemeal approach would leave developers to decide for themselves what materials they produced without adequate market signals. This would not generate the structured and sequenced material proper curriculum demands. It is likely to lead to unnecessary duplication, resource gaps in subject areas and across years, market failure in areas of significant educational need, and an order of development which fails to reflect priorities within the school systems. Easier-to-produce materials are likely to be produced first, regardless of their place within the overall learning framework. At the simplest level, an abundance of material could be produced for primary years SOSE but none at all for middle years science. For courses with only a small number of students, the lack of

market size may mean that no resources at all are produced, irrespective of the benefits they may have for the students and teachers involved.

It would create inequities.

Developers would naturally gravitate to the larger jurisdictions because they provide larger markets. Because smaller jurisdictions would have less market power, their particular needs would receive less priority. The same would apply to other areas needing special attention such as rural and regional communities and indigenous students.

It would deliver a poor return on the investment already made in ICT infrastructure.

With around $200 million per year already being spent on putting computers and networks in schools and on training teachers to use them, Australia needs to make the most of its investment. This can happen only if comprehensive digital curriculum resources are available in the areas teachers need.

The effective use of ICT in schools requires three components – infrastructure, teacher professional development, and comprehensive, high quality content. There has been a view, particularly among some technologists, that a supply side strategy would generate sufficient content.

This view was based on two premises. First, it was thought that the large amount of general digital content already available online equated with curriculum materials useful in the classroom. Further, suitable materials would come from programs such as the digitisation of libraries and museums. This view was technology centred and did not take account of the characteristics of curriculum. It was not a teacher and classroom centred view. This is not intended as a criticism of this strategy. The history of new technologies around the world is that the initial focus is on getting the technical issues right. Understanding the business issues comes later through use and experience.

Second, it assumed that supplying teachers with the professional development needed to use the technology would generate demand for the kind of content teachers want, and that the market would respond. Again, this has not been the case. While some teachers have been enthusiastic users of the limited materials available, widespread adoption has been held back by the lack of content. Jurisdictions report that teachers, having been trained to use ICT, are expressing disappointment about the lack of content. They are hesitant to make full use of the technology investment because comprehensive content is not available to meet their classroom needs. They also worry that their students, having become engaged and excited about the new tool this year, may not have the same opportunities to use ICT in subsequent years because of a lack of content.

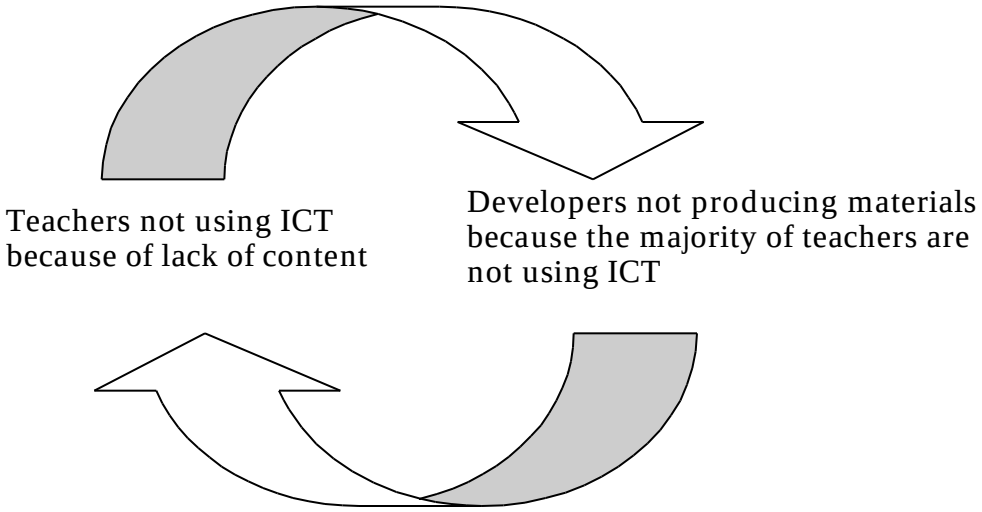


Figure 23: Content availability and use cycle

Australia would lose a first mover advantage.

Under a piecemeal approach, Australia would be left behind as other nations, recognising both the opportunities to improve learning outcomes and that a coordinated effort was needed, took the lead and established themselves as serious players in the digital curriculum market place.

In summary, continuing with the current uncoordinated approach without adequate market structures and the rapid development of a critical mass of developers, users and content will not generate the benefits Australia and Australian students need.

Market framework

Purpose

The current digital curriculum industry is described on page 16.

This section deals with the elements of the market framework needed to assist the future development of the industry. It focuses on the practical tasks to be undertaken.

Market characteristics

A market in digital curriculum resources is only just emerging. There is no real precedent for it, even in the most advanced information based economies. While digital curriculum resources are growing steadily, it is from a very low base. There is no comprehensive coverage of key subject areas, and much of what has been produced lacks the basic elements of scope, structure, sequencing and relevant content that delineates true curricula.

Currently, the small market that does exist is highly fragmented and lacks critical mass. It is characterised by:

- a poorly delineated market space;
- no clear expression of priorities, core expectations or operating rules;
- an inadequate flow of market information;
- no agreed system environment;
- a lack of clarity about pricing signals and rights management; and
- the need for further work to support searching, discovery and the assembly of content by teachers into practical classroom solutions (metadata, indexing, and populating and managing the national portal).

These characteristics are not the result of inadequate policy in the past. They simply reflect the current state of development of the market and the fact that, until recently, the path forward has not been clear.

Market framework objectives

Without any intervention, a market in digital curriculum resources will continue to emerge. However, it will not develop as quickly and comprehensively as needed.

For this to occur, some additional market framework structures are required. They are needed to support rapid development and to strengthen the link between developers and users.

The key requirements for the necessary market framework are to:

- delimit a sufficiently stable market space to inform investment decisions;
- improve the sources and flow of market information;
- provide for quality assurance and safety;
- establish and manage a system environment;
- improve access for, and provide appropriate price and other signals to, users; and
- allow a flexible but robust rights management regime.

Given that this is an emerging market throughout the world, it is necessary to rely on general market principles to establish a set of business rules (ways of operating) and market structures. As the market reaches critical mass and matures, public sector involvement will no longer be required in some areas. At that stage, those areas should be devolved to the private sector or simply abandoned.

Participants

The market is characterised by several classes of developer and many individual users.

The developers include:

- private developers
  - existing curriculum publishers (eg Scholastic)
  - educational content holders and publishers in the after school and study guide markets (eg Encyclopedia Britannica and ISIS)
  - edu-tainment publishers (eg Disney)
  - other content holders and developers (eg interest and advocacy groups)
  - 'new' investors pursuing market channels (eg information companies like News Ltd or PBL, telecommunications companies, and SchoolsNet);

- system level developers
  - national curriculum developers or facilitators (eg Curriculum Corporation, Education.au)
  - State and Territory school systems
  - Catholic and Independent school systems; and
- local developers
  - individual schools
  - teachers
  - students.

Developers may host digital curriculum resources themselves or they may use intermediaries.

The users include:

- individual teachers;
- individual students – in classrooms, at home or through distance education;
- school systems;
- parents; and
- export markets.

Public sector involvement required in market framework

Given the emerging state of the market and the fact that governments are, and will continue to be, inextricably involved in education in Australia, there is a clear need for them to provide leadership to:

- overcome obvious market failure;
- accelerate the pace of development of digital curriculum resources in the national interest;
- improve the return from significant public investment in ICT infrastructure and professional development within the schools sector;
- provide credibility with parents, teachers and in overseas markets;
- reduce duplication and gaps in resources;
- satisfy user demand for safety, relevance and educational soundness;
- respond to demand from the private sector for clearer delineation of
  - priorities
  - expectations about quality and system environment
  - consensus on what constitutes good practice
  - an endorsement mechanism;
- encourage innovative and non-traditional investment including from potential participants who would be reluctant to take part without a public sector mandate;
- maximise structural adjustment gains from the public sector kick starting the market; and
- support the emergence of an export market.

Further, significant components of the market will always be heavily dominated by the public sector both as a source of funds and because of the role of States and Territories in setting curriculum standards and outcomes.

The market in digital curriculum resources in Australia will always be thin. There is no natural reason for the private sector to develop it with the speed and comprehensiveness required. The market will always be constrained by factors such as our small population, and the structure and diversity of the school sector. Further, it is unlikely that non-traditional private sector investors such as companies seeking market channels would act without a strong public sector mandate. The moral and financial hazard would be too high.

However, a thin market does have some advantages. In particular, experience with thin markets can be a distinct competitive advantage in target overseas export markets.

We see significant scope for private sector sponsorships, and alliances and partnerships between the public and private sectors to develop digital curriculum resources. These approaches are already part of customary practice within schools systems. While traditional publishers and new entrants will be attracted by a fee for service involvement from the public sector, non-traditional entrants, particularly those seeking market channel opportunities, provide real scope for new innovative arrangements. MCEETYA has already considered this issue and has adopted a code outlining five key principles for sponsoring organisations which can be effectively translated to the digital curriculum materials environment – the *National code on commercial sponsorship and promotion in school education, 1992*.

Market framework structures

Given the current market circumstances and the clear need to act, two sets of market structures are required:

- a market information function and a quality assurance function; and
- an information broker function.

Further, the market needs a kick start to achieve critical mass quickly enough. This will require some additional structures. These are discussed on page 87.

Figure 24 summarises the various tasks in each of these functions.

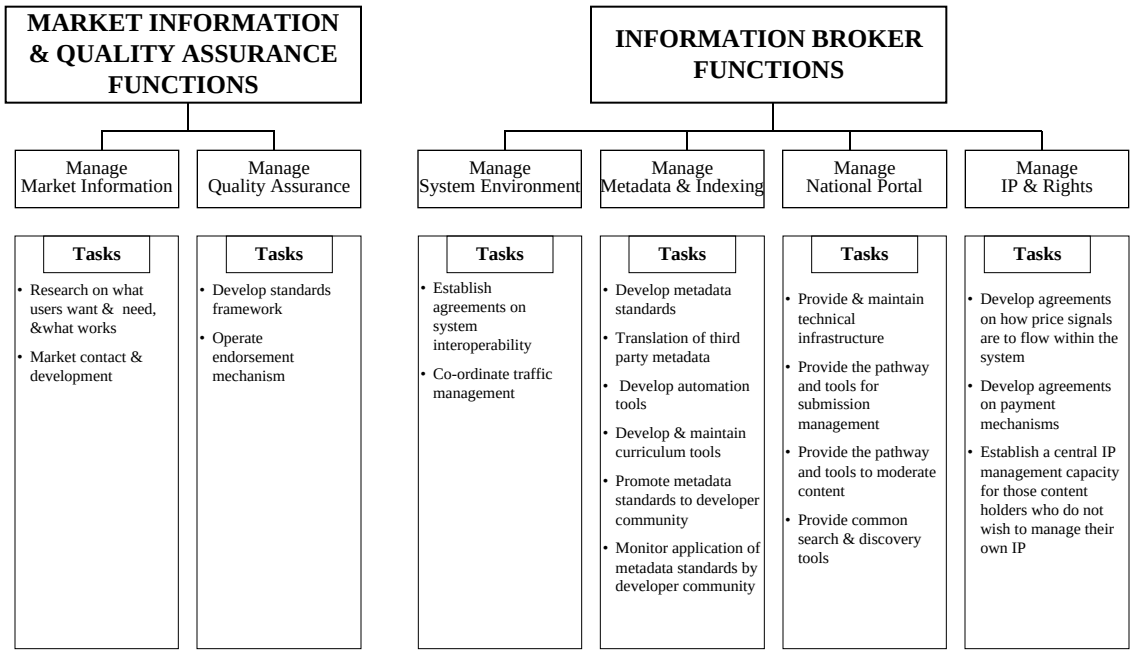


Figure 24: Market framework – functions and tasks

Market information function and quality assurance function

The purposes of this set of functions are to:

- improve the sources and flow of market information; and
- provide for quality assurance to make developers aware of the expectations of commissioning authorities and to assist users in choosing and assembling resources.

Market information function

The tasks in market information involve research, and market contact and development.

Research task

The research task is to:

- commission research into what users want and need, and what works;
- collate and digest that research; and
- communicate it to the developer community, and to decision makers such as the commissioning authorities.

The first research priorities are:

- the practical needs of teachers in the classroom environment;
- student responses to different approaches and to different levels of interactivity. For example, as students become more familiar with the medium, does the level of sophistication in interactives and other resources need to increase; and
- infrastructure issues, including plans for future classroom hardware and bandwidth.

Research into what works includes:

- reviewing Australian and overseas research; and
- longitudinal evaluation of effectiveness of the overall investment, and of what constitutes best practice.

Collating and digesting the research should focus on:

- assembling best practice information to reduce its cost of discovery, especially to new or smaller developers; and

- solving problems inherent in those data sources that are sensitive, or difficult to compare or access.

It should be made clear that the research task we are recommending is for a market purpose. It is not a general or academic research role. This is important because it makes clear what research the market structure is responsible for. Future priorities in research must be guided by what proves to be useful in the market.

It is also important that the research task be separate from the market research that developers should undertake as part of their normal business. It must provide a set of information that is available to all participants in the market, be seen to be independent and of high quality, and address areas in which companies would not naturally invest.

Market contact and development task

The market contact and development task is to:

- provide an initial point of contact for developers (other than the States and Territories in their capacity as developers);

- provide advocacy and information about opportunities; and

- encourage local and export industry development.

A single point of initial contact for developers is needed to simplify access to information, and reduce the cost of discovery about the market and market opportunities. It would not replace the role of the States and Territories in dealing directly with the developer community.

Without a single point of initial contact, developers are forced to deal with eight separate education agencies. This is a significant barrier to entry. A single point of initial contact ensures that information about the needs of all jurisdictions is presented to developers. The market contact role would include providing developers with a channel to the various States and Territories.

It is important that the market contact role involves more than providing a passive point of initial contact. It must actively promote market opportunities and provide information to developers, including:

- existing players in both the digital curriculum and wider curriculum publishing market;
- interested potential players; and importantly
- non-traditional players who might not otherwise see opportunities for their business, or who would not act without some kind of public sector invitation or mandate.

We see no justification for duplicating existing industry development structures just for this market. This role can be handled by existing State, Territory and Commonwealth economic development agencies. Nevertheless, there are some areas where the proposed market contact and development structure has a specific role to support these agencies. This will be particularly important in the first few years. The specific roles are to:

- in local industry development
  - provide channels through to the appropriate areas in State, Territory and Commonwealth economic development agencies
  - brief the agencies on the opportunities, current state and future direction of the market; and
- in export development
  - provide a single point for initial international market contact
  - reinforce the perception of the credibility and quality of Australian education products in potential markets
  - develop recognition of the 'Australian brand'
  - provide market intelligence.

Quality assurance function

The tasks in quality assurance are to develop and maintain a standards framework, and to establish and operate an endorsement mechanism.

Standards framework task

The role of the standards framework is to set out:

- the system environment. This describes how the system will work and how its parts fit together. It deals with features such as modularity, reusability, interoperatibility, custodianship, and teacher control. It also covers developing a framework to specify standards and protocols for assembling digital curriculum resources into properly structured courses

and learning sequences. The proposed system environment supports the market framework and the kick start investment, and is set out at page 92; and

- the educational standards relating to educational soundness and good practice in digital curriculum resources. This involves the development and maintenance of a nationally agreed consensus on criteria for educational soundness and good practice in digital curriculum resources.

Together, they clarify for developers the approach and kind of products commissioning authorities are willing to pay for.

We believe educational soundness is the appropriate measure of quality, not other possible measures such as outcome suitability, curriculum or syllabus compliance, or recommendation by way of certification or otherwise. The reasons for this are explained on page 63 as part of the discussion of the endorsement mechanism.

The criteria for educational soundness must:

- distinguish between digital curriculum resources and general digital content (although some general content may be educationally useful);

- include the characteristics of modular design, and teacher choice in the assembly and customisation of content discussed as part of the system environment;

- promote the purposeful development of curriculum materials necessary to improve student learning outcomes;

- include structure and sequence that support the curriculum frameworks of the States and Territories, either as part of the resource itself or through its ability to be part of a structure and sequence set up by a teacher or school system;

- ensure assessment and monitoring of student progress are built into the resources; and

- require that the materials are suitable for the medium. It is not simply digitising textbooks and materials developed for other media.

Some progress has been made on developing the criteria for educational soundness and good practice in digital curriculum resources. This work needs to be completed. We recommend that the final standards should meet the following principles:

- the standards must be nationally agreed;
- they need to be sufficiently precise to be useful to developers without closing the market to innovation;
- the standards must directly reflect the needs of users and commissioning authorities, and should not attempt to achieve objectives beyond those needed for the digital curriculum market;
- they need to be developed in consultation with commissioning authorities, developers, and teachers; and
- they must be expressed in a way and at a sufficient level of detail to be useful to the developer community.

The standards need to be maintained using the same principles of consultation, documentation and informing the developer community used to develop them. The maintenance of the standards must also involve:

- integrating into the standards the results of the research about what works;
- maintaining the national consensus and connection with teachers as end users; and
- promoting the standards both for their role within the market framework and as part of the brand recognition essential to building export markets.

One drawback with setting standards is that they can close the system to innovation. This should be avoided in the standards framework. There are several reasons for this. One of the characteristics of internet and online businesses is the highly open environment in which they operate. Regulatory constraints and other barriers to entry and innovation have been kept to a minimum. This has promoted dramatic innovation and growth, and this light handed approach should be applied to the standards framework for digital curriculum resources.

Further, as a small trading nation, Australia must remain open to drawing in good quality products from overseas. It should not create artificial trade barriers in the guise of standards.

Nevertheless, the regional comparative advantage in education that Australia currently enjoys will be eroded unless we establish and maintain a robust standards framework. This comparative advantage does not simply affect our export market in educational products. It goes to the heart of the ability of the Australian economy to move faster than competing economies in the global shift to information and knowledge based industries.

We believe the standards should be advisory rather than mandatory, including for work commissioned as part of the kick start investment. The existence of standards will be a strong incentive for developers to work to them but, by allowing alternative approaches, innovation is encouraged.

Endorsement mechanism task

Private sector developers are looking for an endorsement mechanism to improve the appeal of their products. The are likely to use endorsement of their products in two ways. The first is to promote their digital curriculum products to the teacher market. The second is to use endorsements of digital curriculum products to attract parents to other products such as study guides and after school materials.

The fact that developers are looking for an endorsement mechanism does not, in itself, justify public sector involvement. However, there are good market development reasons for providing an endorsement mechanism. It:

- encourages developers to adopt good practice standards;
- reinforces what commissioning authorities want from the developer community;
- increases credibility and confidence in the use of digital curriculum materials among parents and teachers;
- assists users to chose between competing resources; and
- reduces the cost of discovery and assembly of content by teachers.

The endorsement mechanism could operate at the following levels:

- outcome suitability – the extent to which the digital curriculum resources directly contribute to the specific educational outcomes of States and Territories;
- curriculum or syllabus compliance – the extent to which the material meets detailed curriculum or syllabus specifications set by the States and Territories, or by Catholic or Independent school systems;
- educational soundness; or
- a ranking approach – Product A is superior to Product B, rather than a threshold approach, Product A meets the standards but Product B does not.

Our view is that, in practice, only educational soundness tested against the standards framework discussed above is appropriate and achievable. There may be pressure from private developers for more extensive endorsement at other levels but this should be resisted.

Outcome suitability is not appropriate because digital curriculum resources contribute to improved educational outcomes principally by increasing student engagement and motivation, and improving teacher and classroom effectiveness. They are not, of themselves, a magic bullet. Rather, they are a tool which strengthens the best aspects of the traditional classroom environment and teacher role.

Measuring curriculum or syllabus compliance is not achievable because the level of detail and manner in which curricula are specified differs markedly between the States and Territories. Some jurisdictions provide more detailed syllabus for teachers while others deal with this at a school or individual teacher level. The issue here is not that one approach is superior to another, just that endorsement based on curriculum or syllabus compliance would be almost meaningless across jurisdictions and of limited value to teachers within most systems.

A ranking approach goes beyond a legitimate role for the public sector.

If educational soundness measured against an agreed standards framework is the appropriate basis for endorsement, then users of the endorsement information – primarily teachers but also parents and other members of the general community – need to be clear about what it does and does not mean. An endorsement framework will only meet legitimate market structure objectives – as opposed to simply being a convenient marketing tool for developers – if there is ongoing education and promotion to users about what it means.

The point in the development cycle at which access to the endorsement mechanism is available to developers also needs to be resolved. For commissioned work, such as the kick start investment, endorsement should be an automatic part of meeting the contract specifications. There is no value in building a further step into the process. This means the endorsement mechanism will only need to apply to products that have not been directly contracted by the commissioning authorities.

Further, to prevent the system from being swamped, the endorsement mechanism would normally not apply to most non-commercial teacher-developed and school-developed materials. These materials are covered by the moderation process managed by the information broker (see page 74).

Attempts by developers to informally submit materials early in the development cycle should be resisted. This would be the most expensive approach and, even if developers were willing to pay the marginal costs, would place an unsustainable burden on those undertaking the assessments. Once the standards are set and published, the responsibility should rest with the developers. However, a set of clear examples of good practice materials needs to be available to guide them.

The endorsement mechanism should only assess materials once they are fully developed. This avoids an inappropriate risk transfer to the public sector. It also allows for more effective cost recovery. The marketing benefits to developers mean that they should meet at least the marginal cost of operating the

endorsement system. However, the investment in developing and maintaining the standards framework is properly part of the public sector kick start needed for the rapid development of a critical mass of high quality digital curriculum resources.

A further task associated with the mechanism is protecting the integrity of endorsement. This requires registering an appropriate trademark in the same way as other quality marks are protected – for example, the Woolmark.

Information broker function

The purpose of this set of functions is to manage:

- the system environment;
- metadata and indexing;
- the national portal, including common search, discovery and assembly tools; and
- intellectual property and rights.

Managing system environment

The proposed system environment is set out on page 92.

The tasks in managing the system environment are to :

- manage the interoperability between distributed custodians of content; and
- coordinate data traffic management.

They do not involve managing caching or managing url stability.

Caching is a school system or jurisdiction level issue. Because the system environment uses distributed custodianship of content resources, many users will choose to cache curriculum resources as well as external resources. The reasons for this include student safety, cost efficiency (eg between charges for the use of material and charges for bandwidth), and responsiveness (eg time lags caused by bottlenecks or peaks in demand). However, these decisions about what and how much to cache need to be made at school system level.

URL stability is a developer issue (other than the urls associated with the operation of the system environment itself, such as the national portal).

System interoperability task

The system interoperability task is to maintain the ability of the components of the system environment to work together without the need to:

- develop new 'glue' every time a component is added; or
- rearrange the environment.

The system environment assumes:

- distributed custodians of content;
- curriculum resources held in a modular form, able to be reassembled and reused;
- the capacity for jurisdictions and school systems to customise the look and feel of the environment to make the system appear to have been uniquely created for them; and
- the content being responsive to the different customisation and assembly environments of the various school systems.

To work effectively, this requires technical agreement between the jurisdictions. This technical agreement must focus on interoperability, not on specific proprietary solutions. For example, the technical agreement should allow any school system to create a unique environment for its teachers to use. Each will want to include material for their teachers and schools other than purely curriculum resources. While they may choose the same tool sets, the system must allow for different approaches and innovation. It is not efficient to build this interoperability uniquely for each new set of materials or tools. There needs to be agreement up front about specifications and standards.

It is important to emphasise that system level interoperability differs from interoperability between digital curriculum resources. The requirement that these resources be modular and able to be reassembled and reused in many different course structures – including those developed uniquely by an individual teacher for a single classroom – is part of the standards framework and the procurement conditions set by the commissioning authorities.

Coordination of data traffic management task

The data traffic management task is to develop agreements and protocols between the major participants in the system on:

- managing the large day-to-day data traffic associated with distributed custodianship;
- planning for changing technologies;

- planning the sizing of the system in a period when the amount of content and the number of end users are rapidly growing; and

- dealing with unexpected problems such as failure of a key link, or a major content holder's system going down.

The capacity to undertake these tasks already exists. The issue for the market framework is one of coordination, not centralisation or duplication. Therefore, the jurisdictions need to develop a set of agreements and protocols to handle data traffic management.

Managing curriculum metadata and indexing

Many of the tasks discussed in this section are currently being undertaken under the leadership of Education.au. As discussed on page 94, we believe that Education.au is the natural body to undertake the information broker function recommended by this report, including continuing its work on metadata and indexing. MCEETYA and CESCEO have already agreed to the basic curriculum metadata standards and a process to update them as required. The tasks mentioned in this report should build on that foundation and, specifically, extend them to make them useful to, and useable by, developers.

The tasks in curriculum metadata and indexing are to:

- develop metadata standards and metadata components that can be applied by developers;

- manage the translation of third party metadata;

- develop automation tools to allow developers, including teachers and schools, to apply the metadata to curriculum materials produced by them;

- develop and maintain curriculum indexes to match these standards;

- promote the metadata standards to the developer community; and

- monitor the application of the metadata standards by the developer community.

Develop metadata standards task

The development of metadata task is to:

- describe the metadata components (the tags);
- develop rules about what is and is not included in curriculum metadata, allowing for local additions; and
- create standards that specify how the metadata components relate to each other, and are to apply to digital curriculum resources.

The metadata standards should be developed in a way that allows them to be applied by developers. Central tagging at national or a school system level would be too expensive and too slow to handle the rapid growth of digital curriculum resources recommended by this report.

To rapidly develop the market, the metadata development work needs to be completed quickly. The additional effort required should be funded as part of the public sector kick start.

Translation of third party metadata task

Two other sources of metadata need to be accommodated by the system:

- metadata from content providers within the curriculum chain that is not curriculum related – for example, tags to meet the needs of departments, school systems or individual schools for their own purposes. This should be dealt with by allowing local additions to the curriculum metadata standards; and
- metadata from content providers from outside the curriculum chain – for example, content holders like Encyclopedia Britannica, television and print media, libraries and museums.

Content providers from outside the curriculum chain will have metadata standards designed for their own needs. For example, museums need metadata standards appropriate to managing collections. These standards are not directly compatible with those used for curriculum resources.

It is not realistic to expect these providers to apply curriculum metadata tags to their content. It would be very expensive and time consuming for no direct business benefit. However, to effectively access and use this external content in classrooms, teachers and school systems need to be able to use the same search and discovery tools that they use for curriculum materials. Therefore, an important role for the information broker is to:

- develop the capability to map third party metadata to curriculum metadata;

- identify those external resources to be mapped based on the demand from teachers and schools; and

- include the translated metadata in the curriculum indexes.

Develop automation tools task

To apply metadata at the developer level, a set of automation tools is needed. These tools allow metadata tags to be applied to digital curriculum resources without the need for specialist knowledge. The approach is similar to being able to pay a bill using a telephone IVR system without knowing the technicalities of how an IVR system works.

There are two reasons for developing these automation tools. First, applying metadata is a specialist area. Automating the task relieves most developers, especially smaller developers and individual teachers, of the need to master the skill. Second, automation will deliver a uniform level of high quality tagging in the overwhelming majority of cases. This leaves the small number of people skilled in metadata tagging free to concentrate on standards, future development and more difficult cases.

Again, the emphasis should be on flexibility. There is no need to mandate a single set of automation tools even though many developers may choose the same arrangements. Rather, the specification and standards that should apply to such tools need to be agreed by jurisdictions.

Those with similar needs may choose to cooperate in the development of the automation tools. If all jurisdictions agreed to a common approach, developing a standard set of tools could form part of the public sector kick start.

Develop and maintain curriculum indexes task

The purposes of curriculum metadata are to allow:

- modular digital curriculum resources developed for one course and with one structure in mind, to be more easily reassembled into different structures and reused in other courses; and

- users to find and assemble the content they require quickly, within a structure familiar to them, and with a minimum of specialist technical knowledge other than their teaching expertise.

The first purpose is part of the standards framework and is included in the specification of good practice in digital curriculum resources.

However, by itself, metadata tagging of digital curriculum resources does not deliver the second purpose – allowing users to find and assemble content efficiently and quickly. To do this, the metadata must be harvested (searched out and collected together) and incorporated into structured indexes.

These structured indexes are not yet fully developed. This development will involve:

- research into the ways in which teachers specify, search for and assemble the materials they need; and

- agreement between jurisdictions on how to codify this research into index structures that match the metadata standards and components.

While some work has already been undertaken, it needs to be completed quickly because it is essential to using the rapidly growing pool of digital curriculum resources effectively. The additional effort required to develop the indexes should be funded as part of the public sector kick start.

This work should focus on structured indexes, in preference to other possible approaches. While natural language parsing may eventually be the best approach, the technology is too immature and expensive at the moment. In any event, curriculum materials and classroom teaching objectives are partially structured already, for example by course, subject area, topic, subtopic, year, or target audience. This means that structured indexes are a natural approach to the material. Further, this approach is familiar to teachers and other users because it is the way in which written materials are usually organised. For example library catalogues, Index Medicus, Psychological Abstracts, or catchwords in legal judgements all use this approach. They provide multiple pathways to finding the material the user requires.

Once the structure has been defined, the indexes need to be populated with the metadata applied to digital curriculum resources. While the system environment favours a distributed approach to most tasks, this function is best managed centrally, even though some of the processing tasks can be distributed. This:

- ensures that there is a master version of the indexes of known and consistent accuracy and comprehensiveness;

- reduces the overhead associated with harvesting metadata from distributed holdings of curriculum resources; and

- allows for a more structured submission process to support related tasks, such as moderation.

The indexes, which may be mirrored throughout the system, then support the search, discovery and assembly tools provided by the national portal or by individual school system sites.

Promote the metadata standards task

Once the metadata standards are developed, the developer community needs to be informed about them. Promotion should reinforce the fact that the standards are an integral part of the quality framework. Developers should be left in no

doubt about the importance of the standards to the effective operation of the system.

Further, the promotion needs to be ongoing in order to keep developers up to date as the standards change, and to catch new developers as they enter the market.

Monitor the application of metadata task

Monitoring the way metadata is applied by developers is a quality assurance task.

It is necessary for three reasons:

- first, tagging digital curriculum resources with metadata is crucial to making content accessible to end users, and to the effective operation of a distributed system;
- second, the only efficient approach is for developers to apply the agreed metadata standards to their own products; and
- third, a 'publish first – review later' approach similar to that proposed for submission management and moderating content avoids unnecessary delay in making digital curriculum resources available to users (see pages 72 and 74).

A system of periodic review of the quality of metadata tagging on a targeted selection of digital curriculum resources is the most efficient approach. This should be done by an expert group. There is no need to review all material, provided that the standards are expressed in a way that developers can interpret and apply, and given that automation tools will relieve smaller developers of much of the technical task.

Obvious exceptions and errors will be picked up as the metadata is harvested to create curriculum indexes. In the first instance, these exceptions should be referred back to the developer. More difficult issues, especially those that may indicate a need for revising the metadata standards, will need to be dealt with by people expert in the area. This means jurisdictions need to develop a set of agreements and protocols to handle difficult metadata problems. The same expert group used for the quality assurance of metadata tagging could also undertake this task.

Managing the national portal

The system environment supports a national portal for access to digital curriculum resources. The success of the portal approach has been demonstrated by EdNA Online and by the education sites or channels operating in several jurisdictions.

Two points should be made:

- a national portal for curriculum resources does not prevent school systems operating their own education sites or channels, indeed it supports them; and

- the national portal will undoubtedly handle educational issues, services and materials beyond digital curriculum. This is already the case with EdNA Online and education sites or channels already in operation in some jurisdictions. These issues are important, but this report covers only those tasks associated with digital curriculum.

The tasks in managing the national portal are providing:

- the necessary technical infrastructure and maintaining it;

- the pathway and tools for submission management;

- the pathway and tools for moderating content; and

- search, discovery and assembly tools for users.

Providing and maintaining the technical infrastructure task

This task involves the hardware, software, bandwidth and support personnel needed to run a national portal. The issues associated with this task are already well known from the experience of Education.au with EdNA Online.

The only point to be made is that funds need to be available so the portal can cope with rapid growth in digital curriculum resources and the number of users accessing the indexes and tools.

Pathway and tools for submission management task

The submission management task involves the process by which the metadata describing and pointing to new digital curriculum resources is included in the curriculum indexes. This process does not involve the actual resources themselves because the system environment provides for them to be held by distributed custodians.

There are two ways to handle new submissions. Developers could notify the information broker that a new digital curriculum resource is available and submit the metadata to be included in the indexes. Alternatively, the information broker could periodically examine selected sites to collect the necessary information.

Given that the system environment specifically accommodates resources developed by individual schools, teachers and students, the first approach should be used. However, to prevent the national portal being swamped, initial processing of submissions from individual schools, teachers and students should be handled at a school system level, especially in larger jurisdictions.

To keep the system as open as possible, we recommend that the submission of digital curriculum materials should be managed using the following principles:

- having as few steps as possible in the submission process;
- allowing the market to choose which materials it favours rather than attempting to cull materials at the submission stage;
- including new resources in the indexes as quickly as possible – in a matter of hours rather than days; and
- adopting a 'publish first – review later' approach.

A further aspect of submission management is dealing with resources that have become obsolete, unavailable or for which there has been no market demand. The usefulness of the indexes will degrade over time if these resources are not culled from them.

There is no single solution to this issue. Some resources will be actively withdrawn by custodians because they no longer wish to maintain them. The submission process must allow for the custodian to notify the information broker.

Jurisdictions need to agree on how to manage resources that simply become unavailable or have not been accessed for an extended period of time. The agreement needs to allow users to report resources included in the indexes that cannot be accessed. If a resource is unable to be accessed for a specified period, then it would be culled from the indexes by the information broker. The agreement also needs to cover materials that are not used. If a resource has not been accessed for a specified period, then it also would be culled from the indexes on the basis that users have found it unsuitable.

While there is a considerable overhead associated with culling, it is essential to maintaining the quality of the indexes.

Pathway and tools for moderating content task

Moderating content involves:

- a rudimentary check of whether resources have been correctly assigned within the indexes – for example, that a resource has not been mistakenly tagged as relating to science rather than art; and

- testing the suitability and safety of the resources for students – for example to ensure the resource does not contain racist material.

Moderation does not involve testing resources against the standards criteria, applying the evaluation mechanism, making an expert assessment of the metadata, or providing users with a recommendation. The market will provide sufficient signals about these issues as users make their own judgements about individual resources. Undoubtedly, such judgements will be shared and discussed between users and at professional forums. The national portal and school system sites have a role in disseminating these market signals through chat rooms, bulletin boards and other means.

Moderation is essential to the safety of the system for students and, therefore, to its credibility with teachers and parents. However, unless it is correctly handled, it could become a bottleneck in the system and a significant drain on resources.

The potential bottleneck can be overcome by adopting a 'publish first – review later' approach. This is a risk management strategy that accepts that digital curriculum resources come primarily from professional developers and professional teachers. It is reasonable to trust that the overwhelming majority of the material will be appropriate in terms of safety for students. Any remaining risk is minimised by the fact that materials are typically part of pre-established learning sequences, or are assembled for use by teachers before students come into contact with them.

The potential drain on resources can be managed in two ways. First, materials submitted to the endorsement mechanism, or which are developed as part of contracts with commissioning authorities, do not require moderation. Second, in a distributed system, the moderation workload can be shared amongst many people.

Further, provided that jurisdictions take the role in the submission management process discussed earlier, much of the work associated with choosing moderators, notifying them that new resources have become available, and dealing with moderation issues can also be done on a distributed basis.

Jurisdictions need to develop a set of agreements and protocols on the approach to be taken, what is to be covered and how to handle distributed moderation. They would form part of the agreements associated with submission management.

The information broker would then maintain the agreements and coordinate the overall moderation task, but only arrange moderation for materials submitted directly through the national portal.

Providing search, discovery and assembly tools task

Teachers need sets of tools that allow them to:

- find the digital curriculum resources they need;
- assemble the resources into a learning sequence for use by their students, either by customising a prearranged sequence or by uniquely devising their own; and
- administer the use of resources by students, for example registering students, monitoring their progress, setting up discussion groups, receiving assignments, receiving assessments, and recording results.

Students need sets of tools that allow them to make use of resources and participate in activities associated with the sequences set by their teacher. They also need a structured environment that encourages independent exploration and extension, but still within the safe, guided environment provided by the system.

It is inefficient to develop different sets of tools for different digital curriculum resources. This has been the tendency in the past with CD-ROMs, but it is very expensive and it forces users to learn how to use new tools every time they use a new set of curriculum resources.

Good practice in digital curriculum resources includes requiring materials to be modular and able to be reassembled and reused. Given this, the tool sets must be usable across all materials where appropriate. If they are not, the benefits of the modular approach to resources are reduced significantly.

This does not necessarily require a single, mandated set of tools. The system environment provides for a national portal which needs to have a common tool set. However, it also allows school systems to develop their own sites which customise the look and feel of the system and add local materials. These sites could provide a different common tool set for that school system. The important point is that they can be usable across all materials.

The sensible approach would be to establish agreement among jurisdictions about how tool sets and resources should interact. This avoids increased cost arising from developers having to deal with different standards.

Managing intellectual property and rights

The tasks in intellectual property and rights (IP) management are to:

- develop agreements on how price signals are to flow within the system;
- develop agreements on payment mechanisms; and
- establish a central IP management capacity for those content holders who do not wish to manage their own IP.

There is no single, neat practical solution to IP management within a distributed system environment. Accordingly, the approach to IP management should reflect the following principles:

- flexibility, so the system accommodates different arrangements that meet the needs of developers and users, rather than attempting to impose a single structure;
- school system level decision making on issues such as how far down the user chain price signals are to be passed;
- credibility, so that owners of intellectual property have confidence in the system;
- compatibility with the culture of the school education system in Australia, and with intellectual property solutions that have been developed for materials in other media used by teachers. Where there is a culture of sharing, such as between teachers on materials they develop themselves, this should be able to continue.

Fundamentally, the issues in IP management for digital curriculum resources are the same as for materials produced for other media except:

- the modular approach to resources means that there are many more objects to be managed; and
- there are many points in the chain where purchasing decisions can be made, as opposed to, say, textbooks where the decision is made only when a book is bought.

It is also important to distinguish between IP management associated with using developed resources and the issues associated with the development task. As a general principle, developers should make their own decisions about how component IP within their products is handled. If component IP management is passed through to the user level, the complexity of the arrangements will increase dramatically. Developer responsibility for component IP should be included in the standards for good practice in digital curriculum resources and in contracts for work from the commissioning authorities.

Price signals task

The price signals discussed here are for the use of intellectual property, not infrastructure access charges which are not within the scope of this report.

Effective markets contain price signals. In the market for digital curriculum resources, price signals can operate in four ways:

- developers may wish to provide 'free' access for teachers to digital curriculum resources they have developed as a means of achieving some other business objective (see the discussion on payment mechanisms below);

- school systems can meet the cost of accessing materials for schools and teachers within their jurisdiction;

- schools can make purchasing decisions between competing products and in terms of their own budget priorities; and

- teachers can make purchasing decisions between competing products, either within a school system or in an independent capacity.

The system must accommodate all of these approaches without making any of them mandatory. Except at the developer level, the decision about which approach or combination of approaches is to be adopted should be made at the school system level.

'Free' access from developers is likely to be common practice. There is already a culture of teacher and student developed resources being shared in this way. Similarly, some private sector developers interested in targeting the after-school study guide market have indicated they are willing to provide curriculum resources to schools and teachers without charge. The materials developed as part of the public sector kick start could also be provided in this way because jurisdictions will already have invested in them, but individual jurisdictions should be allowed to pass some or all of this cost through to schools as price signals. However, we do not believe that there is any benefit in developing complex transfer pricing arrangements between jurisdictions.

At the present stage of development, the general practice has been for school systems to purchase digital curriculum resources and allow schools and teachers to use them without charge. Accordingly, no price signals have been passed through to end users. Some systems may wish to retain this practice while others may wish to bring decisions about purchasing digital curriculum resources into line with their school-based approach to other financial decisions.

To avoid unnecessary complexity, we recommend that materials developed as part of the public sector kick start should be provided to all jurisdictions without use-based charges. It would then be a matter for each jurisdiction to decide whether to pass on price signals for using them to their schools and teachers.

Payment mechanisms task

The payment mechanisms discussed here are the ways in which value passes from users to developers.

This value has four forms in the digital curriculum market:

- public good – the policy benefit that governments wish to achieve both in the education sector (eg reduced disengagement amongst middle school boys) and in the general community (eg economic objectives such as the growth of an export market, and social objectives such as improving opportunities for regional communities);

- professional development – the value from sharing resources between teachers;

- money – payment for use of the intellectual property in digital curriculum resources, as outlined above in the discussion on price signals; and

- other economic benefits – including developers wanting to promote related materials, for example the after-school study guide market, or market channel benefits.

The system needs to allow for value to pass in all these ways.

Market channel benefits involve companies willing to invest in developing digital curriculum resources as a means of gaining access to a large group of potential consumers to sell unrelated products. This group of potential consumers includes parents as well as teachers and students.

While there are issues of protecting students from inappropriate commercial pressure and maintaining the privacy of parents, market channel techniques are already widely used in schools. For example, book publishers and photographers use schools as a marketing channel through to parents. They receive the commercial benefit of a large pool of potential consumers of known demographic characteristics and the school receives other benefits, such as 'free' access to products or customer acquisition payments based on new customers or sales made.

While decisions about market channel access will always be made by individual jurisdictions and school systems, the larger the pool of potential customers, the more attractive it is for companies to invest in the digital curriculum market in order to gain access to the pool. Jurisdictions may find it helpful to gain the benefits of taking a collective approach to this issue.

Central IP management task

This task involves the information broker using the national portal to manage intellectual property on behalf of developers who do not wish to manage it themselves.

Because the digital curriculum resources will be held on a distributed basis, most developers will manage IP themselves using one of the payment mechanisms discussed above. However, some developers may find it more efficient to use the information broker to manage their IP rights for them.

The system needs to accommodate this on a commercial basis to prevent introducing unintended market distortions, or crowding out potential business opportunities in content management on behalf of developers.

Central IP management requires pricing and payment mechanisms (for the owner of the intellectual property and for the system itself), access control, and tracking usage. It would require agreements between the information broker as operator of the national portal and those jurisdictions running their own sites.

Kick start public sector investment

The case for a kick start public investment

This section deals with the case for a significant, coordinated public sector investment to kick start the rapid emergence of a critical mass of digital curriculum resources.

A critical mass of digital curriculum resources is one that is:

- comprehensive in and across subjects and years;
- supports the needs of teachers across their whole classroom strategy;
- carries forward from year to year so students can build skills, and benefit from the higher degree of engagement the medium provides to them; and
- gives teachers choices between resources that contribute to similar purposes.

A critical mass needs to be developed quickly in order to:

- avoid delay in delivering the educational benefits to students, so children currently in the system do not miss out on life opportunities;
- deliver the social and economic objectives required by the national interest;
- maintain Australia's competitive position both generally within the world economy and within the education market; and
- meet the expectations of parents and the general community about the role of ICT and the educational returns from the investment already made in schools.

Delay in educational benefits

The problem of disengagement of children from school education, especially middle school boys, is an increasing priority. Disengagement and poor achievement at school starts a cycle of alienation from the life of the broader community, a belief that social institutions have no relevance and cannot deliver benefits to them as individuals, low self-esteem and entrepreneurial spirit, dysfunctional social and risk-taking behaviours, reduced pathways to higher education, and limited life and labour market choices.

Further, recent research has shown strong links between subject choice and young people's opportunities in further education and in the labour market. Unfortunately, the subject choices with greatest influence on their opportunities in later life, such as mathematics and science, have benefited least from research into factors influencing student achievement. Too often, they are still presented in highly abstract and conceptual ways that most students find difficult to relate to.

This is not because the teachers have not kept pace or have failed in their professional practice. The time and effort required to make these subjects more interactive and engaging, and to introduce a range of activities within a classroom that speak to students at all levels of achievement – not just those in the middle – is beyond any one teacher. Digital curriculum resources help overcome this problem.

It would be simplistic to argue that all of these issues result solely from disengagement at school or that ICT and comprehensive, compelling digital curriculum offers all the answers. However, ICT is a clear point of leverage which can contribute directly to better results for our children. The research indicates that this link is not in the form of some 'new' effect that improves student learning outcomes. There is little evidence to support this sort of link. Rather, the link is to factors that are already well known to influence educational attainment, student engagement and motivation, and teacher and classroom practice.

Social and economic objectives and competitive position

In addition to creating new economic development opportunities, the economic and social objectives for a kick start investment in digital curriculum resources include:

- building the social fabric of the nation by reinforcing cultural identity and reducing inequity. For young people and those in rural and regional communities, it involves reducing alienation – the feeling that they are disconnected from and not sharing in national goals and in the benefits of economic reform and development;

- strengthening local communities by reducing barriers to investment, re-emphasising their importance in the national fabric, and increasing the perception of their viability among the people who live in them; and

- supporting the consent to govern that underpins our democracy by giving people confidence that government is still able to make things better.

These objectives are being pursued in the context of:

- a fundamental shift in the world economy through rapid and sustained growth in the information sector; and

- the need for new social and economic infrastructure if Australia is to share in the increased wealth the new economy is generating.

In the view of the OECD, successful exploitation of this requires governments to take a new economic perspective. The role of government needs to shift towards investment in social capital to address market failure and to accelerate development in the new economy.

Just as the information sector is the source of new wealth in the world economy, it also provides the means to exploit it.

The largest benefits from the information economy are reaped by early adopters. The benefits are not distributed equally across all economies. Government action is required to build the social capital necessary to fully exploit the emerging opportunities.

ICT is a powerful tool to support this new investment in social capital. While it is only one of the necessary levers, it provides a set of new solutions, especially for local communities.

Education and the engagement of young people at school and then in higher education and the workforce are basic elements of this social capital.

Further, as part of a sensible mix of physical and electronic school activities, comprehensive digital curriculum resources allow school systems to improve significantly the experience of people living in rural and regional communities. This is not just restoring educational services equivalent to those that may have been lost, but providing opportunities and quality that have never been available in these communities before.

Meeting expectations

Parents and the general community are exposed to a growing range of heavily marketed private sector services, constant media coverage about the internet and the information economy, and increasing links between popular culture, such as television shows, and online services. Combined with the publicity surrounding the large ICT investment in schools so far, they come to the system with very high expectations of the services that will be available to their children. These services include comprehensive, accessible and easy to use digital curriculum resources. The gap between their expectations and the real level and quality of digital curriculum resources available is too great. This risks eroding the effort that has been put into building parental and community confidence in school education.

The children themselves are immersed in the ICT medium as a part of their daily lives. Young children are now entering the school system already familiar with ICT but there is insufficient curriculum content for them to make effective use of their background. The popular culture of children currently in the middle years of school is dominated by activities associated with computers and the internet. This is not just the time they spend before game consoles or computer screens – although this activity is displacing television as the dominant media in this group – but that much of their interaction with their peers, the books they read and the other media they view, their hobbies and their physical games are based around themes and interactivity that come from ICT.

Children find this environment compelling and engaging. Parents have very high expectations about what it will deliver in schools. Without a kick start, these expectations will not be met.

Limitations of the market alone

By itself, the market will not deliver a critical mass of resources quickly enough to meet these objectives. They are public benefits that accrue to the nation as a whole, to individual jurisdictions and to students, not to developers and investors. Therefore, in order to achieve these public benefits, public sector involvement is required.

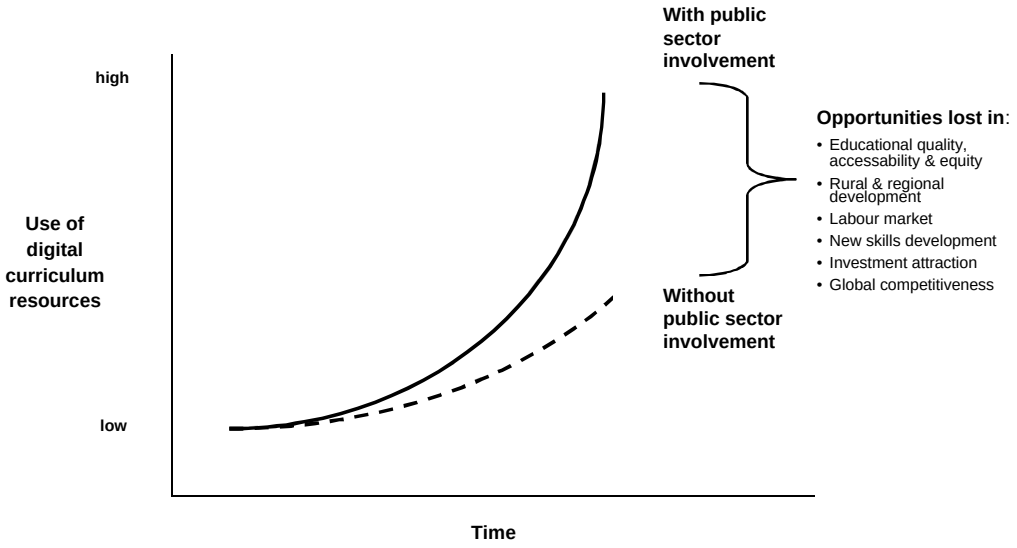


Figure 25: Loss of benefits without public sector involvement

Creating a market framework, including structures designed to enhance the link between developers and users, is an important step and will encourage growth in the amount of digital curriculum resources. However, by itself, it is not enough. It does not address market failure in the scope of the resources, provide

the level of curriculum mapping and other practical kick start tasks outlined below, or provide the level of investment required to secure the benefits in an acceptable time frame.

At the same time, making a public sector kick start investment without establishing a market framework is not sensible. Developers would be operating without adequate market information or a clear expression of the expectations of the commissioning authorities. Users would lack the support structures they need to find and assemble materials. The investment by the commissioning authorities would be once off and, therefore, have no tendency towards sustainability. It would be more expensive in the longer term because of disputes over the reuse of modules in new products by teachers and competing developers.

Coordinated action

Coordinated action between the jurisdictions in providing this public sector kick start is essential because:

- the task is large, and probably too big even for the largest jurisdictions to do alone, both in terms of the intellectual resources required and the cost;
- uncoordinated action will not deliver benefits quickly enough to meet the wider social objectives, such as reduction of rural and regional alienation, and better pathways for at risk youth. Nor will it meet educational objectives, such as achieving a critical mass quickly to encourage widespread adoption by teachers;
- a jurisdiction by jurisdiction approach would result in inequity between groups of students across the nation, and the relative inequity between metropolitan and rural educational opportunities would be entrenched;
- private developers want consensus on what constitutes good practice and on the expectations of commissioning authorities;
- industry development, and brand identification and endorsement in overseas markets would be stronger;
- jurisdictions need sufficient market power to overcome any developer resistance to modular, reusable and interoperable design;
- resources need to be reusable across several year levels and subjects to minimise the overall cost and avoid duplication; and
- a national pool of capital and a nationally coordinated effort is more likely to promote a competitive market structure than a jurisdiction-by-jurisdiction approach.

What is needed for a kick start public investment

In order to provide a public sector kick start, there needs to be agreement on:

- the market framework within which the investment will be made, including consensus on standards and good practice in digital curriculum resources;
- the priorities for investment;
- an appropriate procurement framework;
- ways to make the system sustainable; and
- funding.

The market framework is described on page 53.

Funding is discussed on page 107.

Priorities for investment

Any coordinated kick start of digital curriculum resources needs to be informed by a set of priorities.

The procurement framework discussed below proposes that the school systems acting together should be the commissioning authorities. They have the necessary policy expertise and resources, and are the groups that must finally reach a consensus on priorities over the course of the investment.

However, we believe that the Ministerial Council should also play an active role beyond the normal oversight that Ministers provide to national initiatives. In particular, Ministers should agree on the first priority areas.

There are three reasons for Ministerial involvement:

- speed – the project should start with agreement on the first priority areas to allow development to commence as quickly as possible;
- clarity – the benefits of the project need to be clearly communicated to teachers, parents and the wider community to build early support and enthusiasm. Ministers are well placed to provide the necessary impetus by setting early priorities that are educationally sound and understood by the wider community; and
- direction – Ministerial agreement to a set of first priority areas would send a strong signal that governments around the nation regard the project as an urgent national priority.

In setting the first priority areas, several subject areas stand out for consideration by Ministers:

- in literacy
  - K to 3 literacy
  - middle years literacy (especially the transition years between primary and secondary school);
- in numeracy
  - middle years mathematics and numeracy
  - K to 3 numeracy;
- in science
  - middle years science;
- in information technology
  - secondary years technical literacy (ICT skills);
- in SOSE and civics
  - case studies on civic life and success stories in regional Australia across all years linked to values and the Discovering Democracy program
  - middle years entrepreneurship and business orientation;
- in vocational education
  - secondary years vocational literacy
  - career education; and
- in languages
  - build on existed funded programs.

This list reflects several of the most pressing reasons to invest in a national project to kick start the development of digital curriculum resources discussed elsewhere in the report including:

- enhancing the effectiveness of teachers in critical areas of the curriculum;
- addressing the major educational and social problems caused by disengagement from the school environment, particularly among middle school boys;
- recognising the strong link between subject choices – especially maths and science – and life chances in further study and jobs, and dealing with the question of motivation and access;
- in the longer term, ensuring the labour market has sufficient people with ICT skills;
- reinforcing the importance and contribution of regional areas to Australia's cultural identity; and
- building on the positive impact of teaching to a range of learning styles for indigenous students.

Procurement framework

The procurement framework consists of the organisational arrangements and tasks necessary to:

- establish the priorities and develop the specifications;
- conduct and control the tenders; and
- project manage the developments.

The procurement framework should operate on the basis of:

- fair and open tendering, although an allocation approach may be appropriate in a few special cases; and
- encouraging participation by multiple developers, including the States and Territories, from around the nation.

Organisational arrangements

The organisational arrangements necessary to manage a kick start public investment are set out in the following Figure.

PROCUREMENT FRAMEWORK & MANAGEMENT

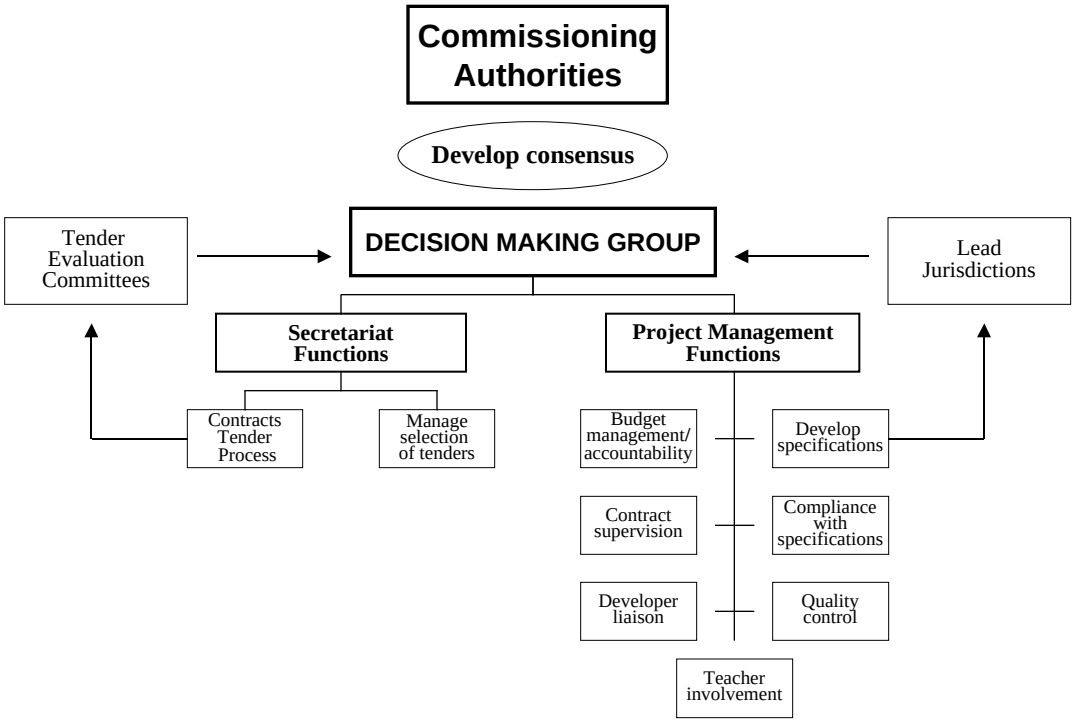


Figure 26: Procurement framework and management

The commissioning authorities are the jurisdictions acting together for this purpose. If the Catholic and Independent school systems also joined the process, they would participate at this level.

Our view is that the Decision Making Group established by the commissioning authorities should be at CEO or near to CEO level. Rather than establish a new structure, CESCEO could carry out this role.

Using lead jurisdictions will allow those States and Territories with special expertise or interest in a particular area of digital curriculum to contribute intellectual resources to the project manager. It leverages off the work already under way in jurisdictions and spreads the workload around the nation, but concentrates effort and reduces coordination overheads. The project manager would coordinate communication and consultation between the jurisdictions. To prevent conflict of interest, if a jurisdiction were acting as a developer in a particular case, it should not also be a lead jurisdiction in that case.

The tender evaluation committees would be established by the Decision Making Group and comprise experts drawn from around the nation.

The secretariat function for the tender process and the project management function have been shown separately. The argument for this approach is to increase the perception of probity, transparency and independence in the tender process. However, to prevent possible conflicts of interest, the organisation responsible for the project management should be precluded from tendering for development contracts funded by the kick start investment. This means the secretariat and project management functions could reasonably be done by the same group.

Tasks

The discussion here is on those tasks associated with managing production of digital curriculum resources. It does not deal with general issues of tender management or communication.

The tasks are to develop the specifications for the digital curriculum resources required, and manage the development contracts.

The specification task is to:

- develop the ongoing priorities for investment;
- undertake curriculum mapping; and
- undertake curriculum design.

While developing the ongoing priorities for investment will be a decision for the commissioning authorities, this work needs to be coordinated and managed. As the priorities directly control the specification process, the project manager should undertake this role.

Curriculum mapping involves:

- identifying the content taught in courses and subject areas in the jurisdictions;
- mapping topics and sub-topics on the basis of how teachers customarily teach the material, and on what students need to learn and be assessed on;
- mapping the assessment requirements for each jurisdiction; and
- mapping when and where the topics and sub-topics are taught in each jurisdiction. In other words, in which subject area are the core concepts clustered and at which year level – for example, the water cycle may be taught in year 7 general science in one jurisdiction but in year 8 geography in another.

Curriculum mapping is an essential first step in the structured but modular approach defined in the system environment (see page 92). Only a few jurisdictions have detailed syllabus documents, and the outcome statements,

while useful, are not able to be translated directly into the curriculum resources required to meet them. Consequently, curriculum mapping involves extensive consultation with jurisdictions, review of commonly used text books and other materials, close involvement from teachers, and discussions with professional associations.

Curriculum design involves:

- translating the curriculum mapping into a scope and sequence of topics that establishes a learning process (although the modular design of resources allows this to be customised or replaced by teachers);
- deciding which resources are suitable for the online environment, or which can be assisted by ICT;
- identifying assessment points in the resources and sequences, and specifying the assessment requirements at those points; and
- making choices about the level of investment needed to deliver the educational outcomes required – the budget balance between the various resources like interactives, textual content, graphics and external links.

Having undertaken curriculum mapping and curriculum design, tenders would not necessarily be issued on a subject basis. In some cases it may be more cost effective to cluster functions together. For example, it may be more efficient to call a tender for 50 interactives across a range of subjects so that a developer can reuse the common shell and functionality elements many times. This approach also promotes partnerships with developers who have specific expertise in a particular area.

The contract management task is to supervise:

- curriculum writing, including ensuring that third party copyright is managed according to the principles outlined on page 76;
- technical design, including the requirement for modular and reusable resources, screen interface issues, and the ability to work with the customisation, search and assembly tools used by the central portal and the jurisdictions;
- consultation and teacher involvement; and
- metadata application and indexing.

Other tasks associated with the project management function include:

- overall budget management and accountability;
- developer liaison;
- overall quality control and sensible harmonisation of interface elements by spreading good practice ideas among contractors;
- managing the involvement of teachers from across the nation, and professional associations; and
- ensuring compliance with contract requirements, including the curriculum specifications.

System environment

This section describes the proposed system environment.

In this report, system environment means a conceptual description of the way in which the various parts of the approach we propose are tied together. It shows the relationship between key functions and participants. Where appropriate, it also suggests some existing participants who could undertake the various functions.

Within this conceptual description, the information broker and the jurisdictions will need to develop technical agreements on how their systems will work together in practice.

The guiding principles of the system environment should be to:

- build on the strong cooperation between the Commonwealth, States and Territories which has underpinned the work of Education.au and the Curriculum Corporation, and has developed a national consensus on key policy issues; and

- maintain the minimum number of organisational structures and relationships necessary to achieve coordinated action, clear roles, and transparent operations.

The proposed system environment assumes:

- distributed custodians of content;

- curriculum resources held in a modular form, able to be reassembled and reused;

- the capacity for jurisdictions and school systems to customise the look and feel of the environment to make the system appear to have been uniquely created for them; and

- the content being responsive to the different customisation and assembly environments of the various school systems.

It operates at three levels:

- market interaction;
- development and technical interaction; and
- management of the environment.

Market interaction

The market in digital curriculum resources is still small and immature. As previously discussed, it lacks the market structures necessary to support a rapid growth in the amount of digital curriculum resources and in the number of users.

Currently, digital curriculum resources are developed through a series of ad hoc agreements in an unstructured market (see Figure 27).

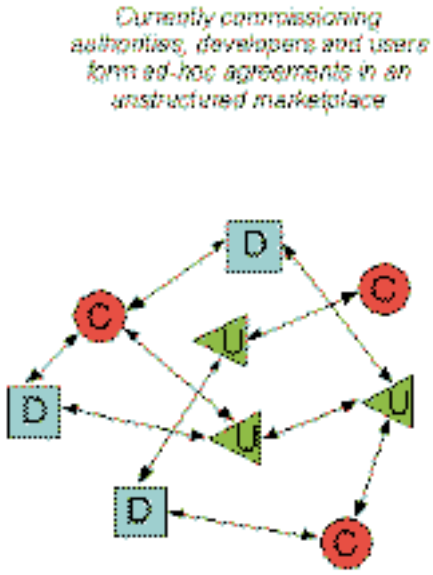


Figure 27: Ad hoc agreements in an unstructured market

The market structures proposed in this report provide a clearer and more disciplined framework within which the market can operate and grow (see Figure 28).

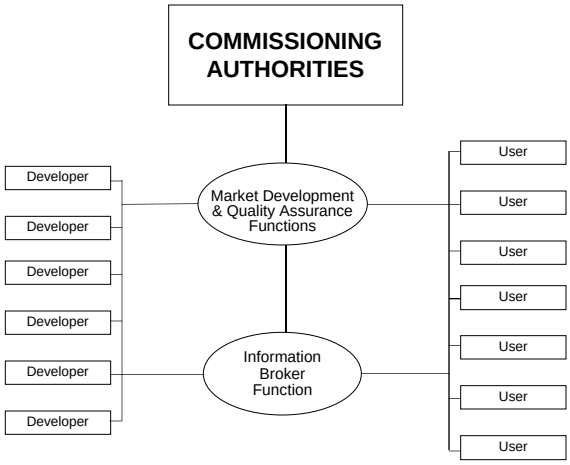


Figure 28: Market structures help participants conduct business

These structure are not intended to constrain the market. There will be activity outside some of the structures, for example where a developer wants to market a product that does not meet the standards framework.

Further, the effectiveness and continued relevance of the structures needs to be reviewed as the market matures. For example, the market information role will change as non-traditional investors enter the market. They will require different information to that wanted by traditional developers, and jurisdictions will need to agree on how to deal with market channel opportunities and other non-cash forms of payment.

Some natural owners stand out among existing participants in the market to undertake the functions required as part of the market structure. While it would be possible to create new organisational arrangements, it is more sensible to capture the experience of existing players.

Education.au already operates a national portal and has been leading the work on curriculum metadata. We believe they should be responsible for the information broker functions. The Curriculum Corporation has special expertise in curriculum materials and in dealing with developers. They should be responsible for the market information and the quality assurance functions associated with curriculum resources.

As both organisations are companies, these roles should be defined contractually. The contracting parties would be the two companies as suppliers of the services and the jurisdictions as purchasers. The purchasing role should be part of the responsibilities of the Decision Making Group established as part of the procurement framework. This keeps the number of new organisational structures to a minimum. Figure 29 shows this relationship.

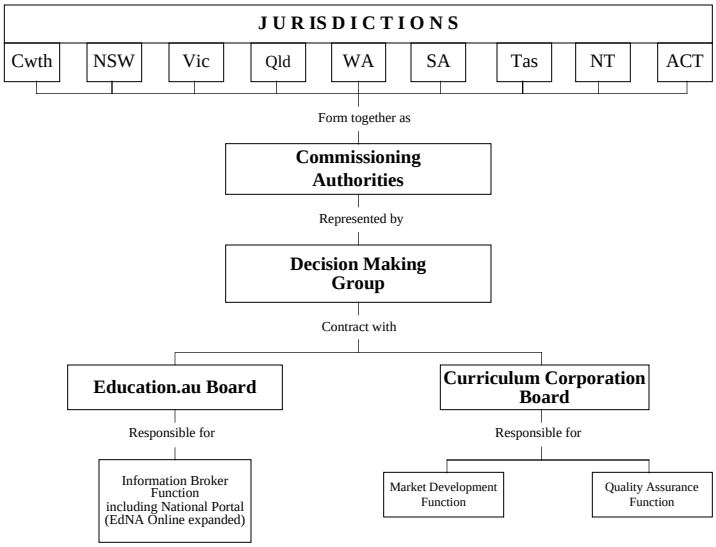


Figure 29: Organisational arrangements for market structures

As is often the case within government, jurisdictions would participate in the market at several levels. Some will be developers. All will be sources of information and sources of demand for digital curriculum resources as part of the public sector kick start. Some will be sources of demand beyond the kick start investment. All will be involved as commissioning authorities purchasing the services necessary to implement the market structures and the procurement framework. Table 14 summarises these roles.

	As Developers	Sources of information for developers	Sources of demand (Public sector kick start)	Sources of demand (Outside kick start)	Contracting for market structures	Contracting for procurement mechanism
All Jurisdictions		✓	✓		✓	✓
Some Jurisdictions	✓			✓		

Table 14: Role of jurisdictions

Development and technical interaction

This section deals with the principles and relationships that define how development takes place.

We believe that a highly centralised approach with a rigid system design would not work. It is inconsistent with the tailored approaches taken by the States and Territories to school education. Diversity is one of the strengths of the Australian

system and a source of new ideas. Further, a highly centralised approach would discourage innovation and speed of action within the market by creating structural bottlenecks. It would act as a barrier to non-traditional investment.

However, there are costs with a decentralised approach. The coordination overhead can be high. The system becomes heavily reliant on having:

- a consistent vision;
- common purpose and good will between the participants;
- a commitment to national goals;
- national consensus on standards and approach in certain areas; and
- coordinated action.

These characteristics need to be maintained over time.

Our discussions with the various jurisdictions reveal a strong and consistent vision, a common purpose and commitment to national goals about the role of ICT in schools. They all believe in its capacity to significantly improve educational opportunity and outcomes for all students.

The need for national consensus on standards and approach is dealt with elsewhere in this report.

Coordinated action

Coordinated action requires an understanding of how the various players fit together and the principles which guide their actions.

Central structures

Even with a decentralised approach, some central structures are required to promote coordination and for reasons of simplicity and efficiency. Figure 28 on page 94 sets out the general market environment.

Distributed custodianship

To maintain and build diversity, competition and participation in the market, we believe the system should encourage distributed custodianship of content. Although some developers may choose not to hold their own content, we do not see any case for mandatory centralised hosting or centralised asset management. Discovering and assembling content can be managed through the national portal and school system sites, indexes and metadata supported by the management tools maintained by the information broker. Risks associated with many custodians, such as failure of a host during a critical time or lags during peak access periods, can be managed by caching and mirroring key resources. This can occur at a school system level or when teachers assemble resources for their

classes. In any event, the risks are more than offset by the reduced risk that comes from having multiple pathways and relying on many geographically separated hosts. IP management can be handled by the custodian of the content or by agreement with the national portal and school system sites.

This relationship is set out in Figure 30.

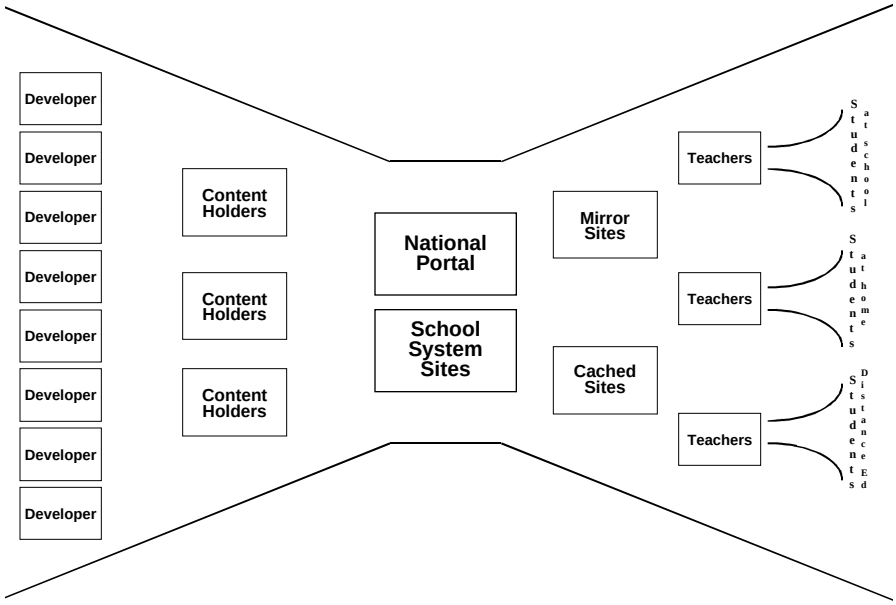


Figure 30: Distributed custodianship

Development task

The approach to the development task shows how the public sector kick start investment fits into the overall approach.

The key principles are:

- modularity – the principle that digital curriculum resources should be created in a way which allows them to be divided into and stored as their constituent parts, and not as tightly bundled proprietary offerings. These parts include text, graphics, interactives, external URL links, student activities, assessment and teacher support materials. They can then be assembled 'on the fly' using metadata;

- reusability – the principle that each of the constituent parts can be used as:
  - part of the predefined sequence for which they were designed
  - part of a sequence that has been customised by teachers working from these predefined sequences
  - uniquely assembled sequences created by teachers, or
  - stand alone resources;
- interoperability – the principle that the reusable modular resources can be combined together in different ways without the need for special software or alteration to the resources themselves;
- informed investment – the principle that the resources available to teachers are not random collections of general digital content. Rather, they are all materials that are specifically directed to the curricula of the States and Territories; and
- teacher control over assembly and use – the principle that, while teachers are offered predefined learning sequences in some areas, they can customise these sequences or assemble the resources into new sequences of their own design.

Modularity, reusability and interoperability are characteristics of the best approach to digital materials. One of the most powerful features of the online environment is its ability to assemble materials so they appear to be uniquely constructed for the task at hand without the need to develop them again on each occasion. An example in the curriculum environment could be an interactive on the water cycle. Even though it may have been developed to introduce the concept in Grade 7 general science, it may also be used to reinforce and test understanding in Grade 8 geography or environmental studies. Further, for one Grade 7 class the teacher might use it to introduce the concept early in the learning sequence while, in another, a different teacher might use it as a summary of what has been learned near the end.

It is important to note that while modularity, reusability and interoperability are common features of the online environment, they have not typically been features of commercially developed digital curriculum resources. The traditional publishing approach to producing an integrated text book has been carried over to CD-ROMs. In a CD-ROM, the content is usually tightly bundled and unable to be separated for reuse in other sequences (even though individual resources may be able to be used alone). Further, in the tightly bundled approach, the exploration paths students might use must be mapped out in advance. This means students and teachers are restricted to the pathways the developer identified, or decided were economically viable for the product.

Tightly bundled materials are:

- insufficiently flexible for teachers and students; and
- very expensive because each component is created for a single learning sequence.

The modular approach allowed by the online environment and the system environment we have described avoids these problems. The time and cost to develop a new sequence reduces as the pool of materials grows. Resources originally created for one purpose are available to be incorporated into new sequences, whether they are developed commercially or assembled by teachers.

Some traditional developers may resist a modular approach. They are likely to want to retain control of the materials they have produced and not allow competitors to reuse them in other products. This has been the experience in New Zealand. Nevertheless, from the perspective of the school systems, teachers and students, modularity and reusability are essential to developing a critical mass of digital curriculum resources rapidly, at an affordable cost, and in a form that supports teachers in the classroom.

The public sector kick start investment should be used to overcome this problem. It will give the commissioning authorities sufficient market power to insist on a modular approach for the materials they pay for directly.

Even though the digital curriculum market will always be relatively small, new players will be attracted by the fee for service nature of the public sector kick start. They will see it as a way to enter a growing market, and to build expertise in interactive publishing that will help them enter the wider online publishing market. In the online environment, companies are rapidly experimenting to find the best way to generate value. Producing digital curriculum resources will provide valuable experience in design, interaction, sourcing, IP management, path to market, and other features of online interactive publishing.

Developers would not be prevented from making tightly bundled offerings available if they wish to. The market will decide if their products meet a usability test for teachers – that is, fit into the workflow they use to construct their lessons. However, to get public money from the kick start, their products must be modular and reusable.

It is important to recognise that, by themselves, modularity, reusability and interoperability will not guarantee that digital curriculum resources will meet this usability test. The public sector kick start investment also needs to be informed by the curriculum requirements of teachers and school systems. For the reasons outlined elsewhere in this report, digital curriculum resources are not the same as general digital content, nor can they be produced by simply digitising vast amounts of material found in textbooks, museums or art galleries.

The role of curriculum mapping in developing learning sequences to meet teachers' needs is discussed in the section on the public sector kick start. The mapping will identify the digital curriculum resources which will be most useful

to teachers in building up a critical mass of materials. Together with teacher developed materials, resources developed as part of the public sector kick start will go into a resource pool. The resource pool is a series of 'buckets' which store individual resources and modules, and are available to teachers and other users to draw on. (The buckets are conceptual – the physical storage of the resources will be distributed).

Using the metadata attached to them, the individual resources and modules can be assembled into:

- predetermined learning sequences where teachers accept the structure and content provided by the developer;
- customised learning sequences where teachers take the predetermined sequence and add or subtract some components; or
- unique sequences where teachers build their own lessons or courses using the individual resources stored in the pool.

These predetermined learning sequences and the curriculum mapping needed to develop them will ensure the materials produced as part of the kick start are immediately useful to teachers. We are not talking about a rigid matrix of courses that teachers must accept or reject in total. By requiring the predetermined learning sequences to consist of modular, reusable and interoperable materials, teachers will have the flexibility to choose for themselves how to use the resources.

This flexible environment is set out in Figure 31.

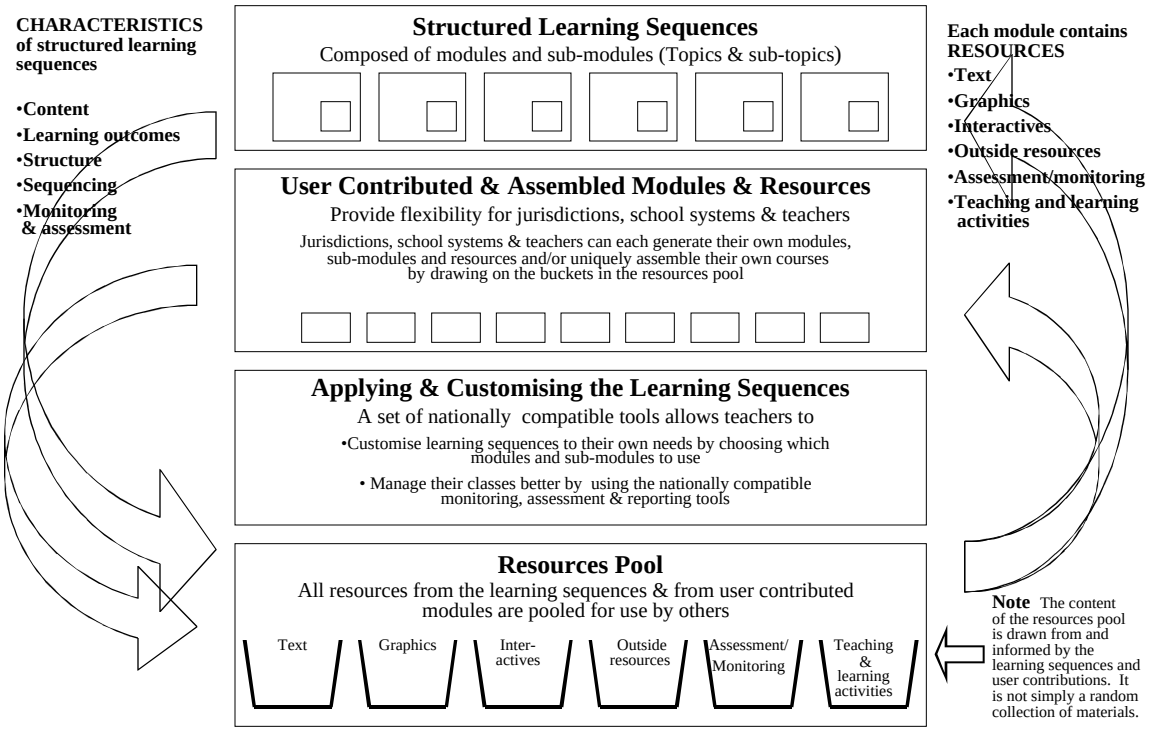


Figure 31: Flexible system environment to support teacher choice

Procurement

No additional elements are required for the procurement framework beyond the mechanism set out on page 87. The Curriculum Corporation has special skills and expertise in specifying and managing the development of digital curriculum resources. We believe they should be responsible for the project management functions.

A project management role would preclude the Curriculum Corporation from tendering to develop resources as part of the public sector kick start. To do so would be a clear conflict of interest. Given that they would not be developing materials, we believe they should also carry out the secretariat functions in managing the tender process. In doing so they would be working under the direction of the Decision Making Group established by the commissioning authorities, separate from their company board.

Nonetheless, if it is felt that transparency requires a separate organisation to run the letting of tenders, the management of the tender box and the work of the tender evaluation committees, the project manager would need to be given an explicit role in advising these committees. Preferably, it should be a full member

of them. This would ensure coordination and a full understanding of the specifications within the tender evaluation committees.

The cost would be approximately the same in either event. If using two organisations is preferred, the procurement framework and management functional chart would change from the one set out in Figure 26 on page 88 to the following arrangement.

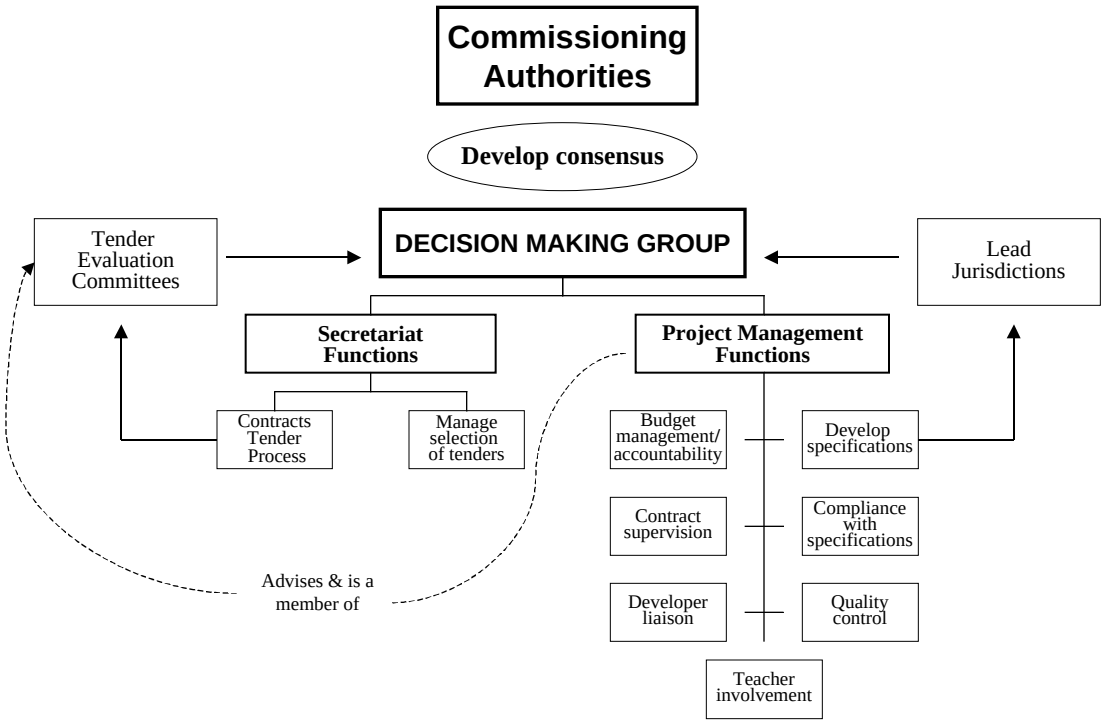


Figure 32: Modified procurement framework and management

Management of the environment

This section deals with the management tools required to allow the information broker to maintain the quality of the technical environment, and the availability and contribution of content.

The report recommends a distributed environment supported by some central structures. The information broker role ties together the distributed technical elements of the environment. This requires a set of tools to undertake management tasks such as tools to:

- place content in appropriate categories and change categories as required;
- edit resource metadata;

- ensure the accuracy of the database;
- manage a secure environment; and
- allocate selected tools to developers.

Many of these tools are distributed but they need to be centrally managed to operate efficiently.

Risk Analysis

This section lists some of the more likely risks associated with the proposals in this report. It is not intended to detail every possible risk.

Risk	Risk level	How addressed in report
Not enough bandwidth or computers available in schools	High (in short term) Low (in longer term)	These issues are outside the scope of the report but affordable access to greater bandwidth is necessary especially in rural and regional areas. Further … All jurisdictions have computer roll out programs New delivery technologies are emerging such as digital television and datacasting Distributed environment allows for caching and mirror sites Some industry sources claim that changes in technology will overcome bandwidth access constraints in the medium term Bandwidth costs continue to trend down
Cost of development too high	Medium (because the financial models are based on limited experience)	Competitive tenders are used for kick start materials Kick start is not attempting to cover all materials – only accelerate move to critical mass Budget is subject to regular review Market development function will attract new entrants

Teachers will not use the resources developed	Medium (in short term) Low (in longer term)	Tailors the digital curriculum resources developed to the learning outcomes set by their jurisdiction Modular approach gives teachers control over when, how and whether they use pre-assembled sequences, customise the pre-assembled sequences, or construct their own sequences from the pool of resources Resources are tools to support existing classroom strategies Involves teachers in the specification process Ongoing professional development Quality assurance on major investments Quick movement to a critical mass across years and subjects
Cooperation between jurisdictions breaks down	Low	Builds on existing cooperative structures that work Accommodates different approaches in different jurisdictions Includes ongoing consultation Envisages strong direction from Ministers
Cost of use too high for schools	Low	Amount passed through to schools as a price signal is under the control of each jurisdiction Standards framework is designed to match the availability of the necessary infrastructure (now and in future) Modular approach gives schools flexibility to decide what, how much and when to use the resources

Overtaken by technological change	Low	The system environment is independent of the delivery mechanism which is the area subject to the most rapid change Modular approach makes it easier to replace individual resources that can be better delivered as technology changes (eg interactives)
Sustainability as curricula change	Low	Modular approach allows those elements that have changed to be replaced without the cost of developing a whole new sequence
Rejection by parents	Low	Integrated into classroom practice and not programmed learning Teachers are in control Safe guided environment, not unstructured access to the internet Doesn't replace books Not dependant on home access
New entrants don't emerge	Low	Fee for service base will attract new players interested in the wider interactive publishing market Market development function actively encourages new entrants Report proposes agreements on market channel issues

Budget

We recommend that Ministers adopt a 50:50 funding formula to share the costs between the Commonwealth and the States and Territories. This is consistent with similar initiatives in the past.

The components of the detailed budget model are set at the end of this section. We have assumed a four year development project. No account has been taken of the possible impact of GST.

The budget has two components – the cost of operating the market framework and the cost of the public sector kick start. It is summarised in Table 15.

		First Year $ million	Each of years 2 to 4 $ million
Market framework	Market information & quality assurance functions	0.72	0.72
	Information broker function	1.88	1.76
Kick start	Procurement framework	0.37	0.37
	Development	10.67	9.39 to 16.70
Total		13.65	12.25 to 19.56

Table 15: Budget summary

The total first year (2000–2001) cost is estimated at $13.65 million. This is based on:

- the priority areas recommended in this report; and
- a cost per screen using the average of the high and low cases as set out on page 109.

The first year cost of the market framework is estimated at $2.61 million. The cost of subsequent years is estimated at $2.49 million.

The first year cost of the kick start is estimated at $11.05 million. The cost of subsequent years is estimated to be between $9.76 million and $17.08 million.

This gives a total cost in the first year of $13.65 million and between $12.25 million and $19.56 million in each of the three subsequent years.

In order to ensure there is a substantial body of material available to teachers for the beginning of the 2001 school year, a start needs to be made immediately. Accordingly, some funds should be made available this financial year. We recommend that $384,000 be provided during the remainder of the 1999-2000 financial year as follows:

- $185,000 for the information broker to scope the development, construct the specific business case for the new system environment, and design the environment (based on estimated cost of these tasks); and

- $199,000 for the market information and quality assurance organisation to register the trademark, commence the market contact and standards framework tasks, commence curriculum mapping in the priority areas, and commence project specification in the priority areas (based on 5 months activity in these areas).

Market framework costs

The budget model for the market framework contains the cost of the market information and quality assurance functions, and the information broker functions.

The budget for the market information and quality assurance functions has been built up on a line item basis. It is based on the actual cost experience of the Curriculum Corporation and contains no loading for higher public sector personnel costs, such as superannuation. It assumes that the State and Territory members of the Endorsement Committee will not receive any extra remuneration for their work.

The budget for the information broker functions has been built up from information supplied by Education.au. It is based on their actual cost experience. It should be noted that in the second and subsequent years it includes $400,000 per annum for new functionality. The Decision Making Group of the commissioning authorities would determine the need for this particular expenditure each year.

Kick start costs

There is little or no pricing information available on the cost of developing digital curriculum resources across a large number of subject areas. This reflects the immature state of the market and the fact that commercial development activity has so far tended to concentrate on a limited range of the curriculum.

To provide a firm basis for a budget model for the kick start we used the cost of developing the resources for year 8 science, and the rate cards for a number of

private sector firms. The rate card information has been included in a way that preserves the commercial confidentiality of the firms that assisted us by making their typical charges available.

The model was developed on a subject area basis scaled up to key learning areas and then extended across all years. Different cost assumptions were made for developing resources for primary and secondary years. This is based on developers' experience so far.

It is important to recognise that while the budget model has been constructed on a subject and year basis, this does not mean that the actual development should proceed in this way. One strength of the approach to digital curriculum resources recommended by this report is the ability to reuse modules developed for one purpose to meet other learning objectives, and for teachers to have control over which resources they use. Similarly, many digital curriculum resources cross subject and year level boundaries. Elsewhere in this report we have also identified the possibility of having certain materials, such as interactives, developed in bulk to gain cost efficiencies from using common templates.

To test the total cost, we constructed the model using two pricing methods – per screen and per module. A screen is a unit of development such as a graphic, a page of text or an interactive. A module is a learning unit within a subject area and consists of a number of screens. The costs per screen are based on figures from the Curriculum Corporation and the rate cards from private developers. The costs in the modular approach are based on work already undertaken by the Curriculum Corporation and supported by information from private developers. Each approach provided a similar high and low cost range.

The budget model is relatively insensitive to the assumptions we have made about subject areas and key learning areas. We have extended the cost of developing resources for year 8 science across the whole curriculum, recognising that some subjects will be more intensive and some will be less. The curriculum mapping process and the experience from the first year of development will allow the model to be refined but we do not anticipate that this will significantly change the final cost.

However, the model is highly sensitive to changes in the cost per screen or module. To deal with this, we have calculated a high case and a low case. Especially in the first year of development, it is likely that the actual cost will track towards the high case because of a lack of experience in the market and the absence of a body of already developed modules and templates that can be reused. However, as the market matures, new entrants enter the market, and the body of already developed materials grows, the costs should track down. This should be identifiable in the regular review of the project that we have recommended.

In the model, meta project management includes the costs associated with budget management and accountability, contract supervision, specification

development and compliance monitoring, developer and lead jurisdiction liaison, overall management of teacher involvement, and the identification of opportunities for cross curriculum development and the reuse of resources, templates and interactive functionality.

The model assumes that the State and Territory members of the Tender Evaluation Committees will not receive any extra remuneration for their work.

For ease of reference, Figure 33 maps the components of the budget model.

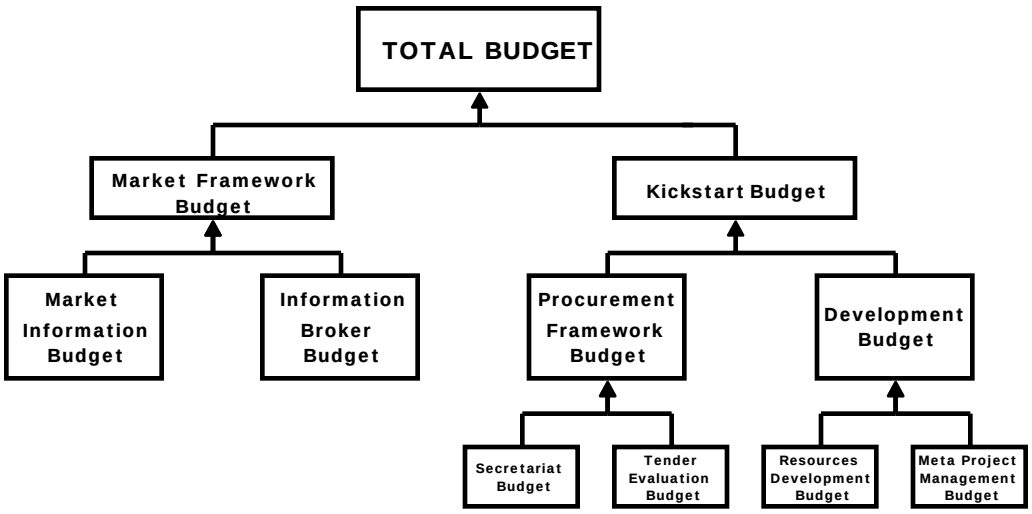


Figure 33: Map of budget model

TOTAL BUDGET OVER 4 YEARS - method 1 (per screen)				
MARKET FRAMEWORK BUDGET				
			Low end	**High end**
	Annual cost	**No of years**	**Total cost**	**Total cost**
Market information				
Commission research - 5 projects pa.	$ 250,000	4	$ 1,000,000	$ 1,000,000
Collate & digest research - 1 x FTE @ $45K pa plus 20% oncosts	$ 54,000	4	$ 216,000	$ 216,000
Market contact staffing costs - 1 x FTE @ $70K pa, 1 x FTE @ $38K pa plus 20% oncosts	$ 129,600	4	$ 518,400	$ 518,400
Market contact - travel	$ 10,000	4	$ 40,000	$ 40,000
Market contact - seminar venue hire @ $1,000 per state/territory	$ 8,000	4	$ 32,000	$ 32,000
Market contact - web page construction, maintenance, updating	$ 15,000	4	$ 60,000	$ 60,000
Market contact - promotional materials	$ 70,000	4	$ 280,000	$ 280,000
Market contact - computers & office equipment @ $6,000 pa	$ 12,000	4	$ 48,000	$ 48,000
Market contact - office rental - 12 square metres @ $500 pa ea.	$ 6,000	4	$ 24,000	$ 24,000
Market contact - communications & administration	$ 8,000	4	$ 32,000	$ 32,000
Standards framework & QA staffing costs - 1 x FTE @ $70K pa, 0.5 FTE @ $38K pa plus 20% oncosts	$ 106,800	4	$ 427,200	$ 427,200
Standards framework & QA - computers & office equipment @ $6,000 pa	$ 12,000	4	$ 48,000	$ 48,000
Standards framework & QA - office rental - 6 square metres @ $500 pa.	$ 3,000	4	$ 12,000	$ 12,000
Standards framework & QA - communications & administration	$ 5,000	4	$ 20,000	$ 20,000
Trademark establishment & registration	$ 3,000		$ 3,000	$ 3,000
TOTAL	**$ 692,400**		**$ 2,760,600**	**$ 2,760,600**
Endorsement committee*				
Travel - 10 of 13 committee members travel @ average $600 per meeting	$ 24,000	4	$ 96,000	$ 96,000
Catering - $100 per meeting	$ 400	4	$ 1,600	$ 1,600
Communications & administration - $20 per member per meeting	$ 1,040	4	$ 4,160	$ 4,160
Attendance fees - chair, industry and teacher rep ($500, $300, $300 per meeting)	$ 4,400	4	$ 17,600	$ 17,600
TOTAL	**$ 29,840**		**$ 119,360**	**$ 119,360**
Information broker				
First year	$ 1,883,000	1	$ 1,883,000	$ 1,883,000
Subsequent years	$ 1,763,000	3	$ 5,289,000	$ 5,289,000
TOTAL			**$ 7,172,000**	**$ 7,172,000**

PROCUREMENT FRAMEWORK BUDGET			**Low end**	**High end**
	Annual cost	**No of years**	**Total cost**	**Total cost**
Secretariat				
Staffing costs - 1x FTE @ $70K pa plus 20% oncosts	$ 84,000	4	$ 336,000	$ 336,000
Staffing costs - 1 x FTE admin @ $45K pa plus 20% oncosts	$ 54,000	4	$ 216,000	$ 216,000
Computers & office equipment - 2 x $6,000 pa	$ 12,000	4	$ 48,000	$ 48,000
Office rental - 12 square metres @ $500 pa ea.	$ 6,000	4	$ 24,000	$ 24,000
Communications, administrative costs, legal & insurance	$ 158,000	4	$ 632,000	$ 632,000
Tender advertising - $5,000 ea. X 6 pa.	$ 30,000	4	$ 120,000	$ 120,000
TOTAL	**$ 344,000**		**$ 1,376,000**	**$ 1,376,000**
Tender evaluation committees*				
Travel - 7 of 11 committee members travel @ average $600 per meeting	$ 25,200	4	$ 100,800	$ 100,800
Catering - $100 per meeting	$ 600	4	$ 2,400	$ 2,400
Communications & administration - $20 per member per meeting	$ 1,320	4	$ 5,280	$ 5,280
Technical expert fees - $500 per meeting	$ 3,000	4	$ 12,000	$ 12,000
TOTAL	**$ 30,120**		**$ 120,480**	**$ 120,480**
DIGITAL CURRICULUM RESOURCES DEVELOPMENT BUDGET				
TOTAL PRIMARY AND SECONDARY COSTS			**$ 35,299,541**	**$ 50,904,725**
META PROJECT MANAGEMENT BUDGET				
Project management fee of 10%			**$ 3,529,954**	**$ 5,090,472**
GRAND TOTAL			**$ 50,377,935**	**$ 67,543,637**

TOTAL BUDGET OVER 4 YEARS - method 2 (per module)				
MARKET FRAMEWORK BUDGET				
			Low end	**High end**
	Annual cost	**No of years**	**Total cost**	**Total cost**
Market information				
Commission research - 5 projects pa.	$ 250,000	4	$ 1,000,000	$ 1,000,000
Collate & digest research - 1 x FTE @ $45K pa plus 20% oncosts	$ 54,000	4	$ 216,000	$ 216,000
Market contact staffing costs - 1 x FTE @ $70K pa, 1 x FTE @ $38K pa plus 20% oncosts	$ 129,600	4	$ 518,400	$ 518,400
Market contact - travel	$ 10,000	4	$ 40,000	$ 40,000
Market contact - seminar venue hire @ $1,000 per state/territory	$ 8,000	4	$ 32,000	$ 32,000
Market contact - web page construction, maintenance, updating	$ 15,000	4	$ 60,000	$ 60,000
Market contact - promotional materials	$ 70,000	4	$ 280,000	$ 280,000
Market contact - computers & office equipment @ $6,000 pa	$ 12,000	4	$ 48,000	$ 48,000
Market contact - office rental - 12 square metres @ $500 pa ea.	$ 6,000	4	$ 24,000	$ 24,000
Market contact - communications & administration	$ 8,000	4	$ 32,000	$ 32,000
Standards framework & QA staffing costs - 1 x FTE @ $70K pa, 0.5 FTE @ $38K pa plus 20% oncosts	$ 106,800	4	$ 427,200	$ 427,200
Standards framework & QA - computers & office equipment @ $6,000 pa	$ 12,000	4	$ 48,000	$ 48,000
Standards framework & QA - office rental - 6 square metres @ $500 pa.	$ 3,000	4	$ 12,000	$ 12,000
Standards framework & QA - communications & administration	$ 5,000	4	$ 20,000	$ 20,000
Trademark establishment & registration	$ 3,000		$ 3,000	$ 3,000
TOTAL	**$ 692,400**		**$ 2,760,600**	**$ 2,760,600**
Endorsement committee*				
Travel - 10 of 13 committee members travel @ average $600 per meeting	$ 24,000	4	$ 96,000	$ 96,000
Catering - $100 per meeting	$ 400	4	$ 1,600	$ 1,600
Communications & administration - $20 per member per meeting	$ 1,040	4	$ 4,160	$ 4,160
Attendance fees - chair, industry and teacher rep ($500, $300, $300 per meeting)	$ 4,400	4	$ 17,600	$ 17,600
TOTAL	**$ 29,840**		**$ 119,360**	**$ 119,360**
Information broker				
First year	$ 1,883,000	1	$ 1,883,000	$ 1,883,000
Subsequent years	$ 1,763,000	3	$ 5,289,000	$ 5,289,000
TOTAL			**$ 7,172,000**	**$ 7,172,000**

PROCUREMENT FRAMEWORK BUDGET			**Low end**	**High end**
	Annual cost	**No of years**	**Total cost**	**Total cost**
Secretariat				
Staffing costs - 1x FTE @ $70K pa plus 20% oncosts	$ 84,000	4	$ 336,000	$ 336,000
Staffing costs - 1 x FTE admin @ $45K pa plus 20% oncosts	$ 54,000	4	$ 216,000	$ 216,000
Computers & office equipment - 2 x $6,000 pa	$ 12,000	4	$ 48,000	$ 48,000
Office rental - 12 square metres @ $500 pa ea.	$ 6,000	4	$ 24,000	$ 24,000
Communications, administrative costs, legal & insurance	$ 158,000	4	$ 632,000	$ 632,000
Tender advertising - $5,000 ea. X 6 pa.	$ 30,000	4	$ 120,000	$ 120,000
TOTAL	**$ 344,000**		**$ 1,376,000**	**$ 1,376,000**
Tender evaluation committees*				
Travel - 7 of 11 committee members travel @ average $600 per meeting	$ 25,200	4	$ 100,800	$ 100,800
Catering - $100 per meeting	$ 600	4	$ 2,400	$ 2,400
Communications & administration - $20 per member per meeting	$ 1,320	4	$ 5,280	$ 5,280
Technical expert fees - $500 per meeting	$ 3,000	4	$ 12,000	$ 12,000
TOTAL	**$ 30,120**		**$ 120,480**	**$ 120,480**
DIGITAL CURRICULUM RESOURCES DEVELOPMENT BUDGET				
TOTAL PRIMARY AND SECONDARY COSTS			**$ 36,848,656**	**$ 55,252,096**
META PROJECT MANAGEMENT BUDGET				
Project management fee of 10%			**$ 3,684,866**	**$ 5,525,210**
GRAND TOTAL			**$ 52,081,962**	**$ 72,325,746**

YEAR 1 BUDGET		
Using method 1 - per screen & priority areas		
MARKET FRAMEWORK BUDGET		
		Annual cost
Market information		
Commission research - 5 projects pa.	$	250,000
Collate & digest research - 1 x FTE @ $45K pa plus 20% oncosts	$	54,000
Market contact staffing costs - 1 x FTE @ $70K pa, 1 x FTE @ $3	$	129,600
Market contact - travel	$	10,000
Market contact - seminar venue hire @ $1,000 per state/territory	$	8,000
Market contact - web page construction, maintenance, updating	$	15,000
Market contact - promotional materials	$	70,000
Market contact - computers & office equipment @ $6,000 pa	$	12,000
Market contact - office rental - 12 square metres @ $500 pa ea.	$	6,000
Market contact - communications & administration	$	8,000
Standards framework & QA staffing costs - 1 x FTE @ $70K pa, 0.	$	106,800
Standards framework & QA - computers & office equipment @ $6,0	$	12,000
Standards framework & QA - office rental - 6 square metres @ $50	$	3,000
Standards framework & QA - communications & administration	$	5,000
Trademark establishment & registration	$	3,000
TOTAL	**$**	**692,400**
Endorsement committee*		
Travel - 10 of 13 committee members travel @ average $600 per m	$	24,000
Catering - $100 per meeting	$	400
Communications & administration - $20 per member per meeting	$	1,040
Attendance fees - chair, industry and teacher rep ($500, $300, $30	$	4,400
TOTAL	**$**	**29,840**
Information broker		
TOTAL	**$**	**1,883,000**
PROCUREMENT FRAMEWORK BUDGET		
		Annual cost
Secretariat		
Staffing costs - 1x FTE @ $70K pa plus 20% oncosts	$	84,000
Staffing costs - 1 x FTE admin @ $45K pa plus 20% oncosts	$	54,000
Computers & office equipment - 2 x $6,000 pa	$	12,000
Office rental - 12 square metres @ $500 pa ea.	$	6,000
Communications, administrative costs, legal & insurance	$	158,000
Tender advertising - $5,000 ea. X 6 pa.	$	30,000
TOTAL	**$**	**344,000**
Tender evaluation committees*		
Travel - 7 of 11 committee members travel @ average $600 per me	$	25,200
Catering - $100 per meeting	$	600
Communications & administration - $20 per member per meeting	$	1,320
Technical expert fees - $500 per meeting	$	3,000
TOTAL	**$**	**30,120**
DIGITAL CURRICULUM MATERIALS DEVELOPMENT BUDGET		
TOTAL PRIMARY AND SECONDARY COSTS	**$**	**9,701,982**
META PROJECT MANAGEMENT BUDGET		
Project management fee of 10%	**$**	**970,198**
TOTAL YEAR 1	**$**	**13,651,541**

ASSUMPTIONS		
Web production costs - per screen basis	**Low end per screen**	**High end per screen**
Web production costs - existing content, template	$ 414	$ 563
Web production costs - new content, template	$ 634	$ 963
Primary and secondary development costs per screen		
Average per screen cost assuming mix of low & high end screens; existing & new content	$ 643	
Fixed costs		
Curriculum mapping and course design for year 1 projects	$ 133,270	
Template construction costs $5,000 per KLA per year level	$ 110,000	
Site registration costs @ $50 per KLA per year	$ 1,100	
TOTAL	**$ 244,370**	
Digital resources to develop in year 1	**No of screens**	**Fixed cost equivalents**
K-3 literacy	550	2
K-3 numeracy	550	2
Middle years (5-8) literacy	1600	3
Middle years (5-8) numeracy	1600	3
Middle years (5-8) science	1600	3
Entrepreneurship/business	1600	1
Secondary technical literacy (cross curriculum; 30 modules)	1000	1
Middle years (5-8) civics - 5 regional areas, years 5-6	1500	2
Middle years (5-8) civics - 5 regional areas; years 7-8	2500	2
Career education (30 modules)	1000	1
Asian languages (2 primary languages, say Indonesian & Japanese)	1200	2
TOTAL	**14700**	**22**

MARKET FRAMEWORK BUDGET			
Market information	**Annual cost**	**No of years**	**Total cost**
Commission research - 5 projects pa.	$ 250,000	4	$ 1,000,000
Collate & digest research - 1 x FTE @ $45K pa plus 20% oncosts	$ 54,000	4	$ 216,000
Market contact staffing costs - 1 x FTE @ $70K pa, 1 x FTE @ $38K pa plus 20% oncosts	$ 129,600	4	$ 518,400
Market contact - travel	$ 10,000	4	$ 40,000
Market contact - seminar venue hire @ $1,000 per state/territory	$ 8,000	4	$ 32,000
Market contact - web page construction, maintenance, updating	$ 15,000	4	$ 60,000
Market contact - promotional materials	$ 70,000	4	$ 280,000
Market contact - computers & office equipment @ $6,000 pa	$ 12,000	4	$ 48,000
Market contact - office rental - 12 square metres @ $500 pa ea.	$ 6,000	4	$ 24,000
Market contact - communications & administration	$ 8,000	4	$ 32,000
Standards framework & QA staffing costs - 1 x FTE @ $70K pa, 0.5 FTE @ $38K pa plus 20% oncosts	$ 106,800	4	$ 427,200
Standards framework & QA - computers & office equipment @ $6,000 pa	$ 12,000	4	$ 48,000
Standards framework & QA - office rental - 6 square metres @ $500 pa.	$ 3,000	4	$ 12,000
Standards framework & QA - communications & administration	$ 5,000	4	$ 20,000
Trademark establishment & registration	$ 3,000		$ 3,000
TOTAL	**$ 692,400**		**$ 2,760,600**
Endorsement committee*			
Travel - 10 of 13 committee members travel @ average $600 per meeting	$ 24,000	4	$ 96,000
Catering - $100 per meeting	$ 400	4	$ 1,600
Communications & administration - $20 per member per meeting	$ 1,040	4	$ 4,160
Attendance fees - chair, industry and teacher rep ($500, $300, $300 per meeting)	$ 4,400	4	$ 17,600
TOTAL	**$ 29,840**		**$ 119,360**
TOTAL	**$ 722,240**		**$ 2,879,960**
* assumes committee of 13 : 8 x state & territory reps, 2 x standards framework staff, 1 x teacher rep, 1 x industry rep, 1 x independent chair			
four meetings per annum			
attendance fees to chair, industry rep and teacher rep @ $500, $300 & $300 per meeting			

Information broker			
	Items	**First year**	**Subsequent years**
		$'000	$'000
Scoping study to define the framework for development and the relationships within the environment	Consultancy	$ 70	
Business case	Consultancy review	$ 15	$ 40
Design of the environment and planning for the stages of development	Consultancy	$ 100	
Purchase of equipment	Hardware	$ 250	$ 100
	Software		
	Licences		
	Integration		
	Configuration		
Hosting and facilities management of the central equipment	Extension of existing EdNA Online contract	$ 120	$ 120
Development of the service and its functionality which will include project management	project management	$ 145	$ 145
	development services	$ 100	$ 100
	templates	$ 20	$ 10
	metadata	$ 60	$ 30
	decision making systems	$ 20	$ 10
	storage		$ 50
	directory structure	$ 20	$ 15
	retrieval	$ 100	$ 50
	user tools	$ 150	$ 150
	management middleware	$ 200	$ 100
	new functionality		$ 400
Quality assurance procedures for development of the service	prototype testing	$ 15	$ 15
	acceptance testing	$ 20	$ 20
Ongoing management of the service	information officer	$ 80	$ 90
Collaborative development and maintenance of the EdNA Metadata Standard	meetings	$ 100	$ 100
	expertise		
	communications		
Legal	tender	$ 150	$ 70
Insurance	contract		
	terms and conditions		
	insurance	$ 30	$ 30
Office infrastructure for 2 people - office rental at 6 square metres @ $500 pm2/pa each & computers & office equip @ $6000 each		$ 18	$ 18
TOTAL		**$ 1,783**	**$ 1,663**
Contingency		$100	$100
TOTAL		$ 1,883	$ 1,763
	Annual cost	**No of years**	**Total cost**
First year	$ 1,883,000	1	$ 1,883,000
Subsequent years	$ 1,763,000	3	$ 5,289,000
TOTAL			**$ 7,172,000**
TOTAL MARKET FRAMEWORK			**$ 10,051,960**

PROCUREMENT FRAMEWORK BUDGET			
	Annual cost	**No of years**	**Total cost**
Secretariat			
Staffing costs - 1x FTE @ $70K pa plus 20% oncosts	$ 84,000	4	$ 336,000
Staffing costs - 1 x FTE admin @ $45K pa plus 20% oncosts	$ 54,000	4	$ 216,000
Computers & office equipment - 2 x $6,000 pa	$ 12,000	4	$ 48,000
Office rental - 12 square metres @ $500 pa ea.	$ 6,000	4	$ 24,000
Communications, administrative costs, legal & insurance	$ 158,000	4	$ 632,000
Tender advertising - $5,000 ea. X 6 pa.	$ 30,000	4	$ 120,000
TOTAL	**$ 344,000**		**$ 1,376,000**
Tender evaluation committees*			
Travel - 7 of 11 committee members travel @ average $600 per meeting	$ 25,200.0	4	$ 100,800
Catering - $100 per meeting	$ 600.0	4	$ 2,400
Communications & administration - $20 per member per meeting	$ 1,320.0	4	$ 5,280
Technical expert fees - $500 per meeting	$ 3,000.0	4	$ 12,000
TOTAL	**$ 30,120**		**$ 120,480**
TOTAL PROCUREMENT FRAMEWORK	**$ 374,120**		**$ 1,496,480**
*assumes 11 members committee, 7 travel each meeting			
6 meetings per annum			
no attendance or committee fees			
$100 catering per meeting			
membership is all state and territory reps plus 2x secretariat, 1x project manager			
technical expert report/liaison on tender submissions			

INDICATIVE SECONDARY DIGITAL CURRICULUM RESOURCES DEVELOPMENT COSTS - YEAR 8 SCIENCE BASELINE

METHOD 1: PRICE PER SCREEN
ASSUMPTIONS

K-10 curriculum mapping and course design costs:		Cost per K-10 subject are	Cost per subject area per year
	1 xFTE @$53K pa +20% oncosts	$ 65,000	$ 5,909
	materials cost	$ 6,000	$ 545
	focus groups & consultations	$ 15,000	$ 1,364
	TOTAL	$ 86,000	$ 7,818

School years and KLA data	
Number of school years, K-10	11
Number of secondary schooling years, 7-10	4
Number of KLA's in each year, years 7-10	8
Total number of secondary school KLA's for years 7-10	32
Estimated number of subjects in year 8	13
Average number of subjects per KLA in year 8	1.625

Web production costs - per screen basis	Low end per screen	High end per screen
Web production costs - existing content, template	$ 414	$ 563
Web production costs - new content, template	$ 634	$ 963

Year 8 science	
Number of modules	30
Number of screens per module	33
Total number of screens	990

	Low end	High end
Total development costs per KLA per year level - existing content, template	$ 3,316,182	$ 4,496,658
Total development costs per KLA per year level - new content, template	$ 5,058,582	$ 7,664,658

Total development costs for all KLA's, all years 7-10 - existing content, template	13,264,726.04	17,986,630.04
Total development costs for all KLA's, all years 7-10 - new content, template	20,234,326.04	30,658,630.04

Total development costs - existing content, template	$ 13,264,726	$ 17,986,630
Total development costs - new content, template	$ 20,234,326	$ 30,658,630

Template construction costs $5,000 per KLA per year level	$ 160,000	$ 160,000
Site registration costs @ $50 per KLA per year	$ 1,600	$ 1,600

Assume existing:new content mix is 50:50, then total costs secondary	$ 16,911,126	$ 24,484,230

INDICATIVE PRIMARY DIGITAL CURRICULUM RESOURCES DEVELOPMENT COSTS - YEAR 5-6 SCIENCE BASELINE

METHOD 1: PRICE PER SCREEN

ASSUMPTIONS

K-10 curriculum mapping and course design costs:		Cost per K-10 subject are	Cost per subject area per year
	1 xFTE @$53K pa +20% oncosts	$ 65,000	$ 5,909
	materials cost	$ 6,000	$ 545
	focus groups & consultations	$ 15,000	$ 1,364
	TOTAL	$ 86,000	$ 7,818

School years and KLA data	
Number of school years, K-10	11
Number of primary schooling years, K-6	7
Number of KLA's in each year, years K-6	8
Total number of primaryschool KLA's for years K-6	56
Estimated number of subjects in year 5	10
Average number of subjects per KLA in year 5	1.25

Web production costs	Low end per screen	High end per screen
Web production costs - existing content, template	$ 414	$ 563
Web production costs - new content, template	$ 634	$ 963

Year 5/6 science	
Number of modules	30
Number of screens per module	20
Total number of screens	600

	Low end	High end
Total development costs per KLA per year level - existing content, template	$ 2,036,516	$ 2,751,956
Total development costs per KLA per year level - new content, template	$ 3,092,516	$ 4,671,956

Total development costs for KLA's, all years K-6 - existing content, template	14,255,614.55	19,263,694.55
Total development costs for KLA's, all years K-6 - new content, template	21,647,614.55	32,703,694.55

Total development costs - existing content, template	$ 14,255,615	$ 19,263,695
Total development costs - new content, template	$ 21,647,615	$ 32,703,695

Template construction costs $5,000 per KLA per year level	$ 280,000	$ 280,000
Site registration costs @ $50 per KLA per year	$ 156,800	$ 156,800
Assume existing:new content mix is 50:50, then total costs primary	$ 18,388,415	$ 26,420,495
TOTAL PRIMARY AND SECONDARY COSTS	$ 35,299,541	$ 50,904,725

BASE DATA FOR PER SCREEN COSTS			
Existing content			
	Hours	Cost low end (hours x hourly rate)	Cost high end (hours x hourly rate)
Business & project management, co-ordination, design and story-boarding & legal advice	1	$75	$75
Transcriptions			
Copy writing	1	$51	$68
Copy editing for web	0.25	$11.25	$17
Copy proofing	0.25	$14.25	$19
Audio processing	0.2	$8.60	$12.40
Audio wrangling			
Audio digitisation			
Audio encoding			
Graphics			
Image digitisation	0.25	$10.75	$15.50
Image web ready	0.5	$21	$28
Graphic design	2	$88	$128
Interface design	1	$47.00	$76
Layout			
HTML coding	0.75	$32	$42
Navigational Design	0.5	$22.50	$34
Other			
Programming	0.5	$22	$32
Database design	0.25	$11	$16
TOTAL PER SCREEN EXISTING CONTENT		**$ 414**	**$ 563**
TOTAL PER SCREEN NEW CONTENT		**$ 634**	**$ 963**
New content per screen cost		220	400

TASK / FUNCTION	Low end	High end
Business & project management, co-ordination, design and story-boarding & legal advice	$75	$75
Transcriptions	$33	$44
Copy writing	$51	$68
Copy editing for web	$45	$68
Copy proofing	$57	$76
Audio processing		
Audio wrangling	$43	$62
Audio digitisation	$42	$56
Audio encoding	$42	$56
Graphics		
Image digitisation	$43	$62
Image web ready	$42	$56
Graphic design	$44	$64
Interface design	$47	$76
Layout		
HTML coding	$42	$56
Navigational Design	$45	$68
Other		
Programming	$44	$64
Database design	$44	$64
IT Support (24 Hours)	$38	$57
Supporting activities		
Legal/Copyright	NA	$250
Finance (processing production salaries & expenses)	$41	$54

INDICATIVE SECONDARY DIGITAL CURRICULUM RESOURCES DEVELOPMENT COSTS - YEAR 8 SCIENCE BASELINE

METHOD 2: MODULE COST BASIS
ASSUMPTIONS

K-10 curriculum mapping and course design costs:		Cost per K-10 subjec	Cost per subject area per year
	1 xFTE @$53K pa +20% oncosts	$ 65,000	$ 5,909
	materials cost	$ 6,000	$ 545
	focus groups & consultations	$ 15,000	$ 1,364
	TOTAL	$ 86,000	$ 7,818

School years and KLA data	
Number of school years, K-10	11
Number of secondary schooling years, 7-10	4
Number of KLA's in each year, years 7-10	8
Total number of secondary school KLA's for years 7-10	32
Estimated number of subjects in year 8	13
Average number of subjects per KLA in year 8	1.625

Web production costs - modular basis	Low end per module	High end per module
Web production costs - existing and new content, template	$ 13,507	$ 20,478

Year 8 science	
Number of modules	30

	Low end	High end
Total development costs per KLA per year level - existing and new content, template	$ 3,280,170	$ 4,953,210

Total development costs for all KLA's, all years 7-10 - existing and new content, template	13,120,678.04	19,812,838.04

Total development costs - existing and new content, template	$ 13,120,678	$ 19,812,838

Template construction costs $5,000 per KLA per year level	$ 160,000	$ 160,000
Site registration costs @ $50 per KLA per year	$ 1,600	$ 1,600
Total costs secondary	$ 13,282,278	$ 19,974,438

INDICATIVE PRIMARY DIGITAL CURRICULUM RESOURCES DEVELOPMENT COSTS - YEAR 5 SCIENCE BASELINE

METHOD 2: MODULE COST BASIS

ASSUMPTIONS

K-10 curriculum mapping and course design costs:		Cost per K-10 subject area	Cost per subject area per year
	1 xFTE @$53K pa +20% oncosts	$ 65,000	$ 5,909
	materials cost	$ 6,000	$ 545
	focus groups & consultations	$ 15,000	$ 1,364
	TOTAL	$ 86,000	$ 7,818

School years and KLA data	
Number of school years, K-10	11
Number of primary schooling years, K-6	7
Number of KLA's in each year, years K-6	8
Total number of primaryschool KLA's for years K-6	56
Estimated number of subjects in year 5	10
Average number of subjects per KLA in year 5	1.25

Web production costs - modular basis	Low end per module	High end per module
Web production costs - existing & new content, template	$ 13,507	$ 20,478

Year 5/6 science	
Number of modules	30

	Low end	High end
Total development costs per KLA per year level - existing and new content, template	$ 3,304,225	$ 4,977,265

Total development costs for KLA's, all years K-6 - existing and new content, template	23,129,578.18	34,840,858.18

Total development costs - existing and new content, template	$ 23,129,578	$ 34,840,858

Template construction costs $5,000 per KLA per year level	$ 280,000	$ 280,000
Site registration costs @ $50 per KLA per year	$ 156,800	$ 156,800
Total costs primary	$ 23,566,378	$ 35,277,658
TOTAL PRIMARY AND SECONDARY COSTS	$ 36,848,656	$ 55,252,096

BASE DATA FOR PER MODULE COSTS Cant separate between existing and new content				
	Unit	Number of units	Cost low end (unit x unit rate)	Cost high end (unit x unit rate)
Concept development				
Business & project management, co-ordination, design, programming and story-boarding & legal advice	per hour	4	260	$ 300
Content preparation				
Interactives	each	1	5000	$ 10,000
Writer	per hour	20	$ 750	$ 1,000
Copy editing for web	per hour	2	90.00	$ 136
Copy proofing (screen and functionality)	per hour	1	$ 57	$ 76
Data input	per hour	3	120	162
Content acquisition				
Graphics - digitisation, production or picture library	per item	30	$ 1,500	$ 3,000
Audio	per minute	5	$ 1,500	$ 1,500
Sound effects/vocalisations	per minute	50	$ 3,500	$ 3,500
Video	per minute	0.2	$ 300	$ 300
Content co-ordinator	per hour	1	$ 40	$ 54
Technology				
Technology management	per hour	3	$ 195	$ 225
Technology design	per hour	3	$ 195	$ 225
TOTAL PER MODULE			**$ 13,507**	**$ 20,478**

TASK/FUNCTION			
Concept development	Unit	Low end	High end
Business & project management, co-ordination, design, programming and story-boarding & legal advice	per hour	$ 65	$ 75
Content preparation			
Interactives		$ 5,000	$ 10,000
Writer	per hour	$ 38	$ 50
Copy editing for web	per hour	$ 45	$ 68
Copy proofing (screen and functionality)	per hour	$ 57	$ 76
Indexing and metadata	per hour	$ 40	$ 54
Data input	per hour	40	54
Content acquisition			
Graphics - digitisation, production or picture library	per item	$ 50	$ 100
Audio	per minute	$ 300	$ 300
Sound effects/vocalisations	per minute	$ 70	$ 70
Video	per minute	$ 1,500	$ 1,500
Content co-ordinator	per hour	$ 40	$ 54
Text	per word	$ 1	$ 1
Technology			
Technology management	per hour	$ 65	$ 75
Technology design	per hour	$ 65	$ 75

Appendix A
Examples of digital resources currently being used in schools

Heinemann Interactive

http://www.hi.com.au

Searchable data base of scientific information. Includes teacher and student materials, interactives and classroom content.

The site has commenced with materials for science, but is being extended to all learning areas. Users subscribe following an initial free trial. The site also makes direct reference to other internet resources and learning materials.

Yowie Education Kit

http://www.yowiepower.com/

CD-ROM, website and teacher and student print materials. Distributed to all primary schools in Victoria.

Collaborative Online Projects

Claypoles

http://www.sofweb.vic.edu.au/claypoles/index.htm

Yvonne Claypole, a teacher from Balnarring Primary School, and her husband Jim, spent 1999 in complete isolation in Antarctica. Their only company was the wildlife of Cape Denison. Teachers and students from across Australia participated in the Victorian Department of Education's Global Classroom Project; "Claypoles - Share the Journey".

Teachers and students from P-10 were able to find a growing range of online and classroom activities to stimulate and engage them in their learning about Antarctica. Jim and Yvonne, as well as their penguin mascot 'Claypole' kept weekly diary entries.

There were term by term teaching activities following themes such as; survival; the environment; history and technology, competitions, newsflashes and online discussions. The online activities addressed learning outcomes across all levels in the SOSE, english, mathematics, science, arts, health and physical education, and technology key learning areas.

Global classrooms

http://www.sofweb.vic.edu.au/gc/index.htm

Global Classrooms projects allow students and teachers the opportunity and power to exchange ideas, opinions, research, experience, data, expertise, artwork and multimedia presentations on any given theme or topic.

Students and teachers are able to share these with a wide range of individuals of different ages, backgrounds, cultures and regions.

Science Trek

http://www.sofweb.vic.edu.au/scitrek/index.htm

Science Trek is part of the Victorian Department of Education's Science in Schools - SET for success strategy. It is an innovative multimedia resource designed to meet the needs of teachers and students of science at Years 7-8 (Curriculum and Standards Framework level 5). Components of the resource include video programs, teacher support materials and an interactive website.

Veterans Online

http://www.sofweb.vic.edu.au/vol/index.htm

Interactive website providing resource materials and projects for online learning and collaboration.

Museum of Victoria Ed Online

http://www.mov.vic.gov.au/ed-online/globalclassroom.htm

Ed Online provides a variety of opportunities for students to search for information and to participate in online learning collaborative projects using the extensive archives and databases of images, text and scientific information.

CD-ROMs

Carmen San Diego

Game based CD-ROM used extensively in primary and lower secondary schools for SOSE.

Content not Australian specific.

Annfibian

CD-ROM produced by the Murray-Darling Basin Commission and distributed to schools to support students in understanding wetlands and their importance for wildlife.

SimCity

Game based CD-ROM used extensively in primary and lower secondary schools for SOSE.

Content not Australian specific.

Parliament at Work CD-ROM

This CD-ROM supports some of the primary and secondary teaching and learning units in the Discovering Democracy kits. It provides challenging and enjoyable interactives that allow students to explore aspects of parliamentary processes and the interplay between people and Parliament.

The following is a description of four of the interactives that appear on the CD-ROM.

Explore Parliament House

This interactive leads students through the Federal Parliament building. Students drag the names of different areas such as the press gallery and different players such as the Speaker to their correct location on a picture of the chamber.

Opal Bay

Students undertake a Parliamentary Committee Hearing into what should be done with an old quarantine station – whether it should be developed or made into a national park. They hear the views of various residents and officials as they wander around the town. They can read newspapers and listen to television reports. As students progress through the activity they sort the views they hear into categories prior to writing a report and recommendation.

Pass the Bill

Students are given the task of seeing a piece of legislation about providing drought relief through discussion in Cabinet, question time in the House of Representatives and lobbying for votes in the Senate.

Balancing the Budget

The task is to reduce the amount of government spending. Students are given the current year's budget allocation for a range of portfolios. As they attempt to reduce the spending for each portfolio, the consequences are indicated. They

must try to reach the target level of spending whilst balancing the demands of health, housing, education, social security and so on.

Stories of Democracy CD-ROM

The Stories of Democracy CD-ROM supports all the primary and secondary units in the Discovering Democracy kits. Stories of Democracy won the 1999 ATOM award for the best primary CD-ROM. It provides a comprehensive set of print, video, audio and graphic sources, a glossary of terms, two timelines – one detailing the development of Australian democracy and one covering international civic events – and biographies of significant people. For each unit, it provides a narrative supported by visual sources and in most cases an interactive to support student learning in the unit.

The following is a description of four of the interactives.

Should the People Rule

Students match types of government with the appropriate definition.

Democracy Destroyed

This interactive relates to a unit about the destruction of democracy in post 1933 Germany. Students match particular examples of anti-democratic behaviour, such as book burning, with the broad democratic principle at stake.

The Law Rules

Students are presented with a range of scenarios that have taken place in the school. They must apply to these situations the key principles of law they have learnt about in the related unit of work. For example, innocence until proven guilty, the right to a fair trial, equality before the law and the independence of the judiciary.

People Power

Students edit a film of the freedom ride through western New South Wales that highlighted the unjust treatment of Aboriginal people. Students are given the sound or narrative about a town and the events that took place there. They must select the related film clip, gradually building up a correctly sequenced and narrated film.

Appendix B
Examples of Australian online curriculum materials providers

This section list some Australian public and private providers of online curriculum materials. The examples are not intended to reflect a comprehensive analysis of the market, but have been highlighted to illustrate the various attributes of public and private sector participants. Each example is identified and briefly described according to target market, revenue model and product range. Where available, details of financial backing and product and service pricing are outlined.

Public sector

Aussie school-house (www.ash.org.au)

Founded:	The Aussie SchoolHouse Foundation, a non-profit limited liability company
Financed:	Sponsored by ACER Computers, Queensland University of Technology, Web Central and others
Target market:	Teachers using internet in teaching, learning and for professional development
Revenue model:	Sponsored, not-for-profit
Products & pricing:	Range of freely-available information, links and projects relating to the use of the internet in teaching and learning, digital curriculum materials, etc.

EdNA (www.edna.edu.au)

Founded:	1995
Financed:	Australian governments
Target market:	Australian educators and learners in schools, vocational education and training, adult community education and higher education sectors
Revenue model:	Free
Products & pricing:	Education resources and tools organised around the curricula of the Australian States and Territories

Australian Registry of Curriculum projects (//rite.ed.qut.edu.au/oz-teachernet/registry/index.html)

Description: A central location to advertise curriculum projects using the internet that welcomes Australian teachers. Many groups including Education Departments, Universities, teacher associations and classroom teachers organise projects for Australian teachers and their students. The projects may be large, looking for many participants, or smaller, teacher organised projects where a limited number of participants are required. The Australian Curriculum Projects Registry aims to provide an easy, central location to find what projects are being offered in Australia to assist teachers to plan ahead to gain maximum value from these projects.

Project organisers are invited to register their projects using the online form. This information then appears in the appropriate month on the calendar or in the on-going category for projects that participants can join at any time

Private sector

ISIS Communications (www.isiscommunications.com.au & www.xsiq.com)

Founded: Australia

Financed: Public listing, Martin & Rosenthal Pictures Pty Ltd, Select Learning (M&R Pictures has a combination of exclusive and non-exclusive distribution agreements to over 7,000 CD-ROM titles. Select Learning holds a variety of rights over 2,000 multimedia training programs)

Target market: Key target market is students studying and practicing from home; also targets parents and teachers

Revenue model: Joining fees– one year $75 or $10 per month, plus

Subscription per subject – one year $100 or $13 per month

Products & pricing: *XSIQ* (due for launch before the commencement of the 2000 school year) is to be a national (although initially only targeted at Victoria, NSW and Queensland) internet based educational service aimed at secondary school students. In addition to acting as a portal for students and teachers, XSIQ will provide a venue for the sale of curriculum based services and self development services. Hybrid CD-ROM based.

Planet English – language learning and course management software developed through a joint venture with Unisearch Ltd. (a wholly owned subsidiary of UNSW).

Virtual school for the gifted (www.vsg.edu.au)

Financed: DARX Consulting Pty Ltd, various Australian private schools

Target market: Gifted primary and secondary students around the world

Revenue model: Course fees

Products & pricing: Range of 9 week courses for primary and secondary students in art and humanities, maths and science, technology, etc.

Individual enrolment fees per course – A$195

Group enrolment fees type 1 (per group per course – offering one email contact, one response from the group to questions and assignments, one report for the group and one certificate for the group) – A$175 + $20 per group member +$10 per additional email address

Group enrolment fees type 2 (per group per course – offering all of the above except each group member receives their own certificate of completion) – A$175 +$25 per group member + $10 per additional email address

World School (www.worldschool.com.au)

Founded: 1999, Australia; appears to be Australian franchise of a globally-focused business, www.worldschool.com

The business is in an early stage of development and not yet operational. Details listed below reflect marketing materials, not actual and available content

Financed: Private

Target market: Australian students (no subject or year-level specified)

Revenue model: Free search engine, educational resources, paid online tutoring (students pay teachers for tutoring assistance and worldschool takes a commission)

Products & pricing: *Worldschool.com proprietary directed learning (wdl™)* – for every subject

Worldschool.com educational resource bank (wrb™) – providing edited, reviewed and indexed curriculum specific subject material

Worldschool.com proprietary search engine (wse™) – for accessing the educational resource bank

Worldschool.com one-on-one real time personal teaching (wpt™)

All services are adapted to each student's specific curriculum, age and location.

Except for worldschool.com personal teaching (wpt™) all services from worldschool.com are free

Heinemann Interactive (www.hi.com.au)

Founded:	Unknown
Financed:	Heinemann, Rigby, CIS Heinemann Australia
Target market:	Australian primary and secondary students and teachers
Revenue model:	Free resources, merchandising and sales of Heinemann traditional and new media products
Products & pricing:	*Infobase* – Educational resources searchable by age level and year level (free, requires registration)
	Infobytes – subtopic related information (free, requires registration)
	Activities, experiment and assessments items – for self-directed and teacher-assisted learning (free, requires registration)
	Outcome statements – aligned with curriculum (free, requires registration)
	Education bookstore – catalogues and online ordering from Heinemann, Rigby and CIS Heinemann

Encyclopedia Britannica

Encyclopedia Britannica have announced their intention to move into the digital curriculum resources market but their products are still being developed.

Appendix C
Examples of the role of States and Territories in producing on line curriculum

All State and Territory school systems have web-sites. Some of the material they contain is for wider educational use, such as guides to resources for teachers. Other material is mainly relevant to individual jurisdictions.

A recent mapping exercise to explore the range of online content materials developed by systems indicates:

- while there are some materials which have a comparatively long and continuous history – for example Oz Projects – many sites are at a formative stage in developing online content development;
- the sites commonly include online project work covering a wide range of topics such as cross curricula units with a focus on environmental issues. They also cover special issues such as competitions, the Olympics, and inter-school contacts;
- older content tends to focus on developing familiarity and skills in using technology. More recent work tends to support specific educational projects or programs; and
- jurisdictions have several projects underway to develop online curriculum.

Current online content and development plans

This section is a summary of information provided to the Curriculum Corporation by DETYA, and the States and Territories about major existing or planned online content development and their websites. Some key links to other sites are noted.

For Students

Web sites

ACT

Department

- Access via the website to Schoolsnet Education. Provides linkages to a number of cultural sites, GLOBE (environmental education), Schoolworld (linkages to teachers, projects and resources), Aussie School House (see below), Enviroquiz, and other sites.

NSW

Department

HSC Online

- Information on 27 subject nodes with more under development – study guide, sample essays, purpose-written tutorials, hot links and teacher resource materials.

Student Projects

- Celebrating diversity by learning and living together – an exhibition of student work;
- Envirothon – a contest for year 11 students;
- Feature artist – an exhibition of student work;
- Look up-Link up – an activity based study of the solar systems and planets;
- Minister's Young Designer Award – support for Year 7 and 8 student contest;
- Murder under the Microscope (with Ozeducate, OzEmails'education division, OTEN, Dept of Land and Water Conservation) – interactive environmental game;
- Olympic 2000 Schools Strategy – contains an ideas for teachers element; and
- School web competition – build a site about great celebrations.

Linkages to:

- Aussie School House (sponsored by Microsoft and Optus Vision) – support for online education projects (Travel Buddies, Book Rap, Project Atmosphere Australia, Christmas Cards), free web space, Think Quest, links to Montage, Vocational Educational Co-ordinators Online, and other sites;

- Montage (sponsored by the British Council, Australia and Central Bureau for Educational Visits and Exchanges UK) – includes an element for posting projects developed by and for schools, including some which appear on Aussie School House, and substantial communication components;

- Childnet International Launchsite (Childnet International, UK) – access to a wide range of validated educational elements and projects designed to exploit the educational capacity of the Web;

- EdNA;

- Learn Online (ABC) – scripts and program records with some additional educational activities; and

- Oz Projects (originated by Nexus, SA, 1993) – projects for Australian students K-12, include Newsday and Murder under the Microscope.

Fair Go

- activities based on consumer protection for students aged 16-18

International Civics and Citizenship Education

- (with ABC and British Council, Australia) projects and international communication

Life in a space colony / A trip to Antarctica

- units to support new Science Stage 4-5 syllabus – staged development during 1999-2000

Northern Territory

- Northern Territory Open Education Centre is trialing the use of online lessons and activities

Queensland

Department

- No online student materials on this website

South Australia

Department

Open Access College (in development):

- virtual online science experiments for Year 9 students; and
- K-12 student materials to be developed in 2000 (possibly with WA).

Lifelong Learning and Resource Network (LEARN SA)

contains a section called Teacher and Student Resources. It provides linkages to a number of sites developed by DETE for students.

- Ozprojects (in collaboration with NSW);
- 'The Titanic in the classroom' – an investigative journey for students to learn about the Titanic;
- ICoN Internet Chess for students (coordinated through DETE) provides online movies for learning chess moves, interschool online chess for primary and secondary competitions, and the ability to play real time and asynchronous chess games with other students throughout Australia;
- Open Access College includes online student support materials across a range of subject areas for students K-12 through a resources section to compliment the distance education materials received through the post; and
- Outreach Education sites, available through the Open Access College website provide some online student materials, and more are being developed. Currently available resources include:
  - Botanic Gardens: Aboriginal Plant Use – online student guide for downloading prior to following plant trails
  - SA Museum – database provides access to an online interactive game about careers and student materials about the ocean
  - Adelaide Zoo – online and activity plans in science, arts, society and environment, and mathematics

SSABSA Online (SA)

- This site includes facts sheets about the SACE, past examination papers, information updates, and assessment plan proformas. It includes links to the Boards of Studies websites in each of the other States and Territories.

Tasmania

Department

Discover Education website (in development):

- a section providing information to support students learning online; and
- online chat sites (forum) and places for students to interact with teachers are currently provided for 'Indonesian with Steve', Information Handling 9/10, Japan Link, and Science Case study (with Open Learning Service School). Others are planned.

Open-IT Project

- Digitising curriculum materials K-12 to be produced by March 2000

Department website

- Includes a student section with links to a range of fun pages for young people such as the Lego Home Page, Bertit's Best Sites for Children, and others.

Tasmanian Open Learning Service

- Online student course support in the key learning areas

Tasmanian Secondary Assessment Board

- This site provides information about particular syllabuses and current assessment requirements. It provides copies of syllabus statements, information about standards and copies of past examination papers.

Victoria

Department

- Sample online student science materials which can be used in for distance education based on CSF level 5 science. This is a joint project being developed by the Curriculum Corporation and the Department of Education, Victoria;

- OZ 2001 (with the SAG of EdNA) which has several sections including First Families;

- SOFWeb has a student section which is divided into Kids Virtual Classroom, VCE students and a Teen Area;

- Kids Virtual Classroom and the Teen Area are sub-divided into the eight learning areas. They include other cross curricula and issues-based curriculum materials, fun activities, and provide links to learning support materials. Student art materials are on show in Students Gallery; and

- a VCE Student section which is proposed for redevelopment.

Board of Studies

- Online information documents about the VCE, including important dates, and statistical information about the VCE assessment program. By January 2000, support materials produced by the Board of Studies are planned to be available online through the Education Channel.

Western Australia

Department

- Website has a section called 'Just for students'. This section comprises information, ideas, contacts and things to do. It has been broken up into five sub-sections – career options, get involved, schools on the net, serious stuff, what's on. The Technology Focus section of this website includes a subsection called collaborative projects. This provides an opportunity for students to publish their work on the internet; and

- EdsiteWA has a section called Kids' stuff. This includes linkages to sites developed specifically for use by children and students.

CD-ROMS

National

- Languages other than English (DETYA)

  – 'Hebat' (Indonesian); and

  – 'Tai Hao Le' (Mandarin)

  to complement print materials ('Suara Siswa' and 'Zhongguotong' respectively, Stages A, B and 2)

NSW

Department

- K-6 Creative Arts;
- Heritage project (with NSW Heritage Office) – exploration of personal heritage and 15 heritage icons;
- Aspire 2000 – Olympic Games Resource for Australian schools;
- language support component – 9 languages with activities;
- Learnscapes – environmental education, applicable across KLAs;
- Industry specific work education resources:
  - hospitality
  - manufacturing;
- Japan Album – beginning secondary students;
- China Album – beginning secondary students;
- Italian Album – beginning secondary students; and
- Indonesian Album – beginning secondary students.

Board of Studies

- ArtExpress 1992 – HSC Visual Arts;
- ArtExpress 1996 – HSC Visual Arts;
- Pickle Street – HSC Legal Studies;
- Waterlines – geography, science and environmental studies;
- OZ I.D.: The Search for Australian Identity and Heritage – years 7-10 Australian History;
- Wayback When: colonial Australian life – years 5 and 6, and years 7-10 Australian History;
- DownUNDER – years 7-10 Australian geography;
- Poster Art 1914-1920 – HSC modern history;
- FlashBACK – years 7-10 Australian history;

- Sparky's Energy Adventure – years K-6 science and technology; and
- Make the Connection – years 5 and 6 science and technology.

Queensland

- The Department's Open Access Unit has seven CD-ROMs available for sale. Four are for students.

South Australia

Department

- Open Access College – K-3 Indonesian interactive book;
- Open Access College – years 4-7 Indonesian student course materials; and
- Open Access College – year 8 Indonesian student course (all in development).

Victoria

Department

- Primary Access to Languages (PALS) for students learning Greek in years 3-6;
- Secondary Access to Languages (SALS) for students learning Japanese, Indonesian, Chinese, Vietnamese, French, Italian, German and Greek at years 11 and 12;
- Where's English? – 10-week course for new arrival students on video and CD-ROM (in development); and
- Primary Access to Languages 1 (PALS) for students learning French, German, Italian and Indonesian (in development).

For Teachers

Web sites

NSW

Department

- Artsonline – creative arts, teacher support and communication)
- Taking it to the Streets – creative arts, online demonstration of performance development;

- Civics and Citizenship Education Benchmarking (with Sydney University) – assessment scale and instruments (planned for term 2, 2000);
- Field Studies Centre Directory – database of services;
- Resources in Environmental Education – database of resources, across KLAs;
- Community Languages – Arabic, Chinese, Modern Greek and Turkish (all planned for June 2000), teacher support;
- K-12 Languages Methodology Online – teacher interaction and support;
- Count Me In Too – support for mathematics research project;
- Science and Technology Support Units K-6 – case studies and other forms of support;
- K-6 Science and Technology in Action (with NSW BoS) – work samples and narrative to support teaching;
- Young Designers – technical and applied studies years 7 & 8, six case studies, work samples;
- The New HSC – support site for implementation;
- Hot Links – access to annotated links relevant to specific KLAs and year levels;
- Featured Articles – access to selected articles for teachers;
- Teaching Ideas – organised by KLA and age group;
- Resource materials on work and career education;
- School Libraries –for school librarians;
- Log on to Literacy – support for teachers of early literacy;
- International Civics and Civics Education; and
- Languages:
  - ALS Mandarin program – K-12 (planned for June 2000)
  - French, German, Italian, Japanese – K-6.

Northern Territory

Department

- The Northern Territory Department of Education website provides policy and administrative information.

Board of Studies

- Northern Territory Board of Studies provides information about curriculum areas, committee structures, and certification and assessment.

Queensland

Department

- The Department website provides information under the following categories – About the Department, Financial Aid News and Views, Our Schools, Policies, Teaching and Learning, Utilities, and Working in the Department. The Teaching and Learning section includes online discussion lists.

The Queensland Board of Senior Secondary School Studies

- Provides information about curriculum, assessment and certification. It provides statistical information and 'A short course in the Australian Constitution' which are print materials online for downloading.

South Australia

Department

- School Entry Assessment – teacher support; and
- SA curriculum Standards and Accountability Framework – (to be produced in 2001).

LEARN SA website

- Provides linkages for teachers to a number of sites developed by DETE including Training and Development and Teachers' and Students' Resources sites;
- Learning Technologies SA provides an online newsletter and a range of resources to support school planing and classroom integration of learning technologies;
- Pathways for planning and programming in schools provides teachers with outlines of what to teach and when to teach it across the eight learning areas and in the cross curriculum area. It is designed to support South Australian government school teachers construct teaching and learning programs using the Curriculum Statements and Profiles for Australian Schools;
- Online Literacy provides teaching and learning suggestions for teachers to support students improving their literacy levels in each of the eight learning areas;
- School-based reform project – joint project between SA DETE, the Australian Education Union (SA Branch) and the University of South Australia. It provides an online report of the project and includes the ability to subscribe to a list server; and
- Curriculum Exchange is an online curriculum support service for teachers across all areas of the curriculum, and other major cross curriculum issues such as work education, literacy, numeracy and cultural inclusion.

Tasmania

The Tasmanian Education Department website comprises many policy and research documents. It also contains:

- Discover Digital Resource Database – a bank of resources, teaching and learning strategies, events, contacts, learning materials contributed by teachers; and

- Educational Computing Professional Development Strategy based on a flexible delivery model. Schools can customise their IT professional development.

Victoria

Department (all in development)

- Course Advice – Switched on Curriculum and Switched on Assessment – range of learning activities to support the implementation of the CSF;
- Sample student work – examples of student work illustrating achievement of learning outcomes;
- Online Curriculum Project – online units incorporating thematic projects across KLAs;
- Oz 2001 Project (with the SAG) – national collaborative projects; and
- Curriculum Standards Framework – P-10 curriculum to be produced online and in hard copy and CD-ROM.

Hot Spots on SOFWeb:

- Online Resource Centre;
- Using the internet;
- The Virtual Lounge;
- The Global Classroom;
- Online collaborative projects;
- Discussion groups;
- Victorian Schools Online;
- STEPS Online;
- Programs targeting science and technology in the primary years;
- Leading Practice IdeaBank;
- Online database of teaching and learning activities incorporating leading practice;
- What's Happening in Education;
- Professional and Leadership Development;

- Learning Technologies in Schools;
- Human Resource Management;
- Key Learning Areas;
- Self Governing Schools;
- Learning with the Internet P.D. Program;
- Middle Years of Schooling;
- Online Education Channel – provides students and teachers with materials to support teaching and learning;
- CSF Digital Networks – Digital Science Network for Science Teachers – online discussion group;
- Scientists in schools – online communication involving scientists in school-based activities; and
- ESL in Practice – ESL professional development course.

Western Australia

Department

- The Education Department of Western Australia has a section named Technology Focus. This has various sub-sections which include information about learning technologies in K-12 classrooms including Technology and Learning Online, Collaborative Projects, and Teachers and Technology. It includes documentation of models of best practice and online journals.

Curriculum Council of Western Australia

- Provides information about curriculum, assessment and certification, and statistical information. Publications are available online for downloading.

Appendix D
Current and potential developers & investors

This appendix lists the main Australian private sector traditional and new media developers, publishers and distributors, and identifies some non-traditional players who have publicly expressed business objectives that could attract them to the digital curriculum market.

Traditional and new media publishers:

- Reed International Books
- Scholastic / Scholastic New Media
- Macmillan
- Jacaranda Wiley
- McGraw Hill
- Rigby Heinemann / Heinemann Interactive

Current developers, publishers, distributors:

- Dataflow
- Dataworks
- Educorp
- Memory Banks
- Edware
- Microtech
- Encyclopaedia Britannica
- ISIS Communications
- Edweb
- Webschool.com
- SchoolsNet.com.au
- Aussie School House

Non-traditional players who have expressed interest:

- C&W Optus
- News Ltd
- Telstra
- AT&T
- IBM
- Apple

Appendix E
Examples of international online curriculum materials providers

This appendix lists some international public and private sector providers of online curriculum materials. The examples are not intended to reflect a comprehensive analysis of the market, but have been highlighted to illustrate the various attributes of public and private sector participants. Each example is identified and briefly described according to target market, revenue model and product range. Where available, details of financial backing and product and service pricing are outlined.

Public sector

National Curriculum (www.nc.uk.net)

Founded:	National Curriculum, UK
Target market:	K-12 UK students and teachers
Revenue model:	Free access, national funding, advertising-free

Florida High School (www.fhs.net)

Founded:	1996, Florida State Department of Education
Target market:	High school students
Revenue model:	Not available
Products:	Courses developed by certified classroom teachers with a knowledge of online curriculum development and instructional delivery Courses reviewed by a group of peers, outside experts and Advisory Board members Complete course delivery including online assessment and instructional support All development tied to Florida State Standards and, where appropriate, national standards

Customers:	End of first year – 1,000 students from 43 districts enrolled in 22 courses End of second year – 2,000 students enrolled from 60 districts in 49 courses

The Concord Consortium (www.concord.org)

Founded:	Unknown
Target market:	Primary, middle and senior high school students and teachers
Revenue model:	Sponsorship
Products & pricing:	Schools pool their development capacity to generate an aggregate of course options NetCourses – for students at primary, middle and senior high school levels CC Services – resources and information for teachers Projects – a range of curriculum-linked and general projects which focus on ICT in teaching and learning Library and resources
Customers:	In 1997/98 the consortium offered 29 internet-based, credit-bearing courses to about 500 students in 10 states

Private sector

AngliaCampus (www.angliacampus.com)

Founded:	UK
Financed:	Joint venture between British Telecom plc and Anglia Multimedia Ltd. Also has private equity finance
Target market:	K-12 students and teachers
Revenue model:	Annual membership fees for unlimited access to the closed network
Products & pricing:	30,000 pages of online curriculum materials - replicated each term on CD-ROM and distributed to all subscribers. Materials include animations, video and sound clips, and interactivity. A great deal of content is text-book in style.

Students – £49.99 pa.

Primary schools – £120 pa.

Middle schools – £250 pa.

Secondary schools – £450 pa.

Blackboard Inc. (www.blackboard.com)

Founded:	1997, USA, in collaboration with Cornell University
Financed:	Venture capital, US$16 million
Target market:	Instructors at K-12 schools, colleges, universities and training organisations
Revenue model:	Mix of free and paid products and services
Products & pricing:	blackboard.com – free service that enables instructors to add online components to their courses and provides for students to access this material at the Blackboard.com website. The service includes automated assistance in creating courseware including the following features – threaded discussions, real-time chat and whiteboard, assessment tools and grade-book, collaborative work groups, content creation, database reporting and course-site statistics, messaging system, online file exchange between instructor and student, online tutorial, user tracking and 5MB of space Instructor fees – US$100 upgrade for a registered course site. This fee provides all the free services and the following additional services – e-commerce capability including the option to charge a fee for students to enroll in an instructor's course, a listing in the featured courses section of the blackboard.com website, technical support and 10MB of space Blackboard courseinfo – server software developed for institutions and individual departments for a common look and feel for all their web sites. The cost is US$10,000 to more than $50,000 depending on the size of the institution and the features required Systems integration and customisation services Education and training services Hosting services

	Course production and migration services
Customers:	More than 10,000 instructors at K-12 schools, colleges, universities and training organisations
	As part of its company information, Blackboard Inc. says that the National Institute of Standards and Technology anticipates a total online education market (including professional training) of US$46 billion by 2005.

Classroom Connect (www.classroom.com)

Founded:	1994, USA
Target market:	Teachers seeking teaching guides and curriculum-integrated lesson planning in print and web-based formats, aimed at assisting the incorporation of digital materials into class
Revenue model:	Mix of subscription, banner advertising and product sales
Products & pricing:	Online activities by subscription
	A single title - such as *100 activities for the online classroom* which includes a 256 page print booklet and one year of access to the 100 Activites Website – sells for US$49.95
	A K-6 curriculum integration collection sells for US$669. It includes teaching guides to American history, mathematics, science, social studies and language arts, webguides which include websites on American history, mathematics, science, social studies, fine arts, music and language arts, *100 activities for the online classroom*, access to hotlinks for elementary social studies and elementary science, a guide to creating internet projects, and a list of recommended educational websites
	A similar styled pack for Grades 7-12 costs US$559
	An individual 32 page webguide to Grade 7-12 science costs US$16.95

Schoolsnet (www.schoolsnet.com)

Founded:	November 1999, UK, by founders of Soccernet
Financed:	Founders of Soccernet, a successful soccer site, 60 per cent of which was recently sold to Disney for £15 million
Target market:	School and university students
Revenue model:	Free access, advertising revenues
Products & pricing:	School and university guides
	Online library
	A school news service
	Access to classroom resources including interactive lessons, essay plans, worksheets, revision guides and other materials is planned

Education Place (www.eduplace.com)

Founded:	USA
Financed:	Houghton Mifflin
Target market:	K-8 teachers and students
Revenue model:	Free – designed to funnel users to the Houghton Mifflin online store
Products & pricing:	Free K-8 resources
	CD-ROMs for sale via affiliated site, for example the *Curious George Learns to Spell* CD-ROM pack (aimed at Grade 1-2 students) sells for US$60. This includes a board game, CD-ROM and teacher's guide. Another example is the *Rescue Geo 1* CD-ROM which is an interactive package for students in Grades 3-6 and sells for US$49.90. The pack contains a CD-ROM, board game, game cards and game pieces.

Tenth Planet (www.tenthplanet.com)

Founded:	1994, USA
Target market:	K-6 Teachers
Revenue model:	Merchandising (software sales)

Products & pricing:	Hybrid internet/CD-ROM with curriculum-linked materials including: Lesson plans Teaching guides Reference materials Assessment and staff development materials

Appendix F
Alternative digital delivery channels

This appendix outlines examples of the three main sources of digital learning materials. Where available, revenue streams have been included.

Traditional educational channels

These traditional educational channels add to their services by:

- increasing the number of programs broadcast using extra capacity; and
- sometimes providing some interactivity via a separate website

RAIsat E3 (Italy)

An Italian public service broadcaster providing an educational TV service – RAIsat *E3* – via near video-on-demand, allowing teachers to order video clips via email.

UR (Sweden)

A Swedish public sector educational broadcaster rolling out digital TV and radio broadcasting, web services and a media library.

South Carolina Educational Television (SCETV) (US)

SCETV is currently providing closed-circuit TV services. It plans to offer a range of educational services on digital TV, including its *Ready to learn* program for pre-school children.

Data broadcasting services

These data broadcasting services provide:

- high speed internet connections that provide access to educational content; and
- delivery of specific learning resources.

RAI (public service broadcaster) and Telecom Italia (Italy)

This group is networking into 34 of the 46 Italian universities via a digital satellite channel. 6,000 students are registered for various diploma level courses.

TPS (Television par Satellite) (France)

TPS, a pay-TV digital satellite service provider in France, is managing a consortium of companies providing an experimental service called SAT&CLIC for 100 high schools in remote regions. This involves internet access via satellite to focused educational materials.

(www.tps.fr)

Espresso for Schools (UK)

Espresso allows English primary schools (7-11 year olds) to receive regularly updated, video rich multimedia to support teaching and learning in the classroom. The service uses data broadcasting to deliver UK curriculum-linked material to schools. It is designed to help children link what they are learning in class to events in the outside world through news, web and TV updates. It is accredited by the Teacher Training Agency to provide teachers with materials demonstrating how ICT can be used within the curriculum.

(www.espresso.co.uk)

New interactive TV services

New interactive TV services:

- allow users to access information independently of the TV channel; or
- use enhanced TV services that let viewers interact directly with the program.

NTL's Knowledge Channel (UK)

This is an interactive TV service for parents and children. The channel is in partnership with two leading interactive education publishers, Dorling Kindersley and AngliaCampus, who will supply content. It is intended to become an everyday educational tool, especially useful for those without personal computers at home.

When it is launched in early 2000, subscribers will be able to view TV friendly versions of the latest primary and secondary maths, science and english curriculum content, categorised according to the English National Curriculum key stages, where applicable. As the channel develops, NTL plans to offer lifelong educational services to viewers, "from nursery to retirement".

AngliaCampus, reportedly UK's largest online educational service, will provide selected subject content to 11-16 year old students. Their education models will support the school curriculum, home work, project work, SAT preparation, exam coursework and GCSE revision. Parents will be charged £15 per month for rental of a decoding box and telephone line.

Greek Ministry of Education

The Ministry has licensed the Irish-developed EdCast system to deliver, in an encrypted format, examination papers to 2000 schools.

Educational Broadcasting System (Korea)

The Educational Broadcasting System was established in 1990 to support Korean school education via TV and radio. It now also delivers content via an internet TV station (www.kedi.re.kr). The system is 50 per cent subsidised by the Government. It is focussed on K-12 students and offers foreign language conversation, vocational education, environmental education and other courses linked to the Korean curriculum.

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