VET PREFERRED STANDARDS (2003)

by

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Acknowledgments

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EXECUTIVE SUMMARY

This report makes recommendations on the future implementation of Preferred Standards across the VET sector to support online learning within a flexible delivery framework. The project is part of ANTA's *Strategy 2002*, which continues implementation of the *Australian Flexible Learning Framework for the Vocational and Education Training System 2000-2004*. The Project team recognises the well-researched technical work that has been done under previous Preferred Standards projects.

The Proof of Concept exercises undertaken in this project show that standards compliance improves interoperability in the case of the Toolbox initiative. Use of the Preferred Standards can also save money – particularly when they improve the operational efficiency of systems involving large capital expenditure. VET sector standards setting activity is likely to be most effective in areas specific to online learning, where Whole of Government standards do not generally override VET sector Preferred Standards. The VET sector Preferred Standards activity in these areas is therefore a valuable activity. The realisation of this value requires greater awareness and ongoing consideration of standards by the broader training industry. To date communication of these benefits and therefore adoption has been limited.

In order to generate greater awareness of the VET Preferred Standards it is important to recognise that there are particular cultural aspects involved and that most VET staff are not employed for their technology skills. They are trainers first and technologists second. Technical support for VET staff therefore needs to be addressed.

Recommendations contained within this report suggest that the provision of a permanent contact point for VET technology standards would have twofold benefits. VET sector ownership of the technical standards agenda, through an alternative mechanism to the current annual project scenario, would provide the necessary ongoing annual review or watching brief that is necessary to maintain currency and relevance. Secondly it would provide an opportunity for addressing the day to day technical issues (large and small) that VET staff encounter, in order to foster interoperability. A particular key requirement is to advise VET providers whether or not products they are considering for purchase or installation conform to the Preferred Standards.

This key element of the Preferred Standards 2000 Communication Plan should be implemented as a priority to capitalise on the existing work while it is still current.

In order to make best use of the resources available, future Preferred Standards projects should survey the needs of clients and ensure that Preferred Standards and Operating Guidelines which correspond to those needs are identified and maintained. Preferred Standards should be those standards – identified by an objective method as detailed in this Report – which support products delivering the best value for money, and interoperability within the sector.

It is not appropriate to recommend, and this report does not investigate, commercial brands, which would convey benefits to particular companies. In the future, however, there may be advantages in adopting open source file formats, which can only be sensibly specified by reference to the corresponding open source software product which uses them. If open source file formats turn out to be of value to VET, a future round of the Preferred Standards project should resolve this issue.

The VET sector should, moreover, keep a watching brief on open source software – a growing industry trend - where it is freely available and could contribute value and interoperability to the sector.

Finally the project Team recognises that the Collaborative Interoperability project has a continuing responsibility for technical standards relevant to flexible learning, as part of it's brief. This report should be passed on as advice to the Collaborative Interoperability project.

1 RECOMMENDATIONS

The Report makes the following Recommendations. Listed after each recommendation are the Sections of this Report where the justification for and further detail of the Recommendation.

The Recommendations are based on the following underlying principles aimed to achieve the best utilisation of funds available for Preferred Standards activities:

1. Preferred Standards activity should respond to the needs of the VET clients;

2. Preferred Standards activity should focus on standards areas where the Sector can influence Preferred Standards adoption;

3. Standards should be selected by a process designed to maximise the educational benefits, minimise costs and maximise interoperability.

Recommendation 1. (Section 3.10)

The booklet introducing the Preferred Standards, developed as part of this project, should be widely promulgated throughout the VET sector.

Recommendation 2. (Section 3.10)

A dedicated VET Preferred Standards advice service, in the form of an email address and/or a telephone number, be established through a peak VET organisation or initiative to provide daily information for VET staff on questions related to the Preferred Standards.

Recommendation 3. (Section 4.7)

In order to make best use of the resources available, Preferred Standards development should focus on areas primarily related to flexible learning.

Recommendation 4. (Section 4.7)

Future Preferred Standards projects should determine, and respond to, the most important flexible learning needs of VET clients.

Recommendation 5. (Section 4.7)

Preferred Standards should be selected which support flexible learning solutions that provide the best educational value for money for clients, and maximise interoperability.

Recommendation 6. (Section 7)

The Collaborative Interoperability project should receive this report as a source of advice on future standards setting activities, and make use of those aspects of the current Preferred Standards which are relevant to it's focus.

Recommendation 7. (Section 7)

The VET Preferred Standards resources should be the subject of a Product Maintenance Review to evaluate identified opportunities for use.

2   INTRODUCTION

This Project is part of the ANTA's *Strategy 2002,* which continues the implementation of the *Australian Flexible Learning Framework (Framework),* which, in turn, supports the broader scope of the *A Bridge to the Future: the National Strategy for Vocational Education and Training, 1998-2003 (National Strategy)[1]*

The *Framework* website is available at http://www.flexiblelearning.net.au.   It supports the *National Strategy* by:

- helping registered training organisations provide lifelong learning opportunities by applying new technologies to vocational learning at work, in educational institutions, in communities and at home;

- building the capacity of training organisations and their staff to offer clients more choice in when and how they learn and the products they can use to learn;

- fostering innovative approaches to a range of technology-enhanced learning, particularly online learning;

- blending online learning with other methods of training delivery to create more flexible ways of meeting client needs and expectations;

- growing the national knowledge pool about teaching, learning and assessing online;

- ensuring a national and international presence for Australian VET in the e-learning environment.

2.1 The Role of Standards

This Report deals with technical standards, i.e., hardware and software protocols and information structures which enable communications and information technology devices and software to support the delivery of online learning material to students, operate effectively and efficiently, and allow communication with information technology equipment serving other teachers and learners. (More detail of the way standards support online learning is given in *Attachment 1.*)

In 1998 and 2000, workshops were held involving representatives from States and Territories to identify standards, the use of which would promote interoperability across the VET sector. These standards were approved by the ANTA CEOs and recommended for adoption across the sector. They are termed *VET Preferred Standards (2003)* and were updated in 2003*.* The VET Preferred Standards (2003) are at

http://www.flexiblelearning.net.au/standards/navigation/home.shtml

In addition, the work on Preferred Standards identified methods of working or practices which benefit online learning, or increase interoperability across the sector. These are termed *Operating Guidelines.* Within the ambit of the education industry, technical standards and Operating Guidelines assist program delivery by

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[1] Strategy 2002, *Preferred Standards, Contractor Brief.*

- improving:

    - equity and access to learning materials,

    - mobility of students among institutes and curricula,

- ensuring that investment in capital infrastructure is strategic.

The use of standards results in these outcomes because of the functionality that the standard provides. In this report the term "functionality" means the thing the standard - or a product based on the standard - actually does. For example, the functionality of a standard may be the ability to structure documents in a way that makes them machine readable. As another example, the functionality of an audio coding standard would result in the products using this standard being able to compress speech information and restore it with acceptable voice quality as perceived by the listener.

In addition to functionality, use of standards can benefit the sector via cost reductions that result from lower capital expenditure or operating expenses (for example, maintenance and training).

An important attribute of the Preferred Standards is interoperability. This means that applications running on different computers or communications equipment at different sites can work together. Interoperability is relevant:

- inward in the institute,

- laterally with other institutes, and

- outward with the world for selling and exchanging services.

Interoperability allows student records to be transferred between institutes or learning objects to be reused by different course designers.

Technical standards may be classified in many ways. The 1998 Preferred Standards project divided the standards into seven classes. The 2000 project used a different classification.

DETYA (now DEST), on behalf of the EdNA Reference Committee (now AICTEC) commissioned a report *Technical Standards for Online Education and Training: a Scoping Study (2000).* This report was distributed widely within Government, Director Generals of Education and the AVCC. The author of the report is the consultant for the Collaborative Interoperability project.

The *Scoping Study* used the following classification of standards, listed on the AICTEC site on *Technical Standards for Online Content Development* at

http://www.aictec.edu.au/priorities/standards/default.htm#sub

The classifications are:

Network Infrastructure: general infrastructure to permit transmission of data and standards for transfer of particular types of media (text, audio and video).

Content Formats: Standards for the storage and presentation of components of online content (text, graphics, audio and video files). Also covers programming languages and accessibility issues.

Resource Description and Resource Discovery: Metadata, search interfaces and vocabularies necessary to assist reliable resource discovery.

General Applications: Web publishing, email, workgroups and video conferencing.

Delivery Platforms and Content Packaging: Software systems used to manage the delivery of online content to students.

Administration and Management: covers such areas as student records and educational statistics.

The Steering Committee has suggested that the Preferred Standards be presented to AICTEC for the information of their members. The Steering Committee has also suggested that the outputs of this project feed into the Collaborative Interoperability project. Use of the above classification would be useful in these two initiatives. It is therefore used in this report.

The cost of altering or modifying the classification structure needs to be considered from two perspectives. The cost involved in conducting workshops can be at times prohibitive. However, if it means that experts in one field can consider all the relevant standards at the one workshop there is therefore some benefit in modifying the classification. Logistically, therefore, it might be worthwhile matching the classification to the standards areas that exist within AICTEC.

2.2 Structure of this Report

This Report is organised according to the logical sequence of the tasks specified for the project. The order, and a brief description of the generic nature of each task, is as follows:

Survey - the current status of awareness and takeup of the Preferred Standards by RTOs and TAFEs.

Focus – a methodology for the selection of Preferred Standards based on the results of the Survey

Proof of Concept - the testing of the fundamental effectiveness of the Preferred Standards activity in contributing to the desired outcomes of the VET sector.

Watching Brief - the identification of standards areas, standards and Operational Guidelines for subsequent collaborative examination and endorsement by the VET sector, which are considered to be high priority for further attention. These include both emerging standards requiring close examination and previously identified standards that require continued monitoring.

3   SURVEY

3.1 Summary

This chapter describes the design of the sample and the questionnaire used to assess the knowledge of, and adherence to, the Preferred Standards by VET providers. The survey included both TAFE Institutes and private RTOs.

The results indicate that awareness of the standards is low and implementation has not occurred to the degree required – particularly among the general population of RTOs. The major reason is the lack of understanding of the Preferred Standards by providers.

There is a need to provide personal assistance to providers to let them know whether products that they are contemplating conform to the Preferred Standards.

3.2 General Principles

The survey of the adoption of standards by the VET sector sample should be sufficiently large to ensure a reasonable confidence level in the results obtained. The providers who are surveyed should be randomly chosen in the first instance. Appropriate sample design and a sufficiently large sample should ensure that there are adequate representations across the following dimensions:

- States and Territories

- Public providers / private providers

- Large institutions / smaller providers and

- Metropolitan providers / regional and rural providers.

3.3 Sample Design

The population of VET providers is highly skewed. The population comprises about 60 TAFE institutes with a relatively large number of students in each, together with about 5000 non-TAFE Registered Training Organisations (RTOs). In 2000[2], over 75% of students attended TAFEs or other government providers.

It is evident that a random sample across all providers would not result in a representative selection of learners, since it would correspond to those learners undertaking the courses offered by the small RTOs. Conversely, a sample based on unbiased representation of the student population would under-represent the smaller RTOs.

Consequently, surveys were taken across two samples.

3.4 Non-TAFE RTO Sample

RTOs were selected at random from the list available from the National Training Information Service (NTIS) website[3]. Emails were forwarded to about 360 recipients, asking them to fill in an online survey form. About 300 emails were delivered. Two follow up emails were sent asking the RTOs to respond. A further 40 questionnaires were sent in hard copy form by post to RTOs who did not have email addresses. The response rate was 22%.

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[2] NCVER, *Vetstats Highlights for 2000,* http://www.ncver.edu.au/statistics/index.htm

[3] http://www.ntis.gov.au/

3.5 TAFE Sample

Survey invitations were sent to all institutes in each State/Territory and follow up action was taken to increase the number of respondents. The response rate was 33%.

3.6 Questionnaire Design

The questionnaire was developed from that used in the 2000 Preferred Standards project in order to ensure that issues raised in that prior survey were addressed.

The questionnaire was designed to test whether providers were aware of, and had adopted the Preferred Standards. It also aimed to discover those issues which are crucial to the management of standards activities by VET. These include the benefits that have accrued from the adoption of standards, implementation issues and – in the case of organisations which have not taken up the standards or have adopted them only to a limited extent – the barriers to adoption which they have encountered.

The questionnaire was intended to be as simple, user-friendly and easy-to-complete as possible. This encouraged respondents to complete it accurately and minimise the resources consumed within the sector. For this reason, the questionnaire tested actual adoption of only a randomly chosen sample of the current Preferred Standards, rather than the complete suite.

The questionnaire was designed to enable analysis and presentation of results in quantitative – rather than qualitative – terms. This provides the most effective management information base for further decisions on Preferred Standards and related issues within the sector.

In order to achieve these objectives and to facilitate processing of the responses, closed questions, requiring a simple yes/no or tick the box responses comprised the major component of the questionnaire.

The questionnaire was implemented as an online form[4] by the Open Learning Institute.

3.7 Target Audience

An important issue in a survey of the use of Preferred Standards is the following. Users are not generally aware of the standards involved in the applications and equipment they are using.

Consequently, the Survey addressed IT managers, as survey respondents who are most likely to be aware of the standards implied by the applications used within their institutes or organisations.

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[4] See, for example, the RTO form at
http://server.vettweb.net.au/phpesp/public/survey.php?name=PS

3.8 Survey Results

The key results are summarised below. The percentages shown without brackets are the percentages of respondents to the questionnaire. The percentages in brackets are the percentages of the total RTOs or TAFEs who were surveyed, that is, those who responded and those who did not respond.

Survey Data: Awareness of Preferred Standards

"Were you aware of the Preferred Technical Standards adopted by the Australian National Training Authority?"	Affirmative Response	
	RTOs	*TAFEs*
	20% (4.4%)	26.3% (8.6%)

Survey Data : Adoption of Preferred Standards

"To what extent have you adopted Preferred Technical Standards?"	Degree of Adoption		
		RTOs	*TAFEs*
	Extensively	2.7% (0.6%)	10.5% (3.4%)
	Moderately	12.0% (2.6%)	21.1% (6.9%)
Major standards adopted by RTOs			
JPEG (Still graphics format)			40%
AVI			14%
Major standards adopted by TAFEs			
JPEG (Still graphics format)			89.5%
Javascript 1.2			78.9%
AVI (Audio/Video Interleave)			68.4%
IMAP (Internet Message Access Protocol)			57.9%
XML 1.0 (eXtensible Markup Language)			52.6%
vCard (Address book information standard)			31.6%

Survey Data: Barriers to Adoption of Preferred Standards

Perceived Barriers and Difficulties		
	RTOs	TAFEs
Insufficient understanding of standards and their implications	45.3%	52.6%
Lack of technical resources	17.3%	21.1%
Conflict with Whole of Government standards		26.3%

Using products from different manufacturers, who use the standards, leading to difficulties with product support		21.1%
Technology with the required functionality does not conform to the standards		15.8%

3.9 Survey Conclusions

The following findings can be concluded from the survey results:

1. Awareness of the Preferred Standards is relatively low.

2. Adoption of the Preferred Standards is low.

3. The perceived benefits delivered to RTOs were insignificant and to TAFEs small.

4. Some interoperability has been achieved in TAFEs (about 10%) but virtually none in RTOs.

5. The highest area of benefits was administrative efficiency in TAFEs (21.1%).

6. The main barrier to Preferred Standards adoption has been insufficient understanding.

7. The major issue among the RTOs was the lack of information about the Preferred Standards.

3.10 The Communications Challenge

Significant resources are required to convene the Working Groups to identify standards as potential Preferred Standards for approval by the ANTA CEOs. At the completion of that process, the identification of those standards as Preferred Standards will be to no avail unless they are communicated immediately and effectively to users, ie, RTOs, as lack of information is the major hurdle to the adoption of Preferred Standards by the VET sector.

The Preferred Standards 2000 project provided a comprehensive Communication Plan to drive implementation of the Preferred Standards across VET.

Training providers have pressing priorities in providing training in an increasingly competitive market. Many of the RTOs have very limited resources and do not have the technical background to understand the Preferred Standards. Furthermore, there is continual change in personnel in the training industry and there is continual evolution of the standards themselves. In the opinion of the consultant, the resources to convey the technical information covered in the Plan, to the audience of 60 or so TAFE Institutes and 5000 RTOs, will be very large. The nomination of further Preferred Standards, some of which may not be relevant to many RTOs, adds to the magnitude of the communication task.

The goal of technical interoperability in the VET sector requires the provision of greater technical advice to staff than is currently available. It is, however, not necessary that providers understand the Preferred Standards at a deep level in order to adopt them.

The current provision of advice includes:

- the establishment of a project website that enables access to the VET Preferred Standards documentation

- introductory scenario-based documentation that guides readers through various decisions concerning standards in daily working life, and

- an "Ask a techo" online discussion list established independently by the Australian Flexible Learning Community.

The current provision of advice and support is commendable, however it is insufficient to achieve broad consideration of VET Preferred Standards and therefore has limited opportunity to contribute to the development of interoperability within the sector.

A booklet has been produced by this project, which is designed to introduce the idea of preferred standards to a non-technical audience. This will give providers a readable introduction to the subject, and, it is hoped, persuade providers to adopt Preferred Standards. But, VET Preferred Standards documentation alone cannot achieve the desired sectoral interoperability What is also needed is a way in which providers can find out whether products they are considering for purchase or installation conform to the Preferred Standards or not.

These considerations lead to the following Recommendation:

Recommendation 1.

The booklet introducing the Preferred Standards developed as part of this project, should be widely promulgated throughout the VET sector.

Recommendation 2.

A dedicated VET Preferred Standards advice service, in the form of an email address and/or a telephone number, be established through a peak VET organisation or initiative to provide daily information for VET staff on questions related to the Preferred Standards.

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4   FOCUS

4.1 Summary

The identification of Preferred Standards and their agreement via a consultative process involves considerable time and resources. The number of standards is continually increasing. Moreover, there are some areas where the activities of the VET sector will have little influence on the standards that organisations adopt.

It would be desirable to identify Preferred Standards to cover any area of need. But this may not be possible in view of the existing level of resources available in the VET sector. It may be necessary to make choices about which are the most relevant to Australian training organisation arrangements.

Each project which sets Preferred Standards should commence by identifying the priority needs of it's clients and work towards identifying possible solutions.

The final – and most important – step is to communicate the Preferred Standards back to the clients to which they correspond.

4.2 Areas of VET Influence for Standards Adoption

From the very earliest days of telecommunications the need to interconnect telegraph and telephone systems required agreement on technical standards so that worldwide communication could be achieved. As telephony became accepted and, ultimately, ubiquitous, interoperability has been further extended by many decades of standards development, refinement and adoption within the telecommunications industry, mainly involving the transmission networks and switching systems[5].

Similarly, technical standards work over the years has resulted in the development of standards that facilitate the operation of applications within the telecommunications and information technology arenas. The standards which support email illustrate the fruits of this stream of development. Most of these standards have already been taken by the VET sector and are unlikely to change within the current generation of technology.

The Preferred Standards activity is therefore competing with other influences affecting the takeup of various standards throughout the Sector. The influences acting on VET staff, apart from the standards work undertaken by the sector, include

- Industry adopted standards. Some standards, both open and closed[6], have been very widely adopted across a range of industries. Often, the range of competing standards is relatively small. VET sector Preferred Standards, selected to accommodate industry trends and ensure interoperability, usually correspond to open industry standards, which are already in use. Their adoption by users within

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[5] An example is the H.xxx series of protocols developed by the International Telecommunications Union for videoconferencing over communications networks using various transmission technologies. The H.xxx standards have been widely agreed to and adopted in most countries.

[6] i.e., proprietary standards - for instance the file structures supporting Microsoft Excel

the sector cannot, however, be credited to their promulgation as VET Preferred Standards, since users had - or would have - adopted them in any case. .

- The need for external interoperability. In the case of some applications, for example email, the range of the required interoperability goes far beyond the VET sector. As well as communicating between VET sector participants, VET staff regularly exchange emails with professional colleagues in other industries, equipment manufacturers, government departments and so on. The adoption of technical standards in these cases is therefore driven by strong forces irrespective of the standards adopted and promulgated by the VET sector.

- Whole of Government (WoG) purchasing arrangements. In many States/Territories the government has entered into particular contractual relationships with suppliers in order to achieve economies of scale in purchasing or interoperability across government agencies in that State/Territory. These arrangements often require the adoption of particular standards.

  There are two cases which apply in this situation. Both tend to decrease the benefit that can be attributed to the VET standard. These cases, which are mutually exclusive, are as follows:

  - The WoG standard coincides - wholly or partially - with the VET sector Preferred Standard. In this case the benefit to be identified should be partitioned between the two influencing sources. Observation of standards adoption indicates that the WoG influence is the stronger so that benefits should be predominantly attributed to that source.

  - The WoG standard is different to the Preferred VET standard. In this case, as mentioned above, the WoG standard is likely to prevail and the potential benefits achievable by the adoption of the VET standard will not, in fact, be realised. It cannot be discounted, however, that having well known and respected VET standards may influence WoG initiatives, either by direct VET involvement in the latter, or by the WoG purchasing managers seeking existing standards and operational guidelines to work from, or be compatible with.

- Standards implied by the purchase of applications or equipment on a local basis because it provides superior functionality or uses less resources (it costs less in terms of money, electricity, floor space, user support etc.) in the context of the specific application being considered. This equipment or software may or may not conform to VET standards.

These considerations apply in various degrees to the classes of standards considered. The degree of influence of VET Sector initiatives is estimated by the consulatant, as shown in the table below.

Standards Class	Degree of VET Influence
Network Infrastructure:	Low
Content Formats	Medium
Resource Description and Resource Discovery: Metadata	High
General Applications	Medium

Delivery Platforms and Content Packaging	High
Administration and Management	Medium

Table 1. Influence of VET Standards

In terms of its ability to affect the course of standards development, the VET sector has the most expertise and influence in its core business areas of vocational education and training and the administrative functions associated with those activities. As a result, proactive initiatives regarding the standards in these areas of activity should result in greater results, for a given degree of advocacy, than in areas where other industry forces are predominant. For example, while the VET sector has relatively little influence in the choice of telecommunications standards adopted by training institutes, it can influence the choice of digital repository standards for the storing and access of learning objects.

4.3 Moving Forward

Preferred Standards activity should therefore, as a tactical move to break the present impasse:

- give priority to communication of the existing Preferred Standards and

- focus standards development on those standards

    - where the VET sector is most likely to achieve adoption by clients and

    - which are of most benefit to clients.

4.4 Client Needs

It is important that the emerging and established standards identified for examination under this project correspond to major areas of functionality which are relevant to the needs of clients, i.e., learners and Registered Training Organisations within the VET sector. These needs are

- access to, and operation of online learning materials within the context of flexible delivery by learners

- the provision of learning by training providers – both at the training provider premises and online – within a flexible delivery framework to a population of learners with different skills, access technology and physical abilities and

- the support of administrative functions, such as enrolment management, student record transfer, and course materials exchange contracts.

The standards areas of greatest importance to the VET sector are those which respond to these needs of clients and, in addition, provide interoperability within the sector.

4.4.1 Accessibility and Equity

A particular client need of special importance under the first dot point above is accessibility to learning materials by a range of learners with different knowledge, skills and physical abilities. Accessibility to information can be determined by the impact of one or more of the following variables:

1. physical accessibility via telecommunications paths. This depends on the bandwidth available from source to destination.

2. the technical capability of the user's equipment for handling the form of the information. Elements of this capability include a matching desktop operating system, applications software, and peripheral devices

3. information in a form that matches the sensory capability and assistive technologies of the individual consuming the information. Technologies that can assist the visually impaired include text to speech translators, voice recognition for information input, tabbing to links on page, ALT labels on images.

4. information at a level of understanding to the individual using the information, such as reading level, appropriate language, cognitive ability in particular domains, for example, mathematics, language, spatial interpretation.

5. affordability of all the components above, to the particular individual and the financial viability of production on the part of the provider.

Any of these variables could be a barrier to participation by the user or provision by the institution. The range of products available from the telecommunications carriers in particular geographical areas determines the first variable. The second is to some degree under the control of the user, but affordability (the last variable) is a linked factor.

Nonetheless, awareness of the other factors, when designing a delivery system, including the standards employed, will make it easier for clients, both provider and the end user. In particular, this report will address aspects relevant to the third factor. As well as being a key delivery method for online learning in general, audio is a particularly important solution for those who are visually impaired. In addition, in the Operational Guidelines, particular attention is paid to the design of web pages to facilitate text to voice conversion by the placement of suitable text prompts to aid navigation.

An important related aspect, in view of the continuing rapid growth of the Web, and the increasing emphasis on web-based learning as a powerful solution, is the design of web pages to provide maximum usability. This aspect is the subject of Operational Guidelines suggested in this report.

The WorldWideWeb Consortium [W3C] have developed a set of guidelines through their Web Accessibility Initiative for information formatting for web accessible information. This is available at: http://www.w3.org/WAI/

In addition, much work is being done through the Human Rights and Equal Opportunity Commission and other Australian agencies to provide guidance to those with accessibility goals[7].

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[7] HREOC: - Disability rights:

http://www.hreoc.gov.au/disability_rights/standards/www_3/www_3.html

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National Clearinghouse on Education & Training for people with disabilities:

http://www.deakin.edu.au/tedca/ncet/issues_and_events/issues_and_events.html

Policies and initiatives for open standards spanning Universities, VET and Schools:

http://standards.edna.edu.au

Government Online:

http://www.govonline.gov.au

NOIE: Access, participation and skills:

http://www.govonline.gov.au/projects/access/index.htm

Educational Technology Review – Accessibility:

http://www.aace.org/pubs/etr/issue2/current.cfm

Web standards: The Web Standards Project is a grassroots coalition fighting for standards that ensure simple, affordable access to web technologies for all:

http://www.webstandards.org

Department of Finance:

http://www.finance.gov.au/accessibility.html

SOCOG: A case study by Tom Worthington about the Sydney 2000 Olympic Games:

http://www.tomw.net.au/2001/bat2001.html

Electronic Document Management and the Digital Library for E-commerce:

http://www.tomw.net.au/2001/edm.html

4.5 Determination of Most Important Needs

It would be desirable in principle to identify Preferred Standards to support all the needs for online learning curricula and providers across the VET sector. As noted, however, in Section 2.10, the resources required to do this are considerable.   If funding constraints occur, there may be cases where it is necessary to make difficult choices as to which areas of client needs to tackle first. *Attachment 2* provides one possible technique for identifying those activities where standards support is likely to provide the best value for money.   The courses, student numbers etc. used to illustrate how the method works are hypothetical and are not necessarily the actual parameters that occur in practice.

A major advantage of this approach is that clients only need to be surveyed to determine their needs. They do not need to understand or talk about standards. In the case of a hairdressing college, for example, they do not need to decide what videoconferencing standard is applicable to their business or understand what the videoconferencing standard does. They simply need state that demonstrations of, say, hair styling by specialist staff at an associated college are an important need.

Other factors not discussed in *Attachment 2* may also need to be considered in making decisions about which are the priority areas standards should support.

4.6 Determination of Solutions and Preferred Standards

In order to identify standards for consideration or updating as Preferred Standards, VET sector staff need to list possible solutions to the most important needs, e.g., videoconferencing, in the example above. These needs could be determined by the method discussed in *Attachment 2* or by some other method.

There will be, in general, several solutions to a particular need. Each solution will involve one or more standards. The solutions to the above example would include

- Video coding for low bit rate communication, using standard H.263

- Advanced video coding standard H.264.

The following paragraphs describe a method for determining the Preferred Standard to meet a given need. Because the judgements in the section that follows are semi-quantitative, it is more instructive to use a graphical presentation to compare solutions/standards.

The use of solutions/standards in a particular context will provide particular benefits (i.e., what the standards or the products that use them actually do) to the users (learners, teachers and administrators) in terms of meeting their needs.

We consider firstly the solution as it appears to a single user. In this case its usefulness primarily consists of the functionality that the solution/standard provides. It may be the fidelity with which voice is compressed and reproduced, the ease in discovering and accessing course material (learning objects in a digital repository), structuring test questions (IMS Question and Test Interoperability) and so on. The benefits derived from the functionality of the standards deployed depends on:

- the skills level of the user,

- the maintenance and support of the standard, affected by

- whether the standard is published

- the number of manufacturers supporting the standard

- the underlying infrastructure,

- the context in which the application is used and

- its relevance to Australian training organisation arrangements.

The value of the implementation of a particular standard is defined as the benefits it conveys towards meeting clients' needs, i.e., its usefulness in training delivery, less the resources used in the implementation and maintenance of the appropriate hardware and software. The resources could include:

- development time,

- hardware/software costs (likely to be less if there are a number of manufacturers supporting the standard)

- licensing fees,

- implementation time, etc.

In some cases, when comparing two solutions/standards or in assessing the value of a solution which does, or does not use a particular standard, a *saving* in resources may be achieved by adopting the solution which best conforms to VET Preferred Standards. These resource savings should be added to the benefits to determine the overall value. This is shown graphically in the following diagram..
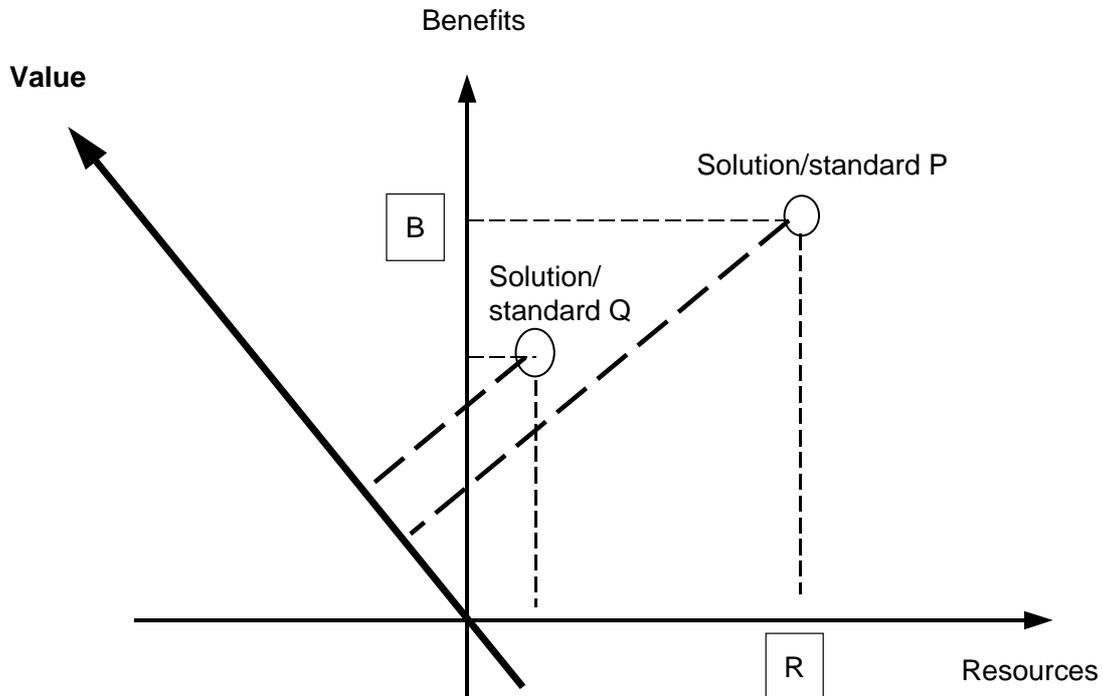
Figure 1. Value Arising from Standards Implementation

In the example shown, solution/standard P would have benefits, B, and resources, R. Its value would, however, be less than the value of Q, which has fewer benefits, but consumes considerably fewer resources.

The value as determined above applies to a stand-alone operation. But users often need to communicate with each other. The impact of technical standards on, for example videoconferencing, depends therefore, not only on the way the standard affects the localised functionality and resources of the particular item of hardware or software, but the interoperability between the user and other users or agencies using the same or different standards. In the earlier example, the interoperability using H.263 would be significantly greater if many of the clients were in remote areas with low bandwidth communications links.

Thus the overall Figure of Merit can be found by multiplying these two factors together, thus

Figure of Merit = Local Value x *Interoperability*

Thus, the overall Figure of Merit depends both on the local value of the solution/standard and its interoperability. This is appropriate since both are needed as conditions for the recommendation of the standard as a VET Preferred Standard: Clearly, the recommendation of a standard which results in zero or even negative value for the user would be resisted by the VET community. Similarly, since the Preferred Standards are intended to promote interoperability within the sector, it is pointless to recommend a standard which has no interoperability.

The Figure of Merit can be visualised as the area of the rectangle in the following figure.
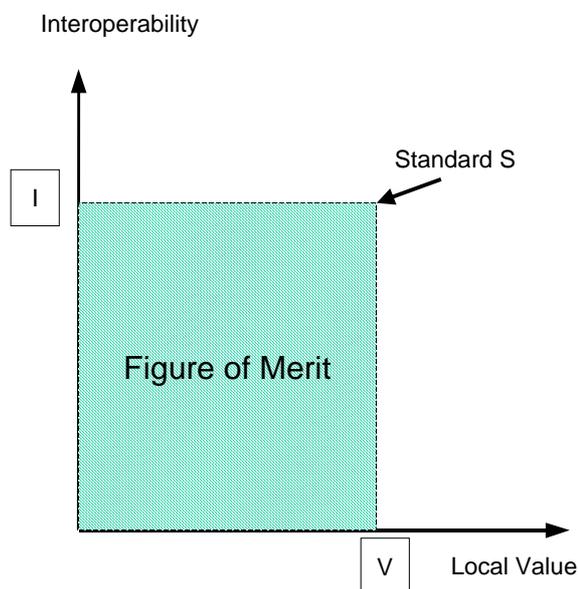
Figure 2. Effect of Standards Value and Interoperability. In this case solution/standard S has value V and Interoperability I.

When competing standards are being considered for recommendation, the Preferred Standard would be that with the higher Figure of Merit.

In practice it is not possible to accurately quantify the parameters discussed above. The analytical framework is therefore to be regarded as a conceptual framework or a semi-qualitative approach to guide and structure the Working Groups' discussion of the impact of solutions and associated standards on particular needs. It provides, as shown above, a mechanism for comparing the impact of different solutions/standards in meeting the same need, or the same solution/standard on different needs.

The framework will usually be used this way to allow relative judgements to be made.

4.7 Conclusion

In order to make the Preferred Standards process effective and efficient it is necessary to focus activities on what matters most and where results can realistically be achieved. This is particularly relevant if funds are limited. The following Recommendations action this point.

Recommendation 3.

In order to make best use of the resources available, Preferred Standards development should focus on areas primarily related to flexible learning.

Recommendation 4.

Future Preferred Standards projects should determine, and respond to, the most important flexible learning needs of VET clients.

Recommendation 5.

Preferred Standards should be selected which support flexible learning solutions that provide the best educational value for money for clients, and maximise interoperability.

5 PROOF OF CONCEPT (PoC)

5.1 Summary

This chapter describes the results of three exercises to determine the effectiveness of the VET standards activity for increasing value and interoperability in the sector. Preferred Standards are particularly valuable when they reduce the expenditure associated with large capital items such as Learning Management Systems

5.2 The Concept

There is not a great deal to be learnt by testing the technical interoperability of standards as such, since their purpose is to achieve interoperability. Most interoperate without problems. However, there are sometimes incompatibilities between different items of hardware and software due to inadequate implementation of the technical standards. Progress in standards harmonisation involves addressing these issues and undertaking further developments of the standards accordingly. This development is usually undertaken outside the reach of the VET sector.

This Proof of Concept (PoC) exercise is intended to provide maximum value to the sector by giving information that is relevant to, and assists, the ongoing management of standards activity within the sector.

The concept to be tested is, therefore, the effectiveness of the VET Preferred Standards activities in achieving value for the sector. In this context, the baseline should be seen as the level of standards take-up and realisation of overall beneficial impacts that would occur in the absence of active intervention by the VET sector. This base is driven by the need for interoperability that participants in the sector need, and would achieve, as part of their normal functional responsibilities, were they not influenced by VET standards activities.

5.3 Proof Criteria

The concept to be tested, as mentioned in the preceding section, is the degree to which benefits have been or will be realised by the identification and application of Preferred Standards to the VET sector. The benefits to be identified are the total benefits less any benefits that would have been obtained via the external influences above.

While the proof criteria as applied to the PoC exercises do not take account of future possible developments, standards activities within the sector would be particularly valuable in the following cases:

- The standard which the VET sector identifies as a Preferred Standard is one of a number of competing standards which, because of the functionality it provides and/or the interoperability it supports, subsequently becomes the dominant standard within the wider industry. This outcome would position Australian producers to rapidly gain share in the international market for training products using the standards to which they are working.

- Subsequent development of the standard greatly enhances the functionality and/or interoperability that the Preferred Standard provides.

5.4 Identification of Projects

It is necessary to discover those projects, past, current or planned, where advantages - in terms of increased value to the VET sector - of using Preferred Standards can be determined. The standards classes chosen were generally those where the VET sector has influence. The choice of projects selected determined the actual standards for examination.

In order to discover suitable projects, contacts were undertaken with expert personnel in the sector.

5.5 Proof of Concept Projects

Areas for examination in terms of Proof of Concept are described in the following sections. The methodologies used for each exercise are given in *Attachment 3.*

5.5.1 The Impact of Standards on the Efficacy of Toolboxes.

A Proof of Concept exercise was conducted examining standards implementation within the Toolbox initiative. This initiative makes a useful case study, as the earliest Toolbox products were developed without the expectations of standards compliance that became mandatory for the later series.

The Series 1 Toolboxes were developed in experimental mode as a demonstration of the power of the Web as an instructional medium. The guidelines for development were not prescriptive on standards and platform issues. As a consequence, various authoring tools, teaching/learning tools and learning platforms were used. In many cases this resulted in the learning content being linked with particular learning management systems, which limited their usefulness for many VET providers. A thorough evaluation was conducted during development which provided many useful pointers for the future.

For the Series 2 Toolboxes, more precise technical guidelines were provided, and adherence to the 1999 Preferred Standards was recommended. Separation of the content from the learning management system was achieved and a greater degree of learner interactivity was provided. A small number of anomalous products were developed, however, in this first effort to apply consistent standards. More rigorous testing processes adopted following Series 2, now prevent such products being released.

Two series 2 Toolboxes were selected for comparison -the Administration Toolbox 201 and the Frontline Management Toolbox 203. The Administration Toolbox adheres to the standards. The web content of both Toolboxes is consistent with guidelines at least in so far as being able to run on any web server, because it used no server-specific file types and no server-based programming. This is a natural result of the Toolbox Guidelines, since the Toolbox guidelines specify that web content may be run from any server or from a CD-ROM or hard disk.

The Frontline Management toolbox includes 5 roles comprising:

- RTO

- Coordinator

- Coach

- Participant and

- Assessor

These roles are implemented by the installation of five .exe files on the PCs of personnel undertaking the roles concerned. Installation is done under a Quick Start guide provided with the Toolbox.

Both Windows and Macintosh machines are cited as Preferred Standards. Accordingly, the toolbox should be able to be used with both machines. But the .exe files cannot be installed on a Macintosh machine and so it would not be possible to use this toolbox among Macintosh users. This limitation comprises a reduction in interoperability.

There is clearly, an overwhelming preponderance of Windows machines employed within the VET sector. Data from Western Australia indicates that in that state the proportion of Macintosh users is about 1%[8]. It is noted that the sample is variable so that the Macintosh usage figure could be too low. In TAFE SA the Whole of Government computer policy means that all PCs are Windows-based. Exceptions can be granted where staff (and students) are engaged in high-end graphics/multi media production. The Toolbox Champion in that State has observed no evidence of Macintosh users in RTOs[9]

Assume, conservatively, that the proportion of Macintosh users in the VET sector is 2% but that all RTOs use Windows PCs. This would mean that in a typical class, removal of the files would enable the remaining 2% or so of users to assume the participant role. It seems that the removal of the roles files would not significantly reduce the learning benefits of the main web-based material. On the other hand, there would be a significant saving of resources by avoiding

- the significant time to install the .exe files, which is entirely lost effort for Macintosh users and

- the additional administrative effort involved in managing non-uniform resources across the class.

The initiative of removing these files to make the Toolbox standards compliant would therefore create additional local value, which could be represented diagrammatically as shown.

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[8] D. Appleby, *Browser Statistics,* WebBoard Posting, 13 May, 2003.

[9] D. Purcell, *RE: Desktop computers - Windows or Mac?,* WebBoard Posting, 14 May, 2003
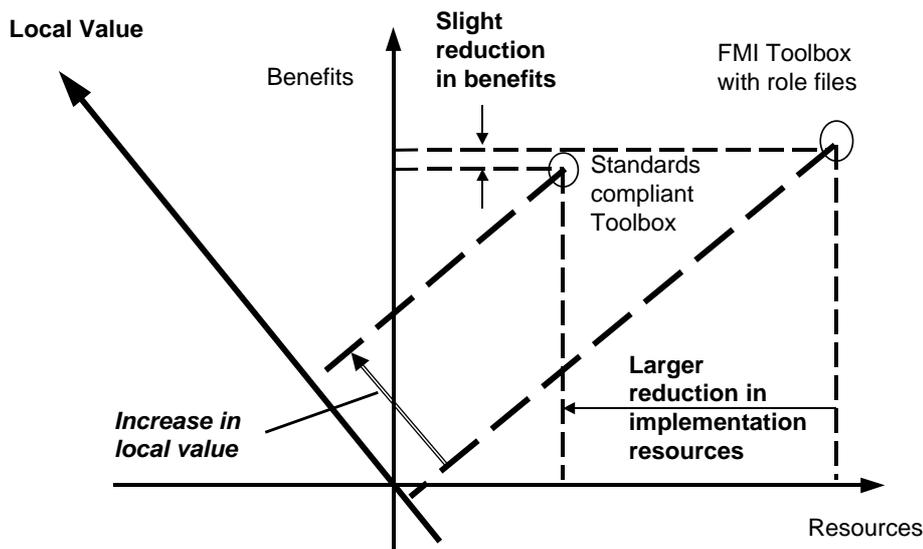
Figure 3. Increase in Value by making the Toolbox Standards Compliant

In addition, a standards-compliant solution would increase interoperability at an average rate somewhat less than 2% per user. It therefore has a higher Figure of Merit.

Compliance of this Toolbox solution to the Preferred Standards would therefore be of overall benefit to the sector.

5.5.2 The Business Advantages of Compliance of Educational Content with the Sharable Content Object Reference Model (SCORM).

5.5.2.1 Concept

The Concept in this case comprises the savings in ICT capital investment and operational expenses that would accrue from a mandate that content be SCORM-compliant.

5.5.2.2 SCORM

SCORM is discussed in detail in *Attachment 4.* Evolving aspects are covered later in the Watching Brief. Briefly, SCORM supports the communication of information concerning learners enrolled in particular courses and specific content objects.

SCORM-compliant publishing software reduces or eliminates the need for browser plug-ins or special clients for the learner to install, and thus reduces the overhead costs of ICT support.

The exercise is not intended to - and does not - prove that SCORM is superior to other Preferred Standards in the same class. In fact, the pedagogical culture for which SCORM was developed, may not be totally appropriate for the VET Sector. An example would be the strong reliance on assessment inherent in the standard.

Future projects should analyse the degree to which SCORM is applicable to the pedagogical models used in VET.

5.5.2.3 PoC Exercise

The experience of QR (formerly called Queensland Rail) was monitored as a case study. QR wanted to focus on good course design without technology impediments in terms of specialist programming. They are migrating from the production and acceptance of content in AICC (Aviation Industry Computer Based Training Committee) format to SCORM in order to allow technical interfacing to their Learning Management System in the most efficient manner possible.

The production and delivery of appropriate documentation will support the participation of content providers in this initiative. QR intend to implement SCORM compliance via two processes. In the case of content developers who are unaware of the tools available, or for whom Queensland Rail is developing the content, the Web-based publishing tool, Publisher, will be used to provide SCORM-compliant material. In the case of other external content providers, the choice of publishing tool will be left to the provider, providing the output is SCORM-compliant.

Background

QR implemented the Saba Learning Management System (LMS) between Nov 2001 and May 2002. The objective was to centralise and streamline the training administration function and to better manage and understand the metrics associated with training in QR, such as the cost of training and resources.

When a learner on the LMS launches SCORM-compliant content, the LMS passes information to the content about the learner, such as profile and preference information and information about any bookmarks the learner might have set during previous visits to the content. When the learner completes a learning session, the content passes results information back to the LMS. For tests, this information can also include the learner response, result, time spent, and relative weighting for every question on the test. The LMS stores this information in the database and provides view access to learners and their managers[10].

QR Objectives

QR is mandating SCORM compliance in order to allow more efficient online course registration and content administration.

The content capability supported by the use of the SCORM specifications is the creation of records of course fulfilment by staff at QR. This is necessary to ensure that the requirements for staff educational attainment are met and to facilitate career planning within the organisation. The LMS consolidates information on the learners and the courses they are undertaking, the results achieved and the range of products available.

Since the implementation of the Saba LMS in May 2002, QR has used one outsourced content vendor for a series of pilot courses: the courseware was developed in compliance with AICC due to the original Saba 3.3.1 LMS not supporting SCORM. It is planned to seek quotations for additional content packages from 3 external vendors. QR expect to be online in 2-3 months with products utilising SCORM.

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[10] Saba 3.4 Content Administrator Guide p 4.19

Scope of Exercise

The exercise comprises creation of SCORM-compliant content and testing its interoperability with the LMS.

The resource savings through the use of SCORM-compliant content are estimated.

SCORM Operation

At the end of an online course the results are sent back to the LMS, identifying the score and pass/fail etc. AICC had a large number of data elements that were captured as part of the metadata schema. AICC metadata files held the basic data fields (up to 8 files for each course depending on implementation) to inform the LMS. The Saba LMS utilised 4 metadata files for AICC which describe the course, the launch file, courseID, mastery score etc. LMS registration required pointing to these files for each course; changes required pointing to those files again.

SCORM, however, is implemented in a different manner and has a subset of the AICC data elements. This is one of the reasons why SCORM runs faster than AICC in returning results back to the LMS. SCORM is implemented using an XML data interface; the file is called imsmanifest.xml and is produced when the course is published in to a SCORM-compliant format using the relevant publishing tools.

With SCORM, the content management section of the LMS just points to a single zip file which contains the course files including the imsmanifest.xml file.

The physical architecture for the utilisation of SCORM-compliant content is described in *Attachment 5.*

QR Case Study Findings

The results of the Proof of Concept exercise are described in the paragraphs below. The benefits include:

- Publishing as SCORM-compliant has not been difficult and content is easy to create when using publishing tools that support SCORM.

- SCORM provides better content management than the prior AICC standard. Content is published as a stand-alone package with metadata. The AICC metadata is created based on the overall course detail, not at an individual module level.

- The Saba 3.4.1 LMS, which QR is currently testing and implementing, effectively manages the interaction with SCORM content. Testing has proven successful and more efficient than AICC. It is believed that this efficiency is a result of the smaller set of data passed back to the LMS in SCORM than AICC. Registration and maintenance are also easier and less time consuming with SCORM than AICC as one does not need to make reference to each of the metadata files that AICC requires.

- Communication between these content packages and the LMS is faster and easier to implement than in the case of AICC-compliant content. In particular, SCORM-compliant content can be ported from one LMS to another, resulting in interoperability of systems for sharing content.

- QR was able to use off-the-shelf tools, costing in the range $2500 to $4000. The development environment is 'what you see is what you get', rather than direct coding such as XML or HTML and is easy for the content creator to use.

- Standards compliance may also reduce the cost of content development since it widens the market open to the compliant content. Vendors believe that funding in VET for custom solutions is inadequate. Therefore, in the absence of economies of scale through the application of this standard, development efforts will be focussed on corporate training system clients.

- Experience in the industry also shows that adopting SCORM-compliant systems will be less expensive than, for example, the creation of a Java application to provide content.

Some of the aspects which can increase the resources required for SCORM compliance are as follows:

- While there are a number of content developers both in Brisbane and Sydney that have been producing SCORM-compliant content for some time, some content vendors are reluctant to conform due to their lack of knowledge of SCORM and related publishing standards. These companies generally see compliance as requiring an investment in reskilling their staff and in technical development. So one must ensure that the vendor has experience in implementing the standards and is not charging additional costs for compliance.

- Multimedia companies want to provide content but do not have the instructional design or education background; others with education and instructional design backgrounds develop more instructionally sound e-learning products. There is a need to establish quality of e-learning standards.

- Use of learner tracking capability and sharing of that information outside the home institution raises issues of privacy and data security.

5.5.2.4 Analysis

An LMS represents a considerable investment which may range up to $1M. The software may have residual bugs since the market is only just now maturing. The time to install and implement is high and local support is generally not available. Pilot installation and a 3-month testing period are requied. It is necessary to determine the most suitable vendor, based on support, flexibility of product, cost and functionality. Many companies choose an LMS, like other software packages, based on a risk minimisation approach. This often ends up in a product being selected that is expensive, sourced from overseas and does not meet the specific functional needs of the business.

SCORM allows good feedback allowing tracking of results and determination of demographics. It thus provides a significant increase in the effectiveness of a large capital investment.

Content production to the AICC standard is significantly more costly than SCORM. The contrast between the low resources necessary for a competent content vendor to provide SCORM-compliant content, and the considerable saving in resources achieved by avoiding modification of the LMS, means that significant local value is created by mandating SCORM compliance.
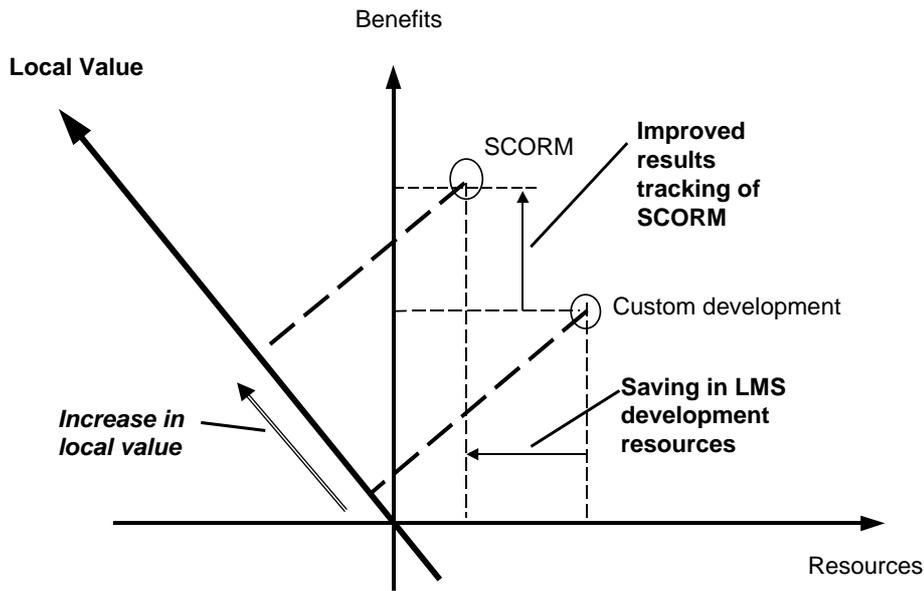
Figure 4. Increase in Local Value due to SCORM Compliance

The increased interoperability further increases the Figure of Merit for SCORM compliance, as shown in Figure 5.
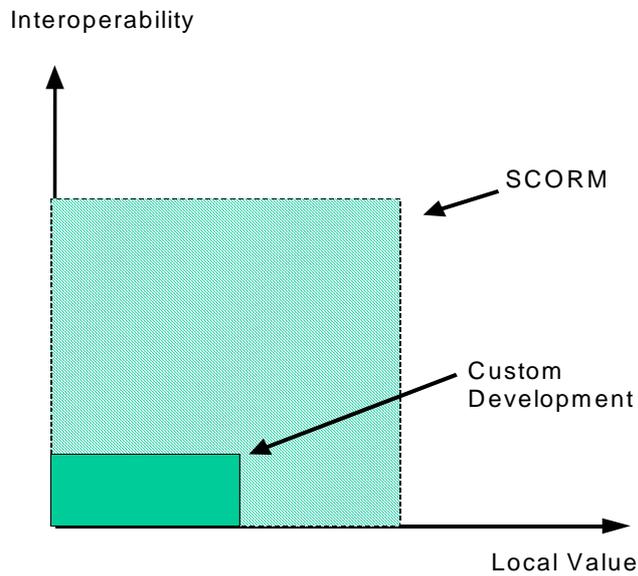
Figure 5. Increased Figure of Merit for SCORM Compliance

The increased Figure of Merit resulting from mandating SCORM-compliant content, as shown in Figure 5, proves the concept of recommending Preferred Standards in this case.

5.5.3 Alignment of VET Preferred Standards with Whole of Government Standards

Alignment of VET and Whole of Government standards was discussed in Section 3.2. Those standards that are congruent would lend support for further compliance in the VET organisations. Those that are in conflict will require alternative approaches or, at minimum, an acknowledgment and awareness of the differences when attempting cross state/territory and, perhaps, international projects.

However, as discussed earlier, it is more likely that when tools are specifically for education and training, the cross border cooperation for standards implementation would not be in conflict with State WoG concerns. This is illustrated in the diagram below.

Potential Conflict/Overlap*

State WoG Standards

VET Specific Standards

Other Govt Dept Standards

Opportunity for Cross Border Cooperation**
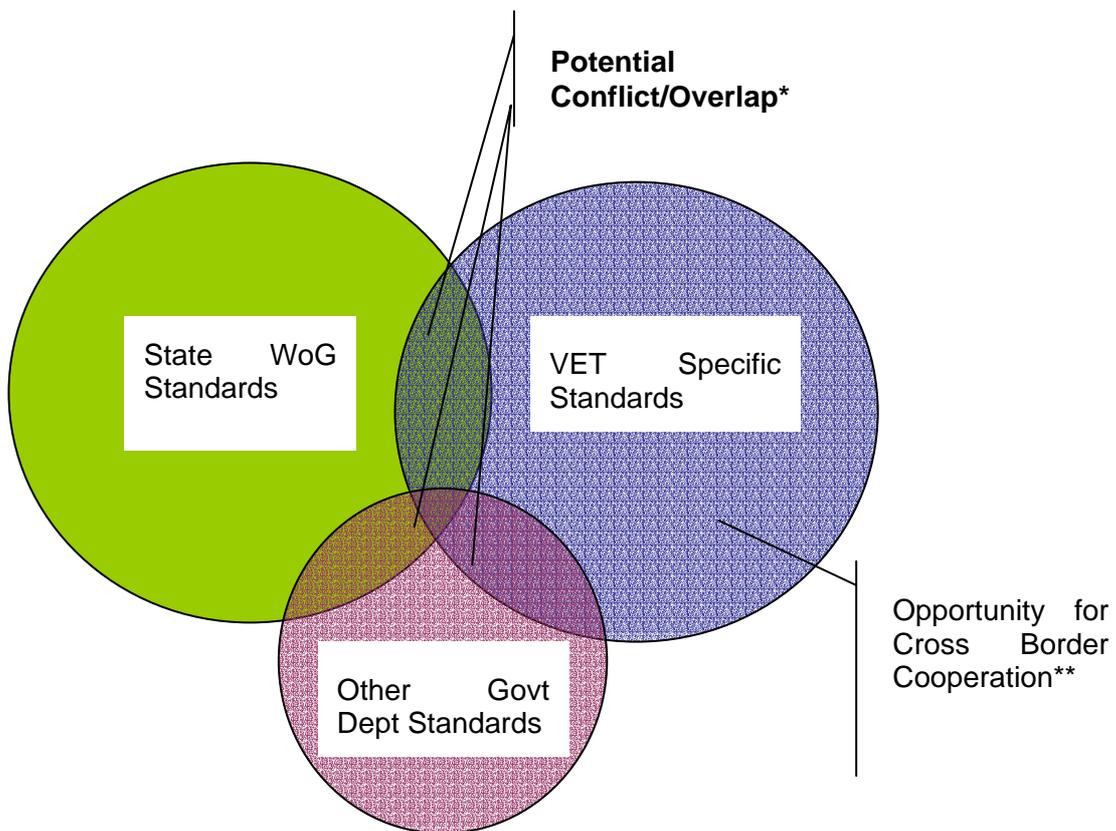
 * Word processing and other desktop software, desktop hardware, communications systems [telephones, computer networks, electronic mail], integrated administration systems such as financial reporting.

** Learning management systems, library management systems, education specific tracking and record keeping systems.

Figure 6. Areas of Standards Overlap

Nonetheless, a great deal of variation occurs across the States/Territories. For example, a Whole of Government review in Queensland requires departments to

implement a platform which is not SCORM-compliant. On the other hand, DET NSW required international standards compliance when seeking tenders for their LMS.

In this section we provide detail supporting the figure above for a sample of States and Territories.

5.5.3.1 South Australia

The South Australian Government develops and maintains policies and standards for information and communication services (ICS). These ICS policies and standards are designed to assist the achievement of the government's strategic directions for ICS at the whole-of-government level. The Strategy and Standards Service Group is responsible for:

- whole-of-government strategic planning for the application of ICS across government, including the development and maintenance of the whole-of-government ICS strategic plan, ICS Directions.

- the development, maintenance, and promulgation of ICS Policies, Standards and Notifications for South Australian Government agencies.

At the higher applications level, the SA Government mandates the use of proprietary products for office functions. The VET Preferred Standards are silent in this area. The following table shows the degree to which the SA government standards align with the Preferred Standards.

Standards Classification	SA WoG products/standards which conform to the Preferred Standards	SA WoG products/standards which do not coincide with the Preferred Standards
Network Infrastructure		TCP/IP, SNMP Novell Netware v4.11
Content Formats		
Resource Description and Discovery	SMTP, X.500	Oracle 7 Server, X.400
Delivery Platforms and Content Packaging		
General Applications		Microsoft Exchange Server
Administration and Management		Windows 2000 Professional MS Office 2000

Table 2. Alignment of SA Government WoG Standards.

In addition the SA Government recommend the adoption of other applications including financial administration and human resource systems, anti-virus software and security services which do not fall within the ambit of the Preferred Standards.

5.5.3.1.1 Victoria

The Victorian Government leverages off the Commonwealth Department of Finance and Administration (DoFA) endorsed supplier standards[11] –specifically for ICT.

In the important messaging domain, Lotus Notes is the software standard that has been strategically adopted within Victorian Government for email, workflow, diary/calendar and Internet publishing purposes. It is currently deployed on over 28,000 desktops across the different Victorian Government agencies.

Alignment with the Preferred Standards is shown in the following table.

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[11] "The Endorsed Supplier Arrangement is a Commonwealth government scheme to provide business with formal recognition that they conform to required standards to supply to the Commonwealth departments and agencies. The Victorian Government Purchasing Board and the Commonwealth Department of Finance and Administration have agreed that Victorian departments and agencies are able to take advantage of the benefits of the ESA

The Commonwealth Government has also expanded the ESA to include other product categories, but Victorian government departments and agencies will be restricted to IT hardware, software, services, and telecommunications

To be granted endorsed supplier status companies must satisfy all of the following criteria:

- compliance with IT standards

- financial viability

- industry development requirements.

Endorsed supplier status can be revoked at any time if companies fail to meet their ongoing obligations. Only those companies who continue to meet the high standards of endorsement retain their endorsed supplier status. Endorsed supplier status is ongoing and may be reviewed at any time through a random or targeted review process."

Standards Classification	WoVG products/standards which conform to the Preferred Standards	WoVG products/standards which do not coincide with the Preferred Standards
Content Formats		
Resource Description and Discovery	SMTP, X.500	
Delivery Platforms and Content Packaging		H320 Circuit Switched Videoconferencing
General Applications		Lotus Notes Citrix Microsoft Exchange Server
Administration and Management		Windows 2000 Professional MS Office 2000

Table 3. Alignment of Victorian Government Standards and VET Preferred Standards.

5.5.3.1.2 NSW

Standards in general seem to be limited to:

- Business Systems

- Agreed Supplier Lists (e.g. telecommunications services)

- Encryption & Authentication

- Web Presence Production standards

Standards Classification	WoNSWG products/standards which conform to the Preferred Standards	WoNSWG products/standards which do not coincide with the Preferred Standards
Network Infrastructure	Joint network for Health and Education	
Content Formats		
Resource Description and Discovery	SMTP, X.500	
Delivery Platforms and Content Packaging		
General Applications		Microsoft Exchange Server
Administration and Management		Microsoft Desktop Applications
Authentication	"Agencies adopting authentication are to use PKC complying with the X.509 version 3 recommendation. Hashing and encryption algorithms are also to comply with national or international standards. Agencies are not to create their own extensions to X.509 certificates."	

Table 4. Alignment of NSW WoG Standards

It can be seen from the tables above that the main areas where WoG standards tend to apply are

- network infrastructure

- office and administrative systems.

There would therefore seem to be – in general – a lack of encroachment of WoG standards in areas of technology concerned with pedagogical applications. This would constitute a degree of Proof of Concept for VET Preferred Standards which

cover the core activities of the education industry, in the sense that the sector has a degree of autonomy in this area.

5.6 Conclusion

There are countervailing and possibly more coercive factors influencing the adoption by clients of the Preferred Standards. The Proof of Concept exercises demonstrate, however, that the Standards provide benefits in areas – particularly online learning – where the VET sector has influence.

6 WATCHING BRIEF

6.1 Summary

This chapter identifies standards whose evolution or emergence is significant for the VET sector. The standards are selected from those areas where VET sector Preferred Standards activity can make a difference. Some of them are included in the Preferred Standards identified in the 2000 project. This material describing the new or evolving standards is intended as resource material for the next round of the process of setting Preferred Standards.

This chapter also provides Operating Guidelines for web page design and standards for deletion from the current list of Preferred Standards.

6.2 Candidate Standards

The Watching Brief considers both evolving and emerging standards. The aim is to alert the Sector to opportunities that are relevant to the activities of the Sector or exploit the functionality that these new and evolving standards will provide. Particular candidate standards for consideration in the Watching Brief can be sought from the following sources:

- The current Preferred Standards approved as a result of the 2000 Preferred Standards project, which updates the 1998 Preferred Standards process.

- The standards areas identified by respondents to the 2000 Preferred Standards survey. Particular standards are listed in *Attachment 6.*

- Technology and communications needs cited in the Search Conferences conducted in the course of the Clicks on Bricks project. The Clicks on Bricks project conducted a series of Search Conferences across the States/Territories. In the course of this project the emerging trend of the provision of wireless connectivity within campuses and within classrooms was identified. Wireless provides flexibility in meeting changing physical arrangements of teachers, learners and teaching/learning equipment and infrared technology is a cost-effective solution to eliminate some of the cabling required for PC connection.

  The study also cited standards – arising from the traditional telecommunications carrier industry – which should be avoided because of the cost of the equipment necessary to implement them.

- Communications needs mentioned by participants in the States/Territories workshops as part of the recent Access to Bandwidth for Connectivity project. In the course of the workshops conducted during this project, the need to have effective connectivity to casual staff was raised as an issue of importance. The achievement of this flexible, mobile connectivity could involve the adoption of standards for mobile communications and Portable Digital Assistants (PDAs), including web browsers installed in handheld devices.

- Standards identified by members of the project Steering Committee:

  - H264 - broadcast quality video

  - IMS Digital Repositories Specification - sharing of learning objects

- MIDI (Musical Instrument Device Interface) - useful for learning about music technology and composition, learning about instrument tuning, and delivery of samples over the Internet with very small file sizes

- XMF (eXtensible Music Format)

- AS 5044-2002 (AGLS Metadata) - Australian Standard

- MPEG 7 - descriptive data for multimedia clips

- DOM (Document Object Model) - interface for updating structure and content of HTML

- DTD (Document Type Definition) - XML representation of document structures, e.g. lists, sections, headings

- EMMA (Extensible MultiModal Annotation), and SALT (Speech Application Language Tags) - integration of speech recognition and synthesis technologies with web technologies

- The 3rd Generation Partnership Project standards for transferring multimedia data over cellular networks. The standards include

- file format: 3gp

- audio codecs: AMR (Adaptive Multi Rate) for voice and MPEG-4 AAC for music

- video codecs: selected profiles of H.263 and MPEG-4 Video

- text formats: XHTML mobile profile and 3gp Timed Text

- still image formats: selected profiles of DCT, GIF, PNG, and SVG

- midi format for synthetic music

- Areas of emerging communications and standards development identified by members of the project team. Among the emerging technology areas standards based on XML and applications supported by the TCP/IP protocol are likely to increase in importance.

- A member of the team visited the 2003 ITU Telecom conference and monitored equipment trends in order to identify emerging standards. He identified mobile communication protocols and voice equivalents to text data protocols Voice eXtensible Markup Language (VXML), cf. XML, as emerging standards for consideration.

6.3 Selection of Standards for Monitoring

Ideally, the selection of standards for monitoring would be based on the review of the needs of clients. In the absence of such a review, the consultant has selected standards where the VET sector has influence and which appear relevant to a wide range of courses.

	Functional Factors					
Activities	**Presentation**	**User Access**	**Exchange**	**Version Control**	**Production**	**Security**
Course Inquiry	XML	XHTML	XHTML, Metadata	Metadata	Open Source File Formats, XML	XML
Course Enrolment & Payment		Metadata	Metadata	Metadata		
Course Delivery						
Text		Metadata	Metadata, RSS, OAI,	Metadata, RSS,	Open Source File Formats,	
Audio	ITU G series (These recommendations define the standards adopted worldwide for transmitting audio and visual and multimedia.)					
Assessment	SCORM, IMS Question and Test Interoperability Specification					

Table 5. Standards Addressed by Watching Brief

These standards are discussed below in the approximate order in which they appear in Table 5.

6.3.1 XML

The overall use of XML as the basis for open source learning and administrative documents, based on standard templates incorporating international formats where appropriate. These would include the relevant IMS Specifications and would cover the following application areas:

6.3.1.1 Course Delivery

Text

- Use of XML-related tools to standardise the capture storage, indexing and presentation of text course content

Collaborative Working

- Within the overall context of the work of ISO/IEC JTC1 SC36 WG2, use of XML-related tools to support group working and to encourage evenness of contribution across syndicates

Course Component Interchange

- Use of XML-related tools to standardise course module definitions, content, assessment, etc to assist the selection of course components from diverse faculties and institutions

6.3.1.2 Student Coursework

Structured Text Response

- Use of XML-related tools to allow students to generate assignment work in standard structures –semi-automatic assessment, filing, checks for plagiarism, etc

Multi-media structures

- Use of standard tools, templates and structures to store, classify and assess multi-media presentations

- Use of Voice XML interactive response for standard voiced based interaction

6.3.1.3 Student Authentication

- Use of standards for physical identity and assessment authentication (e.g. digital signatures). XML signatures are still in the development phase[12] but will provide authentication of the sender of XML documents. This would be particularly appropriate in the submission of documents in courses involving business studies. Such documents would typically comprise answers to test questions, project reports and assessments by teachers.

6.3.2 XHTML

XHTML is designed to bring the benefits of extensibility and machine readability to HTML. However, XHTML is not yet completely supported by browsers. Because of the efficiency and flexibility advantages of editing web pages that use XHTML, the development of browsers, *vis-à-vis* their capabilities to utilise the more advanced features of XHTML, should be monitored.

6.3.3 Using Metadata Standards

Much work has been done in VET on metadata standards. Dublin Core (DC), Sharable Content Object Reference Model (SCORM), Open Archives Initiative (OAI) and Resource Discovery Framework (RDF) are approaches to supporting interoperability of access to electronic information. Some are still in pilot stages, but are quickly being implemented as the need for quality information exchange is increasing. The following paragraphs discuss current aspects of the most important standards

6.3.3.1 Dublin Core (DC)

The use of descriptive frameworks for learning objects or any electronic resource is one that is evolving. The main standard is Dublin Core (DC). In the Australian

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[12] Preferred Standards Project 2000, *Web Protocols, P5.*

context, the metadata schema developed for EdNA Online has led the way to implement the DC metadata schema in the education sector, specifically to describe electronic information. A summary of the status of Dublin Core is given in *Attachment 7.*

6.3.3.2 IMS Learning Resource Metadata

Another standard that is developing is the IMS Learning Resources Metadata Specification, originating in the United States and since expanded internationally, which adds education functionality to its descriptions of learning objects specifically for distributed learning. This framework is expected to be built into commercial learning management systems. The question for the Australian education sector is how, when and if these two will be complementary in application or whether one will take the higher position over the other.

6.3.3.3 RDF Site Summary (RSS)

The acronym RSS is used to refer to several nomenclatures for this standard, viz. RDF Site Summary, Rich Site Summary and Really Simple Syndication.

RSS is a method for:

- syndicating content from dispersed web sources

- checking content for change before re-presenting, as in breaking news and new versions of information.

A summary of this standard is given in *Attachment 8*.

6.3.3.4 Open Archives Initiative (OAI)

OAI is of particular importance for linking together or feeding [exchange] between, for example, the EdNA Online database and State collections of metadata records. It and is therefore relevant to the information repository layer, see *Attachment 9.*

6.3.4 SCORM

SCORM has been developed from other approaches[13], including:

- Delivery platforms

- IMS Content Packaging specification, IMS Content Management, Information and Content Exchange (ICE)[14]. The IMS standards are very flexible, and as a result, may not interoperate between different users. SCORM selects and provides an interpretation of these specifications to achieve interoperability.

ICE is primarily used in business e-commerce applications for content syndication and provision of that information to subscribers. ICE is an XML-based protocol for controlling information access and distribution.

13

   http://www.thelearningfederation.edu.au/repo/cms2/tlf/published/3788/docs/archive/interop. ppt

[14] http://www.icestandard.org/

Given the evolution of IMS, ARIADNE, AICC and IEEE into SCORM as the umbrella, the distinctions among Learning Object interoperability standards have been greatly reduced. This rationalisation now provides for more certainty when implementing a SCORM-compliant system.

It appears through information from each of the contributing manufacturers that compromise and coordination is proceeding to make SCORM release 1.3 the framework for management and content systems in the foreseeable future.

The Proof of Concept exercise explores the benefits of adopting SCORM. The status of the SCORM specifications is given in *Attachment 4.*

6.3.5 IMS Question and Test Interoperability

The IMS Question & Test Interoperability (QTI) specification[15] describes a basic structure for the representation of question (item) and test (assessment) data and their corresponding results reports. It enables the exchange of item, assessment and results data between Learning Management Systems, and content authors.

The IMS QTI specification is defined in XML to promote the widest possible adoption. It is extensible and customisable to permit immediate adoption, even in specialised or proprietary systems. The IMS QTI specification, like all IMS specifications, does not limit product designs by specifying user interfaces or pedagogical paradigms, or by establishing technology or policies that constrain innovation, interoperability or reuse.

6.3.6 Open Source File Formats

Open source software reads and writes data in file formats which are, by the very nature of the software, formats which resemble "open standards". While the file formats may not have been developed by a traditional standards body, they are nonetheless, typically, well documented and amenable to influence by anyone who chooses to contribute. In contrast, a proprietary file format, for example, a word processor or spreadsheet format, may be secret, may not be documented in a way which is suitable for writing software to handle it and is certainly not amenable to change by parties outside the company which originated it.

The use of open-source file formats has benefits which are distinguishable from the use of open-source software packages, such as a word processor, spreadsheet program etc. Even if no such software is used, the documented nature of the file format enables programs to be written which read and write data according to the format. This has advantages in an isolated instance, because there is no need to do the work and entail the technical risks of devising a file format.

Further advantages arise from the fact that data in open source file formats can be exchanged with people and organisations who use software which supports this file format - both software they may have written themselves and software from a potentially wide range of sources.

The task of writing software to use the format is also greatly aided by the availability of open-source software which already performs these functions. This can be used either as an example of how to read and write the file. Segments of the code (lines

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[15] http://www.imsglobal.org/question/qtiv1p2/imsqti_oviewv1p2.html

of human written computer programming) itself can be used and adapted freely as desired. (The only restriction is that if the resulting software is published in any way - used outside the particular institution which incorporated the open source code - that the source code for the entire program should be made available under the same open source copyright license.)

Proprietary software vendors may be - and often are - strongly motivated to inhibit or prevent any other company or person from writing software which reads or writes files which work with their programs. No such motivation exists with open-source software, and it would be legally and technically impossible to impose such restrictions even if there was a motivation. Open source file formats provide fundamental interoperability benefits because software from any number of sources can be used with such files and open source software can, in principle and with significant effort, be adapted to provide special functionality as required.

In some important fields such as word processing, proprietary systems have gained ubiquitous acceptance before the development of open source equivalents. As long as the use of open source software remains low, this presents a significant interoperability problem for any organisation which wishes to adopt open source file formats or open source software. However, these difficulties are purely dependent on the relative popularity of proprietary vs. open source software and are not inherent in open source file formats or software themselves. Open source software has long been widely used in servers and is gaining acceptance on desktop computers.

6.3.7 Specifying file formats as Preferred Standards

The adoption of particular file formats comes within the scope of Preferred Standards.

This section discusses potential problems in specifying the technical requirements of file formats - or more broadly, specifying compatibility with particular complex software environments which are significant to the VET sector. One problem is the diffuse nature of the actual technical documentation which effectively constitutes the standard.

There may be instances where there is no formal document which specifies the file format, or where there is no single, easily identifiable set of technical documents which specifies how a body of data can be functionally compliant with a particular set of software. It might, for example be advantageous to specify that all web material, including static files, server-side programming and database files, be compatible with both the typical Windows-based server arrangements and those of open source web server, including their language interpreters and operating systems. There is, however, no single document, or group of documents, which formally specifies every aspect (e.g., the use of backslashes in URLs and directory names for web material) of what is required for either platform.

This is an example of an interoperability requirement which is important for VET sector web based material. A great deal of effort may be required convert a large educational resource which was developed on, and works correctly, on a Windows server, in order to ensure that it will operate correctly in non-Windows environments. The range of technical requirements for compatibility with one environment or the other is very broad.

In order to succinctly specify compatibility with a complex environment of the web server, file system and server-side programming aspects of Windows, Macintosh or Linux/Unix computer systems, it may be necessary to simply state as much, referring

to the systems by name. No documents may exist which refer to a list of formal standards document that conveys all the required details. Therefore, citing the names of particular software systems may be the only practical way of designating a Preferred Standard which is compatible with those systems.

Preferred Standards activities involve the specification of protocols, file formats etc. to provide local functionality and interoperability in order to enhance VET sector activities. They do not, formally, involve specifying or recommending which particular items of hardware or software should be used by VET sector participants.

Assuming that Preferred Standards do not recommend or specify the use of particular items of open source or any other software, and irrespective of whether open source file formats are specified as Preferred Standards, the use of open source software in the VET sector warrants close attention. Open source software is already in use in all Linux/Unix systems - as are widely used for firewalls and web, name, mail and file servers[16]. Netscape 7 is one of the derivatives of the open source Mozilla[17] project.

Details of open source software can be found in *Attachment 10.*

6.4 Operating Guidelines

6.4.1 Context

Although data on client needs is not available to aid the selection of Preferred Standards and Operating Guidelines for examination in this Report, web access for online delivery is an aspect that is becoming almost universal for students in a wide variety of courses.

A suggested set of Operating Guidelines for website usability are discussed in detail in Attachment 11, because this is an area of need for those intending to develop online resources. It is also an area of some controversy because the requirements of different websites may depend on their purpose, for example – pedagogical, administrative or commercial. What might be a plain and simple approach for a website with a utilitarian purpose, may be inappropriate for a site designed to motivate and encourage particular educational activities.

The draft Guidelines in Attachment 11 are provided as a starting point for the consideration of any future project established for the purpose of setting usability standards for website design.

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[16] Web server usage has been tracked since 1995 by http://www.netcraft.com . In June 2003, Apache (usually under Linux/Unix) was used in 62.5% of domains, and Microsoft Internet Information Server, which always runs under the Windows operating system, was used on 27.2%. Linux/Unix servers are often used on LANs to provide Windows file and printer sharing services with Australian-developed, and now IBM sponsored, SAMBA software - http://www.samba.org .

[17] http://www.mozilla.org

6.5 Standards for Deletion

The Vision of the Preferred Standards project at

http://flexiblelearning.net.au/standards/background/vision.htm

is about access, equity, competition, cooperation, and the use of an eclectic mix of products from different manufacturers to produce effective results. It is not about promoting particular manufacturers.

The Scope of the project is about national cooperation, future proofing, and mixing and matching. It is not about restricting variety and flexibility by mandating particular products.

The History is at

http://flexiblelearning.net.au/standards/background/history.htm

It is important to note that: "It was agreed early in the process that the option of mandating particular proprietary products was inappropriate …"

Standards which refer to commercial brands in the Preferred Standards 2000 project should therefore be deleted as they are inconsistent with the Vision of the project.

Other, emerging, Preferred Standards for deletion are Realtext and Realpix, which have not been adopted by other manufacturers.

7 FUTURE STANDARDS PROCESS

VET Preferred Standards resources include:

- The List of VET Preferred Standards (2003),

- The booklet providing introducing information about the Preferred Standards, and

- a resource proposal for a web enabled Searchable Standards Table or wizard.

It is assumed that several aspects of the Australian Flexible Learning Framework Program areas have the opportunity to continue the cultivation of technical interoperability.

Through the Resources for Teaching Learning and Assessment Program, the Collaborative Interoperability project provides significant opportunity to continue the interoperability agenda. The Communication and Leadership Program provides an avenue for integration of VET Preferred Standards resources into a range of Framework initiatives; Product Maintenance Team have the ability to field email enquiries and redirect them to a technical advisor.

In addition , the opportunity exists to redevelop the current VET Preferred Standards resources to extend their usability and integration within the host of Framework initiatives:

- The Communications team have the ability to promote VET Preferred Standards resources and interoperability concepts and

- the Advocacy and Issues Management team have the opportunity to continue their efforts in this area through engagement with the Collaborative Interoperability project.

- The Steering Committee has observed that it would be beneficial to integrate the resources into a variety of program areas including Toolbox, Learnscope and Flexible Learning Leaders.

It would therefore be beneficial for the VET Preferred Standards resources be the subject of a Product Maintenance Review to evaluate these identified opportunities

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Recommendation 6.

The Collaborative Interoperability project should receive this report as a source of advice on future standards settings activities, and make use of those aspects of the current Preferred Standards which are relevant to it's focus.

Recommendation 7.

The VET Preferred Standards resources should be the subject of a Product Maintenance Review to evaluate identified opportunities for use.

Attachment 1 Standards Implications of Solutions

The way standards support particular solutions is shown diagrammatically in Figure 7. In general, learners and staff within the sector using a particular solution interact with applications running on either a server or their PC. Users adopt a particular solution because of the benefits (functionality, ease of use etc.) which it provides, and the cost.

Carriers and Service Providers:
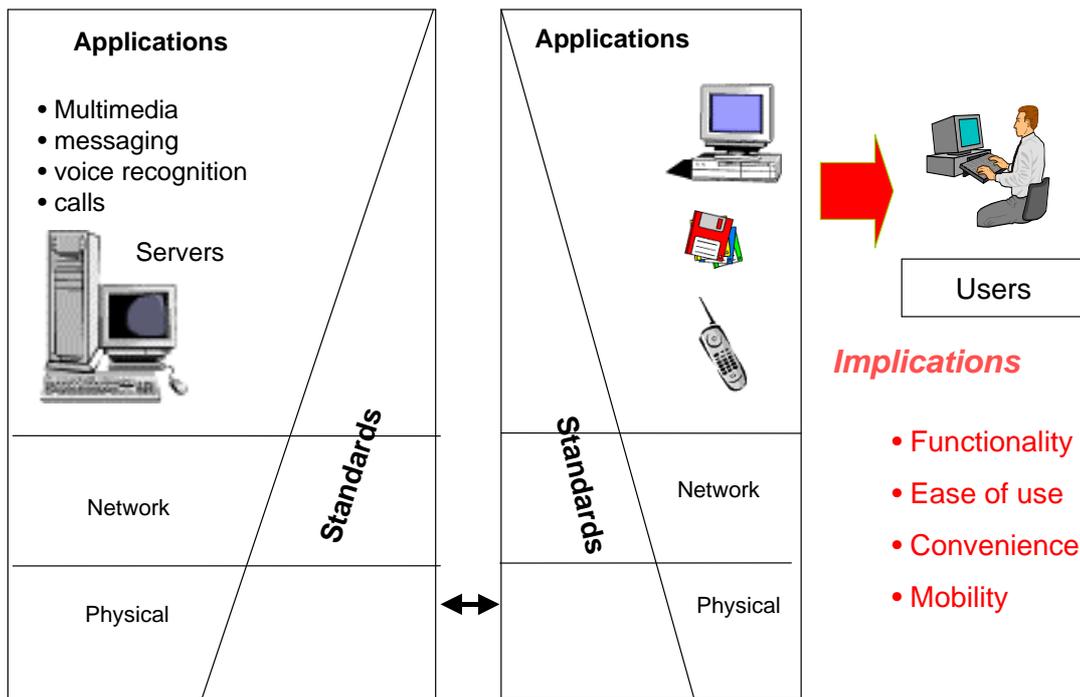
Figure 7. Solutions and Standards

Applications include or are supported by various standards which enable one application to communicate with another, for example an email client on a laptop computer communicating with a mail server.

In order to communicate over a medium like the telephone network, software is required to manage the signal from one end to the other. A layered representation of this software is shown in the diagram. The network software routes the messages between applications and the physical layer software arranges the transmission of the communications data over the physical medium. It must be emphasised that this representation is highly simplified.

The software at the network and physical layers operates according to standards which enable the software at one end to communicate with the software in the same layer at the other end.

Attachment 2 Determination of Client's Most Important Needs

The method is based on techniques of market sectorisation. It provides a possible methodology for identifying the clients' needs where standards support would be of most benefit to the sector.

The first step is to divide the market into sectors. In this case the most appropriate sectors could be the courses offered. The learning process within the VET sector involves participants from both the demand and supply side of the business model. Those on the demand side comprise learners who seek information on which courses of study are available and who undertake study in those courses. The size of the curriculum area could thus be measured, from an end user perspective, the number or learners undertaking it. Alternatively, however, it could be measured by the number of institutes and RTOs offering the particular area of study or by the number of online teacher hours associated with each course.

These courses will have particular needs, the intensity of the needs varying across each sector. Many needs will be common to a number of courses.

The method involves choosing a small, but representative, sample of RTOs. The next step is to survey the sample, asking them to list the activities they need to undertake in teaching, and the importance of those activities. The online versions of these activities constitute the clients' needs. The sectors (courses) and needs form the rows and columns of a spreadsheet as shown below. The courses and numbers shown in the table are examples purely intended for illustration.

		Needs				
Courses	**Number of Students**	**Discuss financial data**	**…**	**Instruct visually impaired**	**View live demo**	**…**
Accounting	20,000	3		1	1	
Hairdressing	4,000	0		0	2	
Total needs intensity		60000		20000	28000	
		⇧				

Table 6. Table of Sectors and Needs

The cells in the table comprise the intensity of the need for that sector. These could be ranked as

Critical   3

Important   2

Optional   1

Unimportant   0 or blank.

The Importance of each need is found by multiplying the number of students for each course by the intensity for the particular need and summing over all courses. For example, the importance to view live demonstrations is given by

20,000 x 1 + … + 4000 x 2

= 28,000.

The need(s) with the highest total (indicated by the arrow in the last row of the table) are then further examined.

The example above classified the size of the market sectors by the number of students undertaking each course. It would be valid to also carry out the analysis in terms of the number of teachers or the number of RTOs offering the particular course.

Attachment 3 Proof of Concept Exercise Methodologies

The following sections describe the process steps undertaken in the Proof of Concept exercises.

Impact of Standards on Toolboxes

The approach adopted was as follows:

- Identify Scenario to be tested

- Revise conceptual framework

- Determine toolboxes to be tested

- Confirm participants in Working Groups

- Distribute conceptual framework

- Acquire toolboxes

- Obtain inputs from Working Group participants

- Institute trial installation

- Report trial parameters

- Accumulate Working Group comments

- Assess benefits and resources of standards implementation in the contexts of the toolboxes selected.

- Draft consultative report

Advantages of SCORM Compliance

The approach adopted was as follows:

- Revise conceptual framework

- Confirm feasibility of implementation of SCORM compliance by Queensland Rail as a test example

- Identify participants in Working Groups

- Meet with Queensland Rail to define and agree interactions

- Distribute conceptual framework

- Detail Working Group Agendas

- Commence liaison with Queensland Rail to monitor implementation progress

- Collate experience of Working Group members

- Collate results of Queensland Rail initiative

- Assess benefits and costs of SCORM compliance in the contexts of the selected scenario.

- Determine overall impact of SCORM compliance via discussion with Working Group members

- Draft consultative report

Whole of Government Standards

The approach adopted was as follows:

- Research reference material and existing documentation

- Identify contacts in State Government Departments

- Develop conceptual framework

- Conduct telephone interviews

- Map areas of VET standards and State Government standards

- Draft consultative report.

Attachment 4 Sharable Content Object Reference Model (SCORM)

SCORM consists of two major components:

- The Content Aggregation Model - how the content itself is handled

  - Content Model: Nomenclature defining the content components of a learning experience.

  - Metadata: A mechanism for describing specific instances of the components of the content model.

  - Content Packaging: Defines how to represent the intended behaviour of a learning experience (Content Structure) and how to package learning resources for movement between different environments (Content Packaging).

- Run Time Environment - communication between the LMS and the source of content, i.e., the server

  - Launch - method for initiating a request from an LMS to a data store

  - API - the communication between the two sites

  - Data Model - description of the data that will be served

It can be noted that the Run-Time Communication API has undergone proof of concept overseas through widespread implementation.

The key actors in SCORM are:

  - Learning Management System

  - Shareable Content Objects (SCOs)

SCOs are a standardised form of reusable learning objects. An LMS is any system that keeps learner information, can launch and communicate with SCOs, and can interpret instructions that tell it which SCO to deliver next.

The following diagram[18] illustrates the conceptual model used by SCORM to define interoperability.

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[18] Diagram taken from Saba 3 Release4 Content Administrator Guide, p 4.20

1) Individual SCOs are created

2) SCOs are assembled into a course and either packaged or

described (CSF)

3) Package file (or CSF file) loaded into LMS

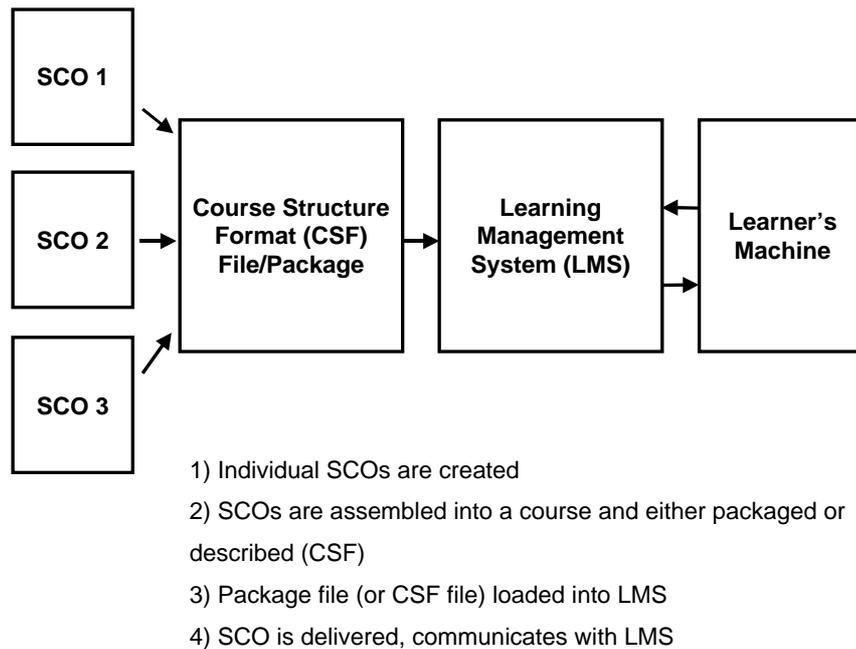4) SCO is delivered, communicates with LMS

Figure 8. SCORM Operation.

SCORM is a foundational reference model upon which anyone can develop models of learning content and delivery. SCORM provides the framework and detailed implementation reference that enables content, technology and systems using SCORM to "talk" to each other, thus ensuring interoperability, re-usability and manageability[19].

SCORM 1.2 defines an Aggregation Model for assembling content into a portable package. This package includes a manifest file that declares the contents of the package and can include the physical content resources.

Advanced Distributed Learning (ADL), the consortium centre that oversees SCORM, provides a compliance testing service.

Benefits

SCORM supports the communication of information concerning learners enrolled in particular courses, their scores and training attendance - that is, information relevant to individual learner competency with regard to the specific content object.

SCORM has benefits in terms of the management of content, for example, learning objects, in one protocol for sharing among organisations, or accessing within a single distributed organisation. If the availability of interoperable course objects is the goal, then the alternative is to build and maintain the software interfaces between a range of content, in different languages, to the various Learning Management Systems. This requires a range of diverse programming skills in local staff, or the need to acquire those skills through outsourcing. This can be an expensive exercise, although alternatives involving distinct learning object repositories, an assembler and

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[19] Masie, p11.

a knowledge management system interfacing with the LMS, may be a competitive alternative.

SCORM as a model has these basic properties:

- Durability – it does not require modification as versions of system software change;

- Interoperability – it can operate across a wide variety of hardware, operating systems and Web browsers;

- Accessibility – it can be indexed and found as needed; and change;

- Reusability – it can be modified and used by many different development tools.

Origin

SCORM was originally developed by the US Department of Defense to ensure consistent instruction in the operation of US and Canadian military equipment. Because of the size of this market there is strong vendor support for SCORM compliance. This has advantages, in terms of economies of scale, which would flow through to other users.

Summary

The status of SCORM is summarised in the table below.

Activity Addressed by the Standard	Course delivery
Standard Proposed for Investigation	SCORM v1.2 and 1.3. SCORM Version 1.2 is now a multi-part document composed of three separate books: • The SCORM Overview • The SCORM Content Aggregation Model • The SCORM Run-Time Environment
Standards Class	− Delivery Platforms and Content Packaging Administration and Management
Advantage to the VET Sector	Common course content development structure for exchange with other institutions. The motivations of the SCORM development group are: • The creation of reusable learning content that can be delivered over a network. • Ensure that such learning is cost-effective and that it can be developed and marketed in a way that allows industry to make a profit. • Provide an ADL [Advanced Distributed Learning] forum that allows the public and private sectors to identify and address

	their common interests in developing and transitioning to the Advanced Distributed Learning environment of tomorrow.
Benefits anticipated:	
Improvement in Interoperability	Interoperability is a key aspect of SCORM. SCORM is based on the several attempts to develop a framework for course content exchange including AICC, IEEE, ARIADNE, ALIC and IMS, and a list of vendors including MicroSoft, IBM, Cisco and Macromedia. Metadata has been a key component of SCORM since Version 1.0. SCORM has been updated to remain harmonised with clarifications and improvements in IEEE LTSC Learning Object Metadata (LOM) and IMS Learning Resource Metadata. In SCORM Version 1.2 the ability to package instructional material and metadata for import and export was added. The content package is an integral piece for meeting 'interoperability', one of the overall requirements of the SCORM. SCORM Version 1.2 incorporates the IMS Global Learning Consortium's Content Packaging Specification and expands it to include additional course structure capabilities. These XML-based specifications provide a crucial link between learning content repositories and learning management systems. SCORM 1.3 is an expansion of the standard to address the sequencing and tracking of individual student progress through the objects including mastery, score, completion, duration, and time span. These functions have been accomplished in stand-alone Computer Based Training systems in the past, but not in a sharable standardised manner. The SCORM developers identify this next level of complexity to be new and quite different to merely describing the sharable content objects (SCOs). They address various pedagogical concepts that are beyond the initial SCORM design. Future directions of SCORM versions are to provide "a new architecture that is highly adaptive, new content models, and the first integration of performance support and simulation" and Intelligent Tutoring Systems.
Purchasing Leverage	SCORM allows content sharing within a standard environment, reducing the need for rework of content already developed. Content should also be easily 'discovered' via the incorporation of a common metadata framework within the SCORM.
Accessibility	The SCORM standard in and of itself does not affect accessibility as defined for the needs of learners with disabilities per se. That would be determined by the applications employing the SCORM standard. An alternative

	definition for accessibility that includes machine accessibility to content stored on the Internet would be affected by incorporation of the SCORM standard. Those learning objects that comply would be accessible by other learning management systems that are SCORM-compliant.
Financial Implications	The financial implications depend somewhat on the stage at which the development cycle is operating in a particular institute. Those that are early adopters may be paying a slight premium. For example, publishing software that is SCORM-compliant is in its beginning stages, so institutes may be confined to a small group of options that cost more. In the future, however, a greater range of products should be available, allowing for greater competition and price reduction. In this context, SCORM compliance could be seen as an investment for the future. Third party tools are being developed to support implementation projects and conformance testing software is available.
Current Industry Sectors where Standard Used	A major user is the US Department of Defense.
Standards Body Responsible	The specifications are being trialled and have not been formalised as yet. At this stage the specifications are in the public domain. Eventually, SCORM standards will be reviewed and finalised by W3C, IEEE and ISO. ADL[20] is the current location for prototype development and assessments. Currently, the ADL Technical Team, with the support and close collaboration of other key groups (IMS, IEEE, etc), are working to expand and improve on the SCORM Version 1.x. Discussions are under way within many standards and specifications producing organisations regarding "next generation" Web-based learning architectures. These discussions are expected to eventually result in implementable specifications.
Other Comments	Laboratories in three centres in the US and one in the UK are working on the project: The ADL Co-Lab Network is comprised of: the Alexandria ADL Co-Laboratory (Alexandria, Virginia); the Joint ADL Co-Laboratory (Orlando, Florida); and the Academic ADL Co-Laboratory (Madison, Wisconsin). In 2002, the ADL Initiative established the first ADL Partnership Lab in the United Kingdom. Content levels can be at the smallest to the largest levels, including courses of study

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[20] http://www.adlnet.org/

	The ADL Technical Team has announced the release of the ADL SCORM Version 1.3 Sample Run-Time Environment (RTE) Version 1.3 Beta-2. This version of the Sample RTE includes the following enhancements from the SCORM Version 1.2 Sample Run-Time Environment Version 1.2.1:
	• Inclusion of a "Sequencing Engine" that implements the IMS Simple Sequencing Specification.
	• Inclusion of the SCORM Navigation Data Model that enables content navigation controls.
	• All source code including the ADL Validator and parser code will be released with accompanying JavaDoc HTML documentation.
	The Beta Release of the Sample RTE implementation provides a working example of a "Sequencing Engine" as described by the IMS Simple Sequencing Specification.
	This release does not contain a complete and functioning LMS, but rather an example of the Run-Time Environment as it may be implemented within an LMS.
	A few areas the ADL Technical Team is currently looking into are:
	• Learner Information Profiles
	• Assessments
	• Data Models
	• Other Application Program Interfaces (API) - SOAP.
	The SCORM Vision (formally known as SCORM Version 2.x) has been reserved as a means to represent this next generation of learning architecture.
	Compliant Products include
	• Lectora Publisher
	• Saba Publisher, which is based on the Lectora product and
	• WebMentor® Learning Management System (LMS) developed by Avilar® Technologies, Inc[21].
	All examples are conformant with SCORM v1.2[22].
	A free SCORM 1.2 runtime building block makes it possible to run SCORM 1.2 compliant learning content in Blackboard's LMS.

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[21] http://home.avilar.com/

[22] http://www.cetis.ac.uk/directory/products/20010814111525/viewProduct

Reference Sources	Making Sense of E-Learning Standards: The Development of the Dimensions Learner Management System - http://www.learning-expanse.co.uk/downloads/MakingSe.pdf
	Excellent simple description of SCORM in context, including pedagogical models.
	Advanced Distributed Learning:
	http://www.adlnet.org/index.cfm?cfid=363505&cftoken=84177685
	Advanced Distributed Learning Co-Labs:
	http://www.adlnet.org/index.cfm?fuseaction=colabovr&cfid=363505&cftoken=84177685

Table 7. Summary of SCORM Status.

Attachment 5 SCORM Operation and Architecture

The way the SCORM specification facilitates communication between the LMS and content is discussed below.
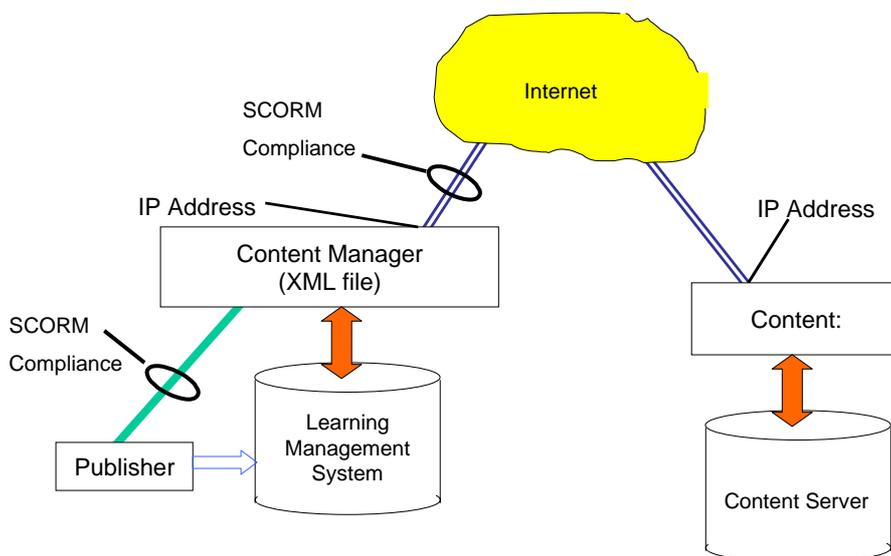

Figure 9. Physical Architecture for SCORM-compliant Software Implementation

The learner interfaces with the LMS in the normal way, e.g., through a standard web browser.

In this infrastructure, the Content Manager can access content stored on a content server. This can be a web server located anywhere on the Internet. In this case both the Content Manager and the Content would have IP addresses. The configuration in the diagram could also be implemented over an intranet. The LMS accesses the Content Manager, implemented as an XML file, via its file name. This configuration allows the flexibility resulting from the separation of the LMS and the content. It simplifies the operation of the Content Manager, which in the case of the AICC standard, is realised via a series (up to 8) text files within the LMS, the number depending on the purpose of the test and the structure of the organisation. These are replaced by a single zip file. Thus SCORM-compliant content reduces the overall data storage requirements and file update overhead for managing content access.

In addition, because of the standardised access and data transfer, there is less room for error when implementing question and test sessions. The SCORM specifications facilitate implementation within a Web-based architecture.

In setting up the session, the authoring tool registers the course identifier, stored in the content, with the LMS. The question and test software in the content file launches the student test data to the appropriate course database with this identifier in the LMS. Records from a student's participation in a particular course can then be transferred, via the Internet, to the content manager and stored in the LMS.

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Attachment 6 Standards Identified by Preferred Standards 2000 Study

These standards comprise:

- IMS.
- Effective ICT infrastructure, platforms and tools for on-line delivery of learning.
- Convergent technologies, particularly video, television and the Internet.
- Multimedia streaming (SMIL, SDP, RTSP, RTP and RTCP.
- Multimedia data types.
- XML.
- DHTML.
- CSS.
- Cataloguing.
- Metadata.
- Workflow.
- Electronic whiteboard sharing.
- Meeting scheduling (iCalendar, vCalendar).
- Java and Javascript.
- DVD.
- Thin client.
- Firewalls, while maintaining security and removing barriers to connectivity of interoperating systems and functions.
- Smart Cards.

Attachment 7 Dublin Core Summary

The following table summarises the status Dublin Core

VET Sector Activity Addressed by the Standard	Course Delivery, Learner
Standards Class	Resource Description and Discovery
Advantage to the VET Sector	Facilitates resource description and discovery within a standard metadata schema within and outside of the VET Sector
Benefits anticipated:	
Improvement in Interoperability	Describing information through metadata tags or in a separate database of records (the gateway model) can increase the likelihood of finding information sought. Metadata can be searched in various collections independently because the queries match the format of the descriptions in DC standard descriptions.
Purchasing Leverage	Reducing the cost of training needed for resource description and searching collections by using the same metadata schema.
Workplace Use Relationships	Dublin Core is a standard internationally, and as it has become an ISO standard. It will at some time, if not already, be a cross-industry standard for information description.
Accessibility	The Dublin Core Metadata Initiative (DCMI) Interest Group is addressing the relationship to the W3C and IMS accessibility efforts as well as those aspects of accessibility related specifically to Dublin Core metadata implementation and support.
Financial Implications	The common resource description schema reduces training costs. The common definition for information architecture obviates the need to create new architectures.
Current Industry Sectors where Standard Used	Examples include the following: DCMI Education WG – The group submitted a proposal for an educationLevel refinement for audience element to the Usage Board, which was accepted. In the next period, the group will work on the development of the Application Profile, and will continue work on vocabulary development for the Education domain.

	DCMI Government WG - In 2002, the group submitted proposals to the Usage Board, some of which were accepted. The group recently issued an update on the *Survey of Government Implementations of DC.* In the next year, the group intends to investigate relations to Web Services Discovery Language (WSDL) and Universal Description, Discovery, and Integration of Web Services (UDDI), and develop guidelines for Government use of DC metadata and training materials. Work on the Application Profile and on functional requirements for service description will continue. DCMI Libraries WG - The group plans to work on a maintenance revision of the Application Profile, provide implementation guidance, reach out to the wider library community and vendors, and start working on an XML Schema for the Library Application Profile once it is stable. DCMI Global Corporate Circle IG – This group will provide a platform for people involved in Knowledge Management in global corporations to discuss issues related to the adoption of the Dublin Core in the corporate world. With the installation of the DCMI Global Corporate Circle IG, it was decided to discontinue the DCMI Business IG. DCMI Global Corporate Circle (Special Interest Group), http://dublincore.org/groups/corporate/.
Standards Body Responsible	DCMI - http://dublincore.org ISO - DIS 15836 - http://www.niso.org/international/SC4/sc4docs.html
Other Comments	DC cross connects with XML programming efforts.
Reference sources	EdNA Metadata Standard: http://www.edna.edu.au/metadata/ EdNA Metadata Elements: http://www.edna.edu.au/metadata/elements/index.html Current status: http://www.dlib.org/dlib/april03/weibel/04weibel.html Homepage: http://dublincore.org Guidelines: *Guidelines for Implementing Dublin Core in XML*. Andy Powell and Pete Johnston, 2002-12-02: http://dublincore.org/documents/2002/12/02/dc-xml-guidelines/ Accessibility: http://dublincore.org/groups/access/

Attachment 8 RSS Summary

VET Sector Issue Addressed by the Standard	Course Delivery – syndication of content from multiple sources
Standards Class	Delivery Platforms and Content Packaging , Content Formats
Advantage to the VET Sector	From the information accessing view, VET learning materials may rely on content from real-world sources that changes over time. Use of an RSS approach may provide access to content in a simpler way than the more advanced syndication and search approaches such as SCORM and OAI. From the information supplier perspective, by publishing information in an RSS feed, the users of aggregators may find the source site and new information contained on it as it changes. An example of the use of RSS for information about online learning can be found operating in Canada at: http://www.downes.ca/cgi-bin/xml/edu_rss.cgi . Four pages of sources are listed, including EdNA Online: http://www.edna.edu.au/service/headline/edna RSS is used by bloggers (people who write "Web logs" – web-based personal and group discussions) to syndicate information from sources of interest to their topic and to feed their writings to other aggregators. If blogging becomes a more common instructional tool for student centred learning, use of RSS could provide information exchange among students and between students and teachers. It could provide on-going research support for student projects, as in the online learning example listed above.
Benefits anticipated:	
Improvement in Interoperability	Provides access to changing feeds of information and with some programming allows the VET website to provide its information to other content aggregators.
Purchasing Leverage	None for the standard, but may allow bartering of content with other information providers.
Workplace Use Relationships	RSS feeds occur from a wide range of sources beyond educational sites. They could thus be used for subject-specific projects within a workplace or for updating interest communities as information is added to a collection.
Accessibility	No problems will be experienced with accessibility if the results presentation is designed with access as a characteristic.

Financial Implications	No cost for the standard, but would require programming expertise for implementation and user training.
Current Industry Sectors where Standard Used	News publishers, weblogs, ICT information exchange, online discussion groups such as Yahoo
Standards Body Responsible	There are two main groups that have taken up RSS development: • Userland – RSS 2.0. Use for general-purpose, metadata-rich syndication • RSS-DEV Working Group – RSS 1.0. Use for RDF-based applications or for access to advanced RDF-specific modules.
Other Comments	RSS is a relatively new protocol which may have some creative applications that have not been considered to date.
Reference sources	Basic article about What is RSS? http://www.xml.com/pub/a/2002/12/18/dive-into-xml.html Slide show about RSS: Conceptual and implementation http://www.weav.bc.ca/slides/weav.rss_files/frame.htm RSS feeds from over 10,000 locations http://www.syndic8.com/ RSS 1.0 http://www.purl.org/rss/1.0/ RSS 2.0 http://backend.userland.com/rss

Attachment 9 Open Archives Initiative (OAI) Summary

Key characteristics of OAI are listed in the following table.

VET Sector Issue Addressed by the Standard	Course Delivery, Information Access
Standards Class	Resource Description and Discovery
Advantage to the VET Sector	As collections of Learning Objects are developed, the ability to share those with others may be served by use of the Open Archive Initiative protocols for metadata harvesting, particularly for e-text materials. Many repositories are testing the OAI protocols, including EdNA Online, Australian Museums OnLine (AMOL), Australian National University, University of Melbourne and the National Library of Australia as well as overseas institutions. OAI will enable their records about their holdings to be accessible through search tools hosted on local user interfaces such as portals and webpages. Using an OAI metadata harvesting approach may open up access to primary scholarly resources in much larger collections than those labelled learning objects specifically.
Benefits anticipated:	
Improvement in Interoperability	Interoperability is a primary advantage of implementation of OAI. Disbursed collections of resources are simultaneously searchable and retrievable when permissions are granted for access to their metadata. The interoperability relationships can be publicly exposed via registration through the Initiative, or they can be closed to confederate repositories that have an interest in sharing digital resources. The second controlled approach is handled through selective harvesting limits, of who has permission to retrieve the metadata or subsets of the metadata records, so that not all resources are discoverable.
Purchasing Leverage	Local storage is reduced by allowing the resource to remain in place and retrieved only when found to be of value to the end user by identification from the metadata harvested. OAI obtained through EdNA Online is likely to be proven without expense to individual VET institutions.
Workplace Use Relationships	As OAI is a relatively new development, the workplace applications are unknown in terms of access to workplace information. However, the use of an OAI 'federated searching' approach in information literacy is a concept that can be carried to the workplace for future use. Regardless of whether OAI is the final standard, the concept will be employed more and more.

Accessibility	In terms of disability access, the application that uses an OAI approach is the determining factor, not OAI itself. In terms of general access to information, use of OAI strategies will enable audiences to access information from a range of data sources that may not be exposed in general web searching such as through common search tools like Google or Lycos, etc.
Financial Implications	There are no charges for using the OAI protocols. The costs will be for programming staff to prepare the website for using OAI. According to the FAQ, "the generic task of configuring a web server to handle OAI-PMH requests and parsing out the arguments should involve less than a day of work for someone experienced with setting up Web servers and writing CGI scripts."
	Service providers who query OAI locations would also need to modify their portals/gateways for inclusion of searches of repositories.
	Compared to other interoperability protocols such as Z39.50, OAI is a simple approach with less functionality, but with easier relative implementation for those organisations without the resources to incorporate the more complex options.
Current Industry Sectors where Standard Used	Library information, subject gateways, electronic publishing
Standards Body Responsible	Open Archives Initiative Steering Committee http://www.openarchives.org/
Other Comments	Although primarily focused on e-prints at its inception, the Initiative also identifies that:
	"The fundamental technological framework and standards that are developing to support this work are, however, independent of both the type of content offered and the economic mechanisms surrounding that content, and promise to have much broader relevance in opening up access to a range of digital materials."
	Furthermore,
	• OAI Uses XML Schemas
	• There is no conflict with Dublin Core metadata structures
	• Other metadata schemas can be supported
	• OAI uses standard HTTP Get and Post commands
	Implementation among a confederation of participants, as repositories or service users [searchers], or both, will most likely require a formal memorandum of understanding because

	of the rights implications involved. Examples of these MOUs have been developed among the Australian organisations using OAI for federated searching and most likely would be available for examination by VET members. The OAI community maintains a discussion list and archives of prior discussions at its website, http://www.openarchives.org/mailman/listinfo/OAI-implementers
Reference sources	Registered OAI data providers: http://www.openarchives.org/Register/BrowseSites.pl Registered OAI service providers [searching]: http://www.openarchives.org/Register/BrowseSites.pl http://oaister.umdl.umich.edu/o/oaister/viewcolls.html　　[167 Institutions; >1 million records] Example implementation of OAI search: http://www.myoai.com/ ANU: http://eprints.anu.edu.au/index.html University of Melbourne: http://eprints.unimelb.edu.au/ Implementation Guidelines: http://www.openarchives.org/OAI/2.0/guidelines.htm OAI Frequently Asked Questions: http://www.openarchives.org/documents/FAQ.html The OAI Protocol: http://www.openarchives.org/OAI/openarchivesprotocol.html Rights Management Implications: Project RoMEO: http://www.lboro.ac.uk/departments/ls/disresearch/romeo/index.html

Attachment 10 Open Source Software

The use of open source operating systems involves abandoning compatibility with Windows based application software[23]. This probably cannot be contemplated in the foreseeable future in the VET sector, but some large organisations, such as the local government of Munich[24], have chosen to do so. Nations such as France and Germany have begun to encourage open-source software to limit their dependence on proprietary vendors and to stimulate local software development. MITRE recently concluded that the U.S. Defense Department relies on open-source software and recommended its further adoption.

The use of Netscape 7 (and other Mozilla derivatives) for web browsing, HTML editing and email is likely to occur naturally because of functionality and security benefits. Because the file formats of address books and bookmarks can be converted in a once-only migration step, the choice of open source software for these functions over their commercial equivalents involves no question of file formats.

However the adoption of open source software packages for word processing, spreadsheets, database management, presentations and graphics involves important decisions about file formats. For instance, while Open Office reads and writes Microsoft-format files, it does not, in general, completely support every detail of the Microsoft formats and so presents some potential communication problems in a situation where files are exchanged between both types of software. Currently, Microsoft applications do not read or write Open Office's native XML-based file formats, so interoperability depends on the ability of Open Office to read and write the Microsoft file formats.

Nonetheless, the are benefits in the VET sector using software which supports open source file formats and adopting open source software in the form of large, well-developed, desktop application programs and suites. These benefits may justify some level of incompatibility with proprietary software and file formats.

These problems are likely to diminish as open source software develops and becomes more widely adopted. Firstly, the existing incompatibilities may be progressively eliminated as the software is debugged and improved. Secondly, the proprietary software may in the future be able to read and write the open source file formats. Thirdly, as a greater proportion of users adopts the open source software, the need to communicate via proprietary formats will reduce. Also, while open source programs may have a level of incompatibility with proprietary file formats, the proprietary software itself has a certain level of incompatibility with its own files. In some instances open source software reads the files correctly when the proprietary program which created it misinterprets its own files or the files created by a different version of the proprietary software.

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[23] Some Windows applications run under the WINE Windows emulation system which is a standard part of most Linux operating systems.

[24] http://www.linuxworld.com/2003/0528.munich.html "Munich, Germany's third largest city, will equip all of the 14,000 computers in its public administration with Linux and other open source office applications."

While the most prominent open source desktop office application suite - Open Office - has broadly compatible functionality to Microsoft Office, in some ways it has greater capabilities. For instance Open Office Writer's styles, bibliographies and its ability to create a variety of indexes generally exceeds the capabilities of Microsoft Word. These are important capabilities for creating large structured documents such as books or potentially web-based material, which is a core activity of great importance to VET.

Open source software has unique benefits over proprietary software in that it can be modified and extended so as to adapt it for local needs. While the costs of doing this may be significant, if the benefits are conferred on thousands of VET sector participants, then considerable expense may be justified. Assuming the extensions are published, then costs of development, testing and debugging may be reduced by the collaborative efforts of other interested parties the world over, including other educational organisations. Furthermore, the additional capability may become a standard part of the software. In these ways, the ongoing improvement and maintenance of features, which are important to the VET sector, can firstly be achieved - whereas it would generally be impossible with proprietary software. It may also be achievable in a better and more cost effective manner than by traditional fully funded software development efforts.

Such changes are generally impossible at any price with proprietary software, and the savings in licensing fees and perhaps training and support costs represent a potential source of funds for adoption and customisation of open source software.

Open source software may have benefits over proprietary software in terms of elegance and usability. Proprietary software vendors rely, in part, on existing customers upgrading to a later version of their program, so the program may have more and more "features" added, which may be attractive in a marketing sense but are often superfluous and confusing for most users. Open source software is not immune to such problems, but as there are no revenues at stake, and since the software is typically the work of volunteers who take pride in their work, functionality and elegance may be expected to prevail in design decisions, rather than marketing considerations.

Open source software is also likely to have advantages in terms of increased security, freedom from viruses and Trojan Horse programs. This reduced vulnerability occurs because the open source nature of the code enables bugs to be more easily identified by expert users, and then fixed by the maintainers of the programs.

In principle, the user can ascertain the functionality of all open source software by direct examination of the source code - but this is usually only practical for understanding particular aspects of the functionality. It is not practical for anyone to manually check the source code for every conceivable security problem. However, for any widely used piece of open source software, there are likely to be a number of individuals and teams making their own security assessments and audits who publish their findings[25].

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[25] This is not to say that open source software is immune from security problems or other bugs. But the public availability of the source code, the typically fast time-cycles of bug fixing, and the efforts of teams of code auditors and the established public forums for reporting problems is widely held to confer more security benefits than whatever is lost by hackers also having access to the source code.

Commercial programs are increasingly tending to communicate with their vendors for reasons of updating, anti-piracy and perhaps other purposes - in ways which are impossible to fully characterise or control the security aspects of. Open source software has no need of this, except perhaps for updates. Since the program can be compiled from source code, any such functions could not be hidden. This gives open-source software a fundamental and significant advantage over any commercial software which communicates with its vendor, due to the former being immune from concerns about security and privacy of commercially sensitive information. This factor is important as the VET sector in Australia enters the global marketplace.

Some commentators believe that there are legal issues concerning the use of Open Source Software. The critical issues involving the General Public Licence (GPL) - the licence used most commonly to distribute open-source software - include its viral nature, definition of a derivative work, copyright ownership and enforceability of its terms.

Open Office

Open Office is an open standard suite of office software which provides performance comparable to Microsoft Office. Adoption of Open Office would avoid the expense and effort of upgrading MS Office in order to be able to read documents originating from users with later versions of the software[26]. Open source software like Open Office can be copied from one hard drive to another at minimal cost over the LAN or on CD-R.

The Sun version - Star Office - is inexpensive and includes a good spell checker, which is absolutely essential. It is provided with some degree of support[27].

Open Office should be implemented on Windows 2000/XP to avoid the necessity for VET participants to change operating systems.

A key element to be investigated is the cost of operations, training, user support and maintenance of installed Open Office software.

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[26] It is reasonable to expect that future releases of Open Office will be able to read and write any extensions Microsoft makes to its file formats, though there may be delays and initial compatibility problems before this is achieved to a high degree.

[27] http://wwws.sun.com/software/star/staroffice/6.0/ http://www.openoffice.org/

Attachment 11 Web Site Usability

Many people still avoid computers because they find them a source of frustration and unpleasant surprises. They feel out of their depth, because they cannot reliably anticipate the consequence of actions such as clicking a link. They may also fear that their actions may break the computer. Consequently they avoid computers and the Web or fail to adequately explore and utilise a web resource for fear of getting lost.

Educational sites must do everything possible to enhance the learner's confidence in navigating and exploring the material, by remaining consistent with basic web protocols as much as possible, and by explaining any special arrangements the learner needs to know about the site in order to use it well.

The Guidelines below are in addition to existing technical standards requirements. They are intended to be a formalisation of what might be considered "commonsense" requirements to make web sites easy to navigate and useable without unnecessary difficulties. These Guidelines may be considered "accessibility" guidelines for users without disabilities, but with the base level skills which are recommended for all online users and listed in *Attachment 12*

Web design has developed in an environment of rich, though not entirely compatible or reliable, web-browser functionality. Interactivity, animation, elaborate graphic design and novel navigational paradigms can, however, reduce the navigability, cross-browser compatibility, speed of download and general usability of the resulting web sites.

There may be specific pedagogical reasons for using elaborate graphics, animation, Flash and other multimedia types, complex menu and image-map approaches to navigation etc. The aim of the suggested guidelines below is not to absolutely constrain the design of educational sites, but to provide a basis of self-evidently valuable usability guidelines which should generally be adhered to unless there is a specific pedagogical purpose to the contrary.

These Operational Guidelines follow from the assumed needs of all users to bookmark, print and save pages so that they can obtain maximum benefit from them immediately, and especially at some later time when their computer is not online, or when they are not near their computer. Most of these usability requirements optimise the ability of the user to communicate with other users and to copy and paste to emails etc. items of text they want to discuss.

A crucial requirement of many of the usability requirements listed below is easy navigation and clear orientation in web sites. If they see the exact URL of the page they are viewing, they can refer to it in communications, so they can return to it (such as with a bookmark) and so they always know where they are. This is made more difficult or impossible by web sites which use frames, Flash or self modifying HTML pages which use extensive Javascript, including with the Document Object Model (DOM).

Many web sites are not meant to be used in the fully functional way that an educational site is. The value of any web-based educational experience is strongly dependent on the learner's ability to make full and easy use of it. To that end, unless there are specific and overriding reasons to the contrary, designers should support the learner's ability to use the resource well, even if this increases the time necessary to construct the site. There may, nonetheless, be situations in which a more narrow

usage of the material and a correspondingly narrower set of learner skills and choices are the best way of maximising pedagogical goals.

The following sections consist of usability goals for the user (on the left in **boldface**) and the web-design requirements for achieving these goals (on the right). These requirements include:

Functionality which must exist in the page itself and/or the web browser in which is accessed.

Barriers - specific techniques which limit or prevent this goal from being achieved.

Interdependence on other functionalities and barriers.

Frames and Other Barriers to Navigation

Since even expert web users often find themselves constrained and lost in a frames-based site, these guidelines - if developed fully and judged to be valid - constitute a challenge to the use of frames in educational settings. This is not to say that frames should never be used - just that their use should be justified in light of the difficulties they generally cause most or all learners.

Frames are often a convenience for designers, but only rarely for users. A widely cited 1996 critique of frames by Dr Jakob Neilsen[28] remains valid today and pertinent to usability of educational web sites:

"Frames break the unified model of the Web and introduce a new way of looking at data that has not been well integrated into the other aspects of the Web. With frames, the user's view of information on the screen is now determined by a sequence of navigation actions rather than a single navigation action.

Navigation does not work with frames since the unit of navigation is different from the unit of view. If users create a bookmark in their browser they may not get the same view back when they follow the bookmark at a later date since the bookmark doesn't include a representation of the state of the frames on the page.

Even worse, URLs stop working: the addressing information shown at the top of the browser no longer constitutes a complete specification of the information shown in the window. If an author copies the URL in order to include it as a hypertext anchor in one of his or her own pages then that anchor will not lead readers to the desired view but to the initial state of the frameset. Similarly, if a user decides to send an email message to a friend with the recommendation to check out a page, then copying the URL from the browser will not work if frames are used. This is because the URL points to the frameset and not to the current view (with the information of interest to the friend). Given that social filtering is one of the most powerful mechanisms for information discovery on the Internet, it is an utter disaster to disable the URL as an addressing mechanism."

Most of these problems do not apply to "inline frames". The most common use of frames, however, is not of the inline type, but of one or more outer frames which make the behaviour of the browser more complex.

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[28] Jakob Nielsen's Alertbox for December 1996: Why Frames Suck (Most of the Time)
   http://www.useit.com/alertbox/9612.html .

The navigational problems of frames were anticipated in the Series 5 Toolbox workshop[29]: "Consider how the trainer can refer to particular pages or segments when you plan the use of framesets."

Two other technologies may present similar problems of being unable to bookmark, return to, save or perhaps print the page as the user sees it. The most common is the use of Macromedia Flash to create pages which change their appearance significantly or entirely as the user interacts with it. The emerging, non-proprietary, open-standards technology of DOM[30] (Document Object Model) can be used to create self-changing pages which have the same problems.

Applying these Guidelines

Usability

A fully developed list of usability goals and requirements along the lines of those listed below would constitute a formal set of guidelines for assessing the usability of a web site, or in most respects a CD-ROM based resource. They need not result in dull or unattractive sites - since attractive layout, animation and complex navigational devices may be judged to be the pedagogically optimum approach after considering the degree to which they may detract from straightforward usability.

These usability goals and web design requirements can be improved with reference to existing educational and general web usability guidelines and through further development through consultation with stakeholders.

A presentation at the National Toolbox Series 5 Workshop[31] warns against "mindless" and "gratuitous" engagement. While these terms were not further expanded upon, examples would include hard-to-find links, excessive navigational complexity, distracting, annoying and non-instructive sounds and the use of animated illustrations, .gif navigational icons and fly-out menus beyond what is necessary to achieve instructional goals.

The presentation lists the following needs of learners:

What do learners expect?

Order

Structure

Guidance

Increments

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[29] Customisation Expectations:

   http://www.flexiblelearning.net.au/toolbox/toolbox5/ .

[30] W3C DOM Specifications: http://www.w3.org/DOM/ . Mozilla (and therefore Netscape) DOM documentation http://www.mozilla.org/docs/dom/ . An example of a page which changes its appearance according to user actions is: http://www.mozilla.org/docs/dom/technote/intro/example.html .

[31] Principles of Online Learning, With Examples of Good Practice, Ron Oliver http://www.flexiblelearning.net.au/toolbox/toolbox5/ .

Feedback

No surprises

The following goals and guidelines, if properly developed and applied, are intended to reduce the number of *unpleasant* surprises which users experience.

Accessibility

While these guidelines on their own are not intended to achieve accessibility for particular groups of users with sensory and motor skills, these requirements will make the site highly usable to those depending on screen readers (text to speech systems). Since browsers have a Text Zoom function, sites which follow these guidelines will be easier to navigate for sight-impaired users, whereas a non-compliant site which relies upon small, hard-to-read or low-contrast graphics for navigation cannot be made more navigable to such users by any browser-based option. (Sight-impaired users may use commercially available screen magnification software[32] which also magnifies graphics.)

Achieving particular standards of accessibility requires prior knowledge of the users' disabilities and special software tools, and often involves significant deviations in design from that which is optimal for non-disabled users. Nonetheless, it is possible to implement some general accessibility enhancements which do not significantly restrict designers or burden non-disabled users. Such enhancements may include:

The use of punctuation, such as commas, to separate list items in addition to their being visibly formatted as a list. This aids dyslexic users and enables the screen reader software used by visually impaired users to clearly indicate the separate nature of the items (Appelby et. al.)[33].

As mentioned by Appelby et. al., using black text on a white background: "no embossing or textured backgrounds". (This improves readability for all people, for those who view the screen at distance - if several people are viewing a monitor and for screens and video projector systems in settings with excessive light which reduces visible contrast.)

Avoiding unnecessary use of tables, and the proper labelling of the table's purpose, rows and columns, to aid those who must interpret it as text. (However tables are a common approach to page structuring and for making HTML render in lines which are shorter and more readable than would be the case if they flowed to the edge of the screen.)

Any such improvements to accessibility will provide important benefits, including:

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[32] http://www.magnifiers.org reports that ZoomText Xtra is the most popular screen magnification package.

[33] Implementing Quality, Accessible Learning: A Pilot program in Developing Accessible Online Learning Resources (David Appleby et. al.): http://www.flexiblelearning.net.au/toolbox/toolbox5/ . This includes discussion of many other accessibility issues, such as slow mouse speed, the use of trackballs and scroll-wheels and some specific problems faced by those with Acquired Brain Injury such as a potential preference for remembering colours and shapes, rather than text or keyboard keys.

The material is naturally more convenient for users with disabilities. As noted in Appelby et. al.: ". . . disabled users did not want to be singled out for special treatment when it came to using online courses.".

This is achieved without the complexities, cost and testing problems involved in maintaining a second, specifically accessible, version of the site.

General Navigation and Printing

In each section below, usability goals are presented in bold on the left, followed by their web-design requirements and discussion.

See the URL of the page currently being viewed.
The objective is clear navigation and orientation.

Frames should not be used, unless they have the pedagogical intention of leading the user through a particular path to the content.

Spawning of additional browser windows should be limited.

Browser windows which are created must have a URL bar.

While it is possible to use Java applets or Macromedia Flash to make complex, animated, interactive and potentially highly sophisticated material which can be rendered by a web-browser with a suitable plugin, the individual "pages" or states of navigation and activity have no URL. Educational material should consist of HTML pages with conventional hyperlinks, with Java applets, Flash, or any other non-HTML based systems are best used when their unique benefits warrant it[34]. For example, Flash can be used as an attention getting device to motivate young learners to continue. But Flash animations must be embedded in an HTML page.

Any modality or multi-page navigation ability within such Flash or Java applets cannot be bookmarked, referred to or recreated with a URL. The same is true of a page generated by a server-based program in response to form data, where the resulting URL does not encode all the information required for the server to create that page again in the future.

Be able to type in a new URL to view.

Browser windows, which are created, must also have a URL bar. Java and Flash should be used for individual interactive items rather than to create navigational paths involving what the learner regards as pages.

Be able to use the browser's Back button.

Browser windows, which are created, should have a toolbar with a Back button.

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[34] A site which uses Java applets to demonstrate principles of optics in a technically rigourous, visually highly instructive manner is: http://micro.magnet.fsu.edu/primer/java/aberrations/chromatic/ . The slider in this example simultaneously alters a simulated microscope image and two 3D representations of optical aberrations. Java is a non-proprietary open-standards programming language for platform independent interactivity in web browsers.

While modern browsers enable the use of the Back button with frames, the inability of the user to see the URL changing makes it hard to navigate more complex Back and Forward movements.

Automatically loading pages, which may present a barrier to backward navigation and falsely labelled "Back" buttons and links in the pages themselves are discussed below.

**Limit the automatic opening of multiple
browser windows and the automatic loading of
pages with different URLs except where this is
the best way of achieving pedagogical goals -
i.e. No (unnecessary) surprises.**

Any page which automatically and immediately loads another page constitutes a barrier to moving back to pages accessed before that page. A workaround is to have a link to manually press in order to load the page, and/or a 10 second time delay with an informative notice on the reloading function.

Pages which automatically open a new browser window or pages which load in a new URL represent one of many surprising and potentially confusing aspects of a website. They could make some cautious users apprehensive about clicking any link or image at all. They may fear that the results will be not what they anticipated or wanted, and that they would then have to close windows and attempt to find their way back to whatever page they were previously reading.

**Be able to bookmark the current page and by
clicking that bookmark later, restore the exact
window contents the user currently sees.**

Frames hide the URL of the main part of the window's contents. The user may think that the main body of what they see is at the URL which is visible in the URL line of the browser, since they may not understand frames, or may not know they are in a frameset. Bookmarking under these circumstances bookmarks the URL of the outer frame, and does not record the URL of the page or pages and other frames which are within the outer frame. So users may think they have bookmarked what they are reading, and only later, after having left that page, find that their attempt to bookmark it has failed.

Browser windows which are created must have normal menus and tool bars so that the usual methods of bookmarking work.

**Each page (as perceived by the user - the entire
contents of the browser window) should,
generally, as far as possible resemble and
behave as a single object. As part of this,
scrolling behaviour, such as with the scroll
wheel, should be as consistent as possible.**

Frames complicate the scrolling behaviour because the cursor (or rather the focus) could be in one of multiple frames depending on where the cursor was last clicked or is currently located.

Loss of page scrolling is expected and necessary behaviour once the cursor is placed in a text box - the text in the box will scroll, rather than the page.

Depending on the browser, a Java applet in the page may upset all scroll-wheel scrolling, irrespective of the cursor location.

Print the page as they see it.

Browser windows, which are created, should have normal menus to allow for printing.

Netscape 4 had difficulty with printing framesets but modern browsers print the entire visible browser window, including the contents of one or more frames. However, if the frames will not print on a page, or if they are scrollable such as "inline frames" then it may not be possible to print the entire contents of the frame, which may frustrate the user's intention.

Since browsers typically cannot print the output of plugins, these should not be used when .gif, .png or .jpg images will suffice.

See the full URL they will view (or open in a new window) before clicking (or right clicking) a link.

Browsers normally display this URL of a link in a lower status bar when the cursor is placed over the link. This is vital to informing users of the likely consequences of clicking the link, so reducing their errors in navigation, and improving their confidence in using the site. However Javascript can replace this with arbitrary text for that link, or prevent the status bar from showing the URLs of links by using it instead for scrolling text at all times.

All browser windows must have a lower status bar which shows the URL of the link over which the cursor is currently located.
If Javascript links are used, then they must either display the full URL, an informative subset of it, or perhaps some other informative text so the user is fully aware of the consequences of clicking the link.

The combination of not knowing what is going to happen when clicking a link, with various totally different kinds of event resulting throughout the site (for example, a new page in the current window, but perhaps new pop-up window, or small menu-less browser window, or a Flash animation with sound etc.) results in surprises which may be off-putting and disorientating for some or many learners.

On the other hand, in some settings, these surprises and game-like functionality may be pedagogically optimum because they uniquely support lively interaction and a "thrill of the hunt" motivational approach.

The learner should be able to open any link in a new browser window by using the right mouse button.
As browsers generally cannot open a Javascript link in a new window, such links should not be used unless there are specific reasons to the contrary.

The new browser window will not have any frame which exists in the current browser window, unless there is Javascript or HTML reload code in the new page to create such frame. This is another reason not to use frames.

The learner should not be distracted with any element of the web page which resembles the "Back" button of their browser.

There should be no links or buttons on the page which is labelled "Back". Such links should be labelled "Previous" or "Up".

The "Back" button is the most important and reassuring navigational tool of all. Ideally it means that any navigational choice or series of choices can be reversed.

The more trouble users have with clicking links and finding themselves in a situation they do not desire, and especially the more difficulty they have in finding their way back, the more stress and frustration they will experience with the site. Consequently, they will be less likely to use it and explore its depth.

Navigation Bar and Regularity of Links

Every page, other than windows which are always secondary pop-up responses to other pages, should have a consistent navigation bar in a prominent position.

Some or all of the navigation bar's links should be common to the entire site, or educational resource, however some parts of the navigation bar may be different for particular parts of the resource.

The "lack of clear 'home' or navigation to main orientation path" was identified as a barrier to effective usage in one of the documents, Fast Track to Usability, at the 2003 Series 5 Toolbox Development Workshop[35].

Navigation bars are easily achieved with frames - from the point of view of the web designer. However, as discussed above, frames are a serious barrier to the learner making full use of the educational material.

The navigation bar should be at the top or left of the page, so it can never be lost at the bottom of pages which are longer than can be viewed all at once - or at the right of pages which are too wide for the browser window.

Non-frames options include:
Generate the navigation bar element of each page via a template function, avoiding the need to revise every page in the site in order to change the navigation bar. This raises questions such as:
The requirement for a content management or web authoring system, which may not be compatible with every HTML file that different instructors may wish to add to the site or which may not be available to those instructors.
Problems of testing to ensure that all such changes to the pages work correctly.

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[35] Fast Track to Usability:

   http://www.flexiblelearning.net.au/toolbox/toolbox5''

Generate the navigation bar on the fly, with Server Side Includes. This means that all the HTML files need to be SHTML or similar, and to have a simple include line at the top of the page. The way this is done may have implications for cross-platform compatibility with particular Web servers and their underlying operating systems. Some open-standards approaches work on Windows machines, while Windows-specific approaches are hard or impossible to make work on open-standards systems. Open-standards have a role to play in making sophisticated sites with server-based programming compatible with both Windows and open-source web servers.

This option is only applicable to material on web servers, not material on CD-ROM or a local file system.

A Javascript approach in which each HTML file includes a common Javascript file which creates a navigation bar or menu dynamically. This needs further research - and involves complication and browser compatibility issues, since Javascript implementations vary considerably.

The template and SHTML server-based approaches may be harder to implement than frames, but the resulting site will be much more navigable and amenable to full, flexible, use by the user.

**All links should be instantly visually identifiable
as such, ideally in ways suitable for users
relying on screen-readers which convert text to
speech or Braille.**
It is vital that the learner be able to visually identify which elements (text and graphic items) on the page constitute links.

A game-like approach, with navigational functionality hidden for aesthetic reasons or to encourage, or require, the user to move his or her cursor over the page, clicking the mouse to find what to press in order to move forward, should only be used for specific pedagogical purposes[36].

**Unless there is a strong reason to the contrary,
all links should be text, or have text closely
aligned with a graphic image which also links
to the same URL.**

Graphic-only links are contrary to basic usability guidelines[37] and cause serious difficulties for sight-impaired learners who are using a text-to-speech system. The graphics link to the home page is, however, becoming a convention.

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[36] Fast Track to Usability:

  http://www.flexiblelearning.net.au/toolbox/toolbox5/

[37]W3C HTML Techniques for Web Content Accessibility Guidelines 1.0
  http://www.w3.org/TR/WCAG10-HTML-TECHS/#image-text-equivalent.

**Links should visually indicate whether they
have been followed previously.**

This is a simple and often essential aid to navigation. When the user has any more than a small handful of links to consider, it becomes impossible to remember which of them have been followed already.   As educational sites have a great deal of content, there will be pages with many such links and the learner should not have to follow links a second time because the site inhibits the usual method of seeing whether they have already read that page.

The standard HTML arrangement of blue and purple - for unfollowed and followed links respectively - should be retained unless there are pedagogic reasons to the contrary. Adherence to these standard colours may also assist those who rely on text-to-speech screen readers.

While it may be desired to harmonise colours with the overall design of the site, breaking the well-known colour relationship with followed and unfollowed links would raise further usability risks. For example, the new colours may not be visibly different on both LCD and CRT screens, due to LCDs having poor contrast in both highlights and lowlights.

Javascript links may not show such colours, so ordinary links should be used wherever possible. Similarly, Javascript-created menus, especially those with mouse-over animations and colour changes, cannot contain the standard blue or purple visual indicator of visited-link status, so they should be used only when needed. An instance of such an exception may be a link to a home-page or other central page, found on a site-wide navigation bar, where it is less important for the visited status of the link to be visible.

All graphics should have Alt text.

Graphics used for links should have informative Alt text. W3C Web Content Accessibility Guidelines require brief and informative Alt text for all images, not just those with links, with the distinguishing information first[38] so that people relying on screen readers with text-to-speech or Braille output can determine the nature of the image or link quickly.

Graphics which are purely decorative should have the Alt text defined as "". Further guidelines and examples for Alt text, such as in image-maps are available[39].

**Links which are visibly links should generate a
new URL, rather than be used to unnecessarily
activate a Javascript function.**

The user will find the site less confusing if all text or graphic items which appear to be links are used for loading other pages, rather than for running a Javascript function.

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[38] W3C Web Content Accessibility Guidelines 1.0, November 2000, Guideline 13.8
http://www.w3.org/TR/WCAG10-TECHS/#gl-facilitate-navigation

[39] David Appleby, *Development Content to Meet Web Content Accessibility Guidelines*,
http://www.flexiblelearning.net.au/toolbox/toolbox5/.

Use a form button to activate Javascript. This is an example of the more general usability problem mentioned in the next item.

Links, or any other navigational item such as a button or Javascript-generated menu item, should indicate to the user the type of action which will result by clicking it. Alternatively, some other means should be used to ensure the result does not surprise the user.

Just as a textbook typically explains its usage of various fonts and layout elements at the start, educational resources should explain any such special arrangements and use a consistent approach to indicate the nature of various types of navigational action.

Particular problems arise from[40]:
Inconsistent actions (eg. clicking the same type of link launches a new browser window, a popup, a PDF file, a Word document, etc.)
Lack of description for external links. It would, for example, be useful to include a description of the usefulness and content of links to external resources so that users can readily decide whether to proceed along that path.

Page Descriptions and URLs

Each page should have a unique, descriptive title, ideally reflecting its position in the hierarchical structure of the site, or competency unit.

This aids users in several ways:
They see an informative title in the top border bar of the browser window.
Similarly, the title appears at the top of a printed page.
It helps find the page amongst many bookmarks, since this will form the description of the bookmark.
Similarly, it helps find the page in the browser's History function.
When choosing between multiple browser windows using Alt-Tab, the titles of the browser windows are visible and are a crucial aid in choosing which one to open.
Similarly, the pages' names, or a very short part of them, are visible in tabs on the Task Bar.

For all but the first and second of the items listed above only a relatively short portion of the start of the title is displayed. If all descriptions of pages in a competency unit (or whatever section in which the learner is likely to open multiple windows) start with a common set of words, (for instance referring to the course or the competency unit), then the text which will be visible will be the same for all pages. Therefore, to make these distinctive for multiple pages within a competency unit or within some other section of an educational website, the page-specific part of the description should be placed first.

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[40] *Fast Track to Usability*, http://www.flexiblelearning.net.au/toolbox/toolbox5/

Longer titles are generally helpful, but may not be printed fully at the top of a page, especially if the space is restricted there due to the URL being long. Again, placing the locally distinguishing information at the start of the title will ensure it is visible.

So that URLs may be easily read by the user,
where the link text is the same as the URL, then
the URL should not contain spaces or
underscores.

Spaces in URLs typically stop Netscape 4.7 from following the link. Even with browsers which support spaces in URLs, such spaces are converted to a "%20" in the resulting URL, so creating an unnecessarily long URL and one which is visibly and technically different from its original form.

Underscores cannot usually be seen or distinguished from spaces in an automatically underlined link, and so present serious problems for manually writing down a URL, or for typing one read from a printed page.

A dash should be used as a word separator in URLs. Unusual characters such as ~ (tilde) and @ should be avoided.

Use lower-case for all directory and file names,
except perhaps where a short acronym for a
directory name is more recognisable as an
acronym through the use of upper case.

A regular approach to capitalisation is desirable. While capitalising the first character of words in URLs can provide a marginal improvement in readability, this leads to problems when reading a URL verbally to others in class, over the phone or in a videoconference. It is also more prone to error when writing down by hand. For these and for technical reasons[41] all lower-case is good practice. All lower-case file - and therefore directory - names were recommended in Feedback on User Needs from Toolbox Champions[42]

URLs of pages should be as short as possible
yet still be in some way intelligible to people.

Some web sites have long and completely unmemorisable database-generated URLs for all pages. Long URLs have a number of problems:
They are often hard to visually recognise (although longer, more descriptive filenames may be helpful).
They present problems copying into emails or other documents. Some sending or receiving email clients (including web archives of email discussion lists) truncate or wrap URLs which are longer than 72 or 80 characters. (This wrapping of URLs is another reason for ensuring the URL has no spaces in it.)

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[41] Capitalisation, such as of xxx.JPG or Xxx.jpg instead of xxx.jpg can cause testing problems for web designers since both will work from a local file system on a Windows machine and perhaps from a Windows web-server, but only one will work on all other server servers, which correctly perform no such case conversion.

[42] http://www.flexiblelearning.net.au/toolbox/toolbox5/ .

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They are hard to read to another person, such as the instructor, in a phone call or via some other voice or chat communication system.
Long URLs may not print fully in emails or at the top of browser printed pages.

Links to web sites beyond the local educational resource should make this obvious to the learner.

It would be helpful to less web experienced users to be told that some links will lead to an off-site location, and whether the link opens a new browser window or not. The development of a suitable link language, to do this, would be benefical

The easiest way to ensure that links to external sites are clearly visible as such may be to have link text the same as the full URL, perhaps minus the "http://". While it may be normal for the link text of links within the site not to directly resemble the files and directories of the URL, all links to outside sites should visibly show their full URL. So a link within the site to a section dealing with some real-life organisation, such as the ACCC, might have link text of "ACCC". But a link to the real ACCC site would have the link text "www.accc.gov.au".

URLs must never contain backslashes.

Microsoft browsers tolerate backslashes in URLs but this is invalid HTML and must be avoided.

Glossary Items, Searching and Indexing

Any glossary (or acronym) definition material available in a mouse-over or pop-up (Javascript or new web browser window) link should also be available as part of a glossary page which can be printed.

All elements of an educational resource which may have lasting reference or short-term educational activity value should be able to be saved to disk and printed.

Rather than have a unique page or Javascript function for each clickable or mouse-over glossary item, it may be better to have a single glossary, as a standard HTML file, with each item being addressable via a target. Then the clickable pop-up glossary window can be a small window which is large enough to show this glossary item. This means the entire glossary can be printed as a useful hands-on educational resource, which is an item of immediate and lasting use for the learner, and which enables hand annotation and easy reference both while using the computer and when away from the computer.

Such a plain HTML glossary can easily be amended and added to by local instructors. If, on the other hand, the glossary items are in separate files, or especially if they are buried in Javascript functions, then it would be much harder for the instructor to update the material and keep it synchronised with other course material.

From the learner's point of view, a single glossary for their entire course would probably be preferable. This will entail additional resources in the creation of educational material, since there is usually a requirement that individual competency units be easily disaggregated in order to facilitate the local consolidation and customisation of multiple units from disparate sources, and their integration with locally created material.

Since the purpose of the material is to empower the learner with no unpleasant surprises, designers should provide a unified glossary for either their entire course, or for each substantial, cohesive, part of it. A plain HTML glossary file, with links from other pages to targets within it, requires no special tools other than an HTML editor to adapt to local requirements - and so is preferable to more technically elaborate schemes.

It is desirable to use a consistent approach to links which bring up glossary definitions so that the user can recognise them as such, rather than as links to other sections of the course which deal with the concept in depth.

Underlining the entire term is awkward and detracts from other goals such as readability when printed. One good approach would be for the glossary link to be a consistent symbol or item of text, such as a question mark **?** following the term or acronym, which would naturally be underlined and show blue or purple according to whether this URL had been previously viewed.

Easy clickable, or mouse-over, access to the definition of terms and acronyms is one area in which a web-based educational resource can be much more instructive and easy to use than the paper-based equivalent.

The originally created educational resource, or whatever is locally created from disaggregation and modification of one or more resources, together with locally generated additional material, should have an index and a search engine if this is at all possible.

It is self-evident that the value of an educational resource to a learner is vastly increased if it has a search function and/or an index. An educational textbook without a comprehensive index and glossary would be unthinkable.

Online material enables the creation of an index, complete with hyperlinks, and a number of other unique items not available in printed materials, such as:
A search function - automatically able to search all the text of the HTML files and ideally Word, .RTF and .PDF files as well.
A reverse-linked bibliography, where firstly links in the main text lead to the bibliography, and secondly where the bibliography entries also link to the references in the text. (This integrates the author index with the bibliography and enables each reference in the site to a specific external resource to be located via a link).

Index fields in Word documents enable the automatic generation of indexes which are useful in proportion to the care with which the index fields were defined and refined. Good indexing is a time-consuming and challenging task but it greatly

enhances the value of the resource to the user. The Australian Society of Indexers site: http://www.aussi.org lists 50 or so Registered Indexers.

Search engines can be created for online or CD-ROM installations. A search function is almost certainly easier to implement for a web site or CD-ROM than a manually marked-up index.

Bibliographies, with reverse links, are technically possible but present significant challenges - and a search engine can provide the location of the references to each bibliography entry.

Freely available, well-documented search engine software, which is widely adopted for educational uses, would be of enormous value to the VET sector.

Printability and Non-standard Media Types

All pages should either be printable, or have a printable version easily accessible.

The optimal page layout for a computer screen may not be optimal for printing, so a separate print version may be needed. This adds complexity to the site, but if the desired results can be achieved with minimal or no duplication of material in files (which would lead to high costs in updating the site and validating its coherency), then a separate printable page is the best approach. CSS (Cascading Style Sheets) may be a good, or the best, way of achieving this by rendering two copies of the one HTML file in two different ways, depending on where the file is located in the site's directories and therefore which CSS file it includes.

Unless there is good reason to do so, a Flash or other complex plugin should not be used for a graphic or text element where ordinary text or .jpg, .gif and .png graphic could be used instead.

Browsers typically cannot print the on-screen visible output of plugins, so they should not be used unless they have unique functions which cannot be replicated by a standard graphics file.

The Windows graphics format ".bmp" is not a valid file format for web graphics, although Microsoft browsers display it.

Pages to be printed should be readable with a monochrome printer.

In addition to sensible font sizes, this requires that the font colours be black or dark grey when printed. Grey or any non-black colour prints as a mosaic of black and white on a laser printer, and so is harder to read, especially at small font sizes. (Netscape 4.7 could be configured to print all text as black, but MSIE 6 and Netscape 7 lack this facility.)

There should not be large areas of black or dark colours. Such large areas consume excessive laser printer toner and take much longer to print with expensive ink-jet ink. The costs and slow speed of ink-jet printing is a major consideration for home users. This, together with the information the user desires being spread over an excessive number of separate pages, constitutes a major disincentive to printing the resource.

The user's ability to print parts of the educational resource is a vital aid to their learning in the short- and long-term. In distance education with limited or expensive on-line time, the value of print-outs for offline reading, reference and annotation is likely to be especially high.

There are tradeoffs between the goals of easy printing, attractive web design for on-screen use and simplicity: maintaining and having the user access separate printable versions involves complexity and risk of an RTO updating one version but not the other. The learner's need for easy printing of educational material should be given a high priority in design decisions.

Web page designers should trial their pages on a monochrome printer.

General Complexity and Ease of Printing

Smaller numbers of pages with greater text and /or graphic content have advantages for users - in respect of printing and reducing the need for navigation to open multiple browser windows.

There may often be pedagogical arguments for presenting the learner with tightly focused material on short pages, such as not to overwhelm them with detail or require them to scroll downwards to see the entire page.

But for a learner who seeks to print some or many pages for later reading, annotation and reference, the task of printing large numbers of pages, each with little content, is inefficient.

Firstly, the learner has to identify the order of the pages and print them in this order. Secondly, paper and probably ink and time will be wasted by the multiple smaller pages being partly blank and partly filled with the same navigation bars etc.

A longer web page, such as HTML which would print on two to four pages of A4 is not a "large file" from the point of view of downloading speed, unless it contains elaborate graphics. Graphic files also result in slow printing, so graphic-intensive pages are probably best kept relatively short.

The counter-argument is that learners may wish to print or refer to only one item at a time, and making each page too long inhibits them from focusing on and printing the particular item they are interested in. Fragmentation of what, in a textbook, would be a longer and more cohesive passage, should only be implemented for well founded pedagogical reasons.

Breaking educational material into excessively small pages and/or into pages which are numerous due to some overlap (such as duplicating a glossary definition in a central glossary page by also having it as a single definition in a pop-up window) imposes difficulty for any learner who wants to access material in a systematic, linear, manner, as they would a textbook.

An example of fragmentation might be one of the earlier Toolboxes - the Series 2 Frontline Management - which has approximately 8,980 HTML files. But such large numbers of files may also reflect the depth and specialisation of the educational resource - and the need to duplicate some material in each directory to ensure that it can be disaggregated easily and reliably.

Since web-based educational resources typically need to be combined with other resources, updated, localised and extended, it would be helpful if specific operational guidelines were developed on a national basis for regularised, informative and generally unsurprising methods of using links to URLs such as:

ordinary pages in the local resource,

glossary and acronym definitions, and

external sites.

Implementation

While Preferred Standards are identified via Workshops of all States and Territories, Operating Guidelines, being more general, are less likely to directly conflict with commitments to particular standards in the various States and Territories.

Attachment 12 Base-level Web Skills for Learners

Learners using a web-based flexible learning system spend many hours working intensively with their web browsers. They need certain basic skills in order to confidently make full use of the educational resource and other web-based resources, such as search engines. These skills include making and using bookmarks and emailing URLs to instructors and other users etc.

The skills listed below are intended to be a basic set for anyone who needs to make extensive use of a web-based system - as any use of a web-based VET educational resource involves. They are all valuable skills in their own right for personal and work purposes. This list of skills may need to be adapted for users with sensory or motor disabilities and for those who due to their age, cultural or language barriers, are not expected to need or acquire all these skills.

The objectives of these Operational Guidelines are:

1. To enable web-based designers to assume a certain level of user skill and sophistication, rather than having to complicate or limit their web-based material in order to cope with the possibility that the user lacks certain crucial abilities.

2. Instructors involved in inducting learners into a flexible learning course will have a set of competencies to work towards.

These skills are not complex or hard to teach. Many people who use the Web regularly already have many or all of them.

Other sets of competencies should be developed for collaboration or interaction between learners one-to-one and in groups:

- Email.

- Real-time "chat".

- Mailing list / web archive / web-posting / file-sharing discussion forum.

- Voice and videoconferencing.

There are two major dimensions to the user's ability to make full use of these four types of communication:

1. Technical skills for operating particular pieces of software, using the functions of particular web-mail and web-based discussion forums etc. These cannot be generalised - the user needs skills specific to the particular systems used in their course or, although email users usually use their own email accounts, rather than any the course may provide.

2. Social guidelines for how to use these systems well. These can probably be generalised to a large extent, irrespective of the details of particular user software or web-based systems. General user awareness of the social factors in group and one-to-one communication will lessen the need for course instructors to assist learners in this regard.

The web skills listed below have no such social dimension. Nor do they depend much on the particular browser which is used - although there are some browser-specific differences such as in their bookmark capabilities.

Web Usage Skills

These are basic skills, based on self-evident needs for maximising the utilisation of course and other web-based resources, both while online and later, such as by printed and saved pages. The skill set comprises the ability to:

- type in a URL, such as from a printed document, and make the browser display this page.

- open multiple browser windows and switch between them quickly - Alt-Tab on Windows. Multiple browser windows may be created by the site - and learners must know how to right click a link to open it in a separate browser window, or to create a fresh window for further activities whilst leaving the current window or windows active. This avoids the need to minimise one window before maximising another one from the task bar.

- change the size of windows from full-screen to less than full-screen (and vice-versa) - and then be able to move and resize the smaller windows so they work with two or three windows simultaneously visible when they wish to.   This enables users to view more than one web page at a time, which greatly increases their capacity to access information freely.

- bookmark a page using a button, menu item or keyboard shortcut.

- use bookmarks, via a menu item or button - and preferably via the keyboard shortcut which opens the most powerful bookmark facility - so users can easily open a page they previously bookmarked. This includes the ability to open a bookmark in a new browser window so as not to end activity in a current window. Bookmarks are discussed further below.

- use the History list and Go button (Netscape) or View > Go to (MSIE). History is discussed further below.

- save a page on their computer so it can be opened later when offline. This involves specific browser commands to save the entire page, with graphics etc. and some knowledge of the user's own computer's filing system. (Both printing and saving pages and files on the computer are fundamental processes by which learners can maximise their utilisation of educational resources and web-based material in general. To be unable to do this restricts their ability to read this material, and makes it impossible to create hard copy for annotation and reading when not near a computer.)

- use search engines. For instance they should know it is easy to find pages containing certain words and a phrase in the .edu.au domain. and perform more sophisticated searches. They should be given some practice refining a search - such as not just for "battery" but for

automotive batteries, in Australia or within a more narrow geographic area by including city and town names in the search terms.

- be familiar with their computer's clipboard, and know how to copy to it and paste from it, in order to be able to integrate their web activities with chat, email and discussion forum communications. They must be able to copy and paste in a variety of circumstances, such as between email / chat / discussion forum activities and the URL line of their browser. They also need to know that the browser, with a right click option, makes it easy to select a link's URL and copy it to the clipboard, where they can paste it into an email, or into the URL line of another browser window. Since some web pages, PDF files and Word documents contain URLs which do not function as links, the ability to select the text by dragging the cursor over it, empowers them to easily copy and paste the URL and so to view those pages without manual typing. Prepending "http://" to the URL to make it a clickable link in the recipient's email system greatly facilitates communications.

- depending on the nature of the course, be familiar with filling in a web page form and the action of sending it - so the information goes back to the server (or perhaps is processed locally by Javascript or a Java applet) with the result being a new page probably depending on the way the user filled in the form.

Bookmarks and History

The History and Bookmark functions of a browser are crucial to the navigation which is central to all serious web usage. The History and especially the Bookmark functions of Netscape 7 are more extensive than those of Microsoft Internet Explorer 6 (MSIE 6). MSIE 6's Ctrl-H History displays only limited-width details of the names of pages visited, and no URLs, while Netscape 7's History displays both fully, with dates, and provides the ability to sort on name, URL and date.

Netscape 7's Ctrl-B Bookmark facility is similarly much more informative than MSIE 6's "Favourites". Bookmarks can be sorted by name, URL and date. Bookmarks can be searched, with searches being saved in the Bookmarks themselves. Multiple bookmarks can be selected, moved, copied and pasted. Netscape's Bookmark facility is practical for handling many thousands of bookmarks, enabling a user to add them freely and maintain a growing Bookmark list for years. MSIE 6's Favourites cannot be searched and so are much harder to use if more than a few dozen are accumulated.

Netscape's bookmarks are saved as a single bookmarks.html file. This is more efficient than MSIE Favourites use of individual "shortcut" files. Both MSIE 6 and Netscape 7 can import and export bookmarks.

The full use of bookmarks would allow a user, for example, to search for sites which are relevant to the field, and bookmark them for immediate and later use.

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