

**Open Source Courseware:  
A Baseline Study**

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## **Abstract**

This report presents the results of a study that aims at contributing to the pool of knowledge about Open Source Courseware (OSCW), a fast growing phenomenon in the tertiary education arena. The study sought to identify and document the existing and potential OSCW initiatives globally, analyze the issues involved and discuss potential implications to online tertiary education globally. The study reveals that OSCW has generated interest in all parts of the world with the USA taking the lead. Although the concept is yet to have measurable effects on learning in institutions of higher learning, there are indications that OSCW is viewed as a valuable opportunity by institutions in developing countries. However, their participation is being constrained by lack of the requisite resources to develop and adapt courseware to suit their specific environments. It is also observed that commercial software vendors are beginning to show interest in OSCW. Given current trends, the author predicts that commercial vendors will eventually build partnership with OSCW consortia to provide support and maintenance to OSCW users – a service which is currently lacking.

### **1.0 Introduction**

Since the Massachusetts Institute of Technology (MIT, 2002) announced its intention to post its courses on the Web about two years ago, institutions seeking to mainstream flexible learning are increasingly adopting the open-source courseware concept that is, making their courses and programs a set of global public goods, available on the Web to any educational institution interested in using them, provided that they adhere to some basic rules of engagement. While the ultimate objectives of these institutions remain unclear, there is no doubt that this trend is likely to change the landscape in very significant ways.

The open source approach is not by itself distance learning and neither does it replace face-to-face learning. Rather, it facilitates availability, development, and distribution of the best available learning materials in a cooperative manner, thereby tapping the best brains around the world for the benefit of all, with continuous improvement. Producing and distributing the material through this approach involves developers and providers at many different locations and organizations, in and outside any one institution, operating in a partnership mode. Feedback is encouraged from all

users and in some cases, the developers allow users to modify the content as they find appropriate, provided that such modified content is in turn, shared with all members of the partnership.

An emerging trend in the development of OSCW is the building of global coalitions or consortia institutions, sometimes involving private sector developers/providers under the so-called "creative commons," concept, an evolving concept proposed by Professor Lawrence Lessig of Stanford University.

For individual institutions, the OSCW concept needs careful consideration. Because the courseware is developed by individual staff, rendered in electronic form and made accessible to everyone, many issues arise, including:

- ownership of intellectual property rights (IPR) for the content;
- branding of the content since it is subject to modification by users;
- Standards as more and more players get on board;
- Interoperability between content developed by different groups;
- Implications of Global Agreement on Trade in Services (GATS);
- Potential conflict with software patents.

In response to these challenges, two key initiatives have emerged: Creative Commons and the IMS Global Learning Consortium as the "de facto" licensing and standard setting authorities, respectively. A "creative (knowledge) common," is the space between vigorously defined IPR on the one hand and public good on the other. Recognition of the source (contributor) and conditions for use (e.g., permission of modification without authorization, or not) are currently handled on a case-by-case basis using standardized contracts. But how far can this go, especially when the users are in developing countries where the rule of law is not well enforced? What happens when the intellectual property is translated to another language? The above issues and questions are discussed further in subsequent sections.

## **2.0 Current Status**

The development of open source courseware is a very recent phenomenon. Since MIT's announcement, a number of other institutions have joined in. MIT now has 900 courses already posted on its Open Source Courseware website:

<http://ocw.mit.edu/ocwWeb/> and the plan is to have all the 1800 courses by 2008. MIT open courseware is being translated into

other languages in India, Germany, China and Vietnam under special arrangement with MIT and in some other cases (e.g. Makerere University in Uganda), MIT has agreed to let institutions create mirror sites at their locations. An interesting development is that MIT now has a separate website where users can learn how to create their own OCW:

<http://ocw.mit.edu/ocwWeb/HowTo/Index.htm>.

Several other universities around the world, either singly or in groups have indicated interest in joining the OSCW bandwagon in the years to come. Yet, at the same time, some other universities around the world consider online course content to be proprietary material; access to this material is restricted (through usernames and passwords) to those who have paid the relevant access fees. The introduction of OSCW is, therefore, bound to have a significant impact on the management of, and business in online education as we know it today, especially in the light of the General Agreement on Trade in Services (GATS) which will soon be the global norm.

The most current trend is to move towards consortia of the 'converted', involving institutions around the world. Noteworthy mentioning here is an effort by the Helwett Packard Foundation that brings together the MIT, the University of Utah, Rice University, and [opencourse.org](#) (private company) with a view to developing an open sustainable learning opportunity. Each one of these partners has already an OSCW effort of its own and in some cases with major international partners (e.g. the MIT - [China Open Resources in Education \(CORE\)](#)). As institutional interests start coming into play, it is not clear which way these efforts will eventually head.

### **3.0 Who is involved?**

If the nineties were called the e-decade, the current decade could be termed *the o-decade* (open source, open systems, open standards, open access, open archives, open everything). This trend, now unfolding with special force in higher education, reasserts an ideology that has tradition traceable all the way back to the beginning of networked computing. Some (Unsworth, 2004) trace it back to Thomas Jefferson's famous principle that "ideas should freely spread from one to another over the globe") – a trend that has been adopted by reputable institutions, including not only some of the great public and private universities, but also major private foundations.

Almost all the major developments in OSCW have their roots in the USA. MIT continues to be the *'de facto'* leader among institutions of

higher learning involved in OSCW worldwide. But several others are making significant contributions to the development of the concept. Players include individual HE institutions, foundations and business enterprises, working alone and/or in partnership (consortia). A list of some of the key collaborative initiatives is given in Appendix 1. Some of the notable ones (based on the author's own literature search) are described below.

### **3.1 Institutions**

#### *3.1.1 Already existing products*

##### The University of Michigan at Ann Arbor

For sometime, the University of Michigan has had two academic software tools which are used by the 30,000 students and 1,500 academic staff at the institution. In 2002, the University decided to rewrite the tools for use in the open source environment, in collaboration with other institutions (Olsen, 2002). The software tools are: *UM.CourseTools*, which is used for teaching and learning, and *UM.WorkTools*, a related software that is used for collaboration and research. The re-written software is based on the interface standards of the Open Knowledge Initiative (OKI), the effort of a consortium of universities led by the Massachusetts Institute of Technology and Stanford University.

##### Rice University

Rice University has evolved to be one of the lead institutions in Open Source Courseware. Its *Connexions* environment for collaboratively developing, sharing and rapidly publishing scholarly content on the Web is unique in that it contains educational materials for all ages – from children to college students and professionals. Like most other leading OSCW providers, *Connexions* content is free to use and reuse under the [Creative Commons "attribution" license](#). Rice University is part of The William and Flora Hewlett Foundation OCSW Initiative which also includes MIT, Carnegie Mellon University and the Harvard University Library. More information on *Connexions* is available at <http://cnx.rice.edu/>.

##### North Carolina State University

North Carolina State University's *Digital Enterprise* project is the cornerstone of its [Open Courseware Laboratory](#) which begun in 1998, initially for its students and staff. Educational material available under the project is publicly available for individual use via the web without any charge. Compared to the MIT, NC State's

OSCW seems to be less developed and not much has been added for about one year. More information on the NC State initiative is available at: [http://digitalenterprise.org/rd/\\*http://open.ncsu.edu/](http://digitalenterprise.org/rd/*http://open.ncsu.edu/)

### Harvard University

Harvard University, a premier university in the USA known for its world-famous MBA program is also a member of the OSCW family. With support from the [William and Flora Hewlett Foundation](#), the Harvard University Library Open Collections Program was established in November 2002. The objectives of the program are "to create comprehensive, subject-based digital collections that will benefit teaching, learning, and research; (and) to create high-quality digital resources which can be shared with other institutions". The first collection is titled: *Women Working, 1870-1930*. More information is available at <http://ocp.hul.harvard.edu/>.

### *3.1.2 Pipeline Projects*

#### Cornell University's Open Source Package for Electronic Journals

With the support of the [Andrew W. Mellon Foundation](#), Cornell University is developing an open source package for producing electronic journals and monographs (Carlson, 2004). The software was originally developed for Cornell University Library's collection of mathematics and statistics electronic journals. According to the University, a beta version of the re-tooled software (called DPubS for Digital Publishing Software) will be available in 2005. Penn State University libraries and press have offered to cooperate in testing and enhancing the software. A conference organized by Cornell University in 2004 to seek suggestions on features the software should offer drew participants from US, Australian, German and Chinese universities – a demonstration of the fast-growing interest in OSCW.

### **3.2 University-University Consortia**

#### The Sakai Project

Four universities which have hitherto had their own open learning initiatives have recently announced a collaborative venture to create open-source courseware tools and related software for higher-education institutions (Foster, 2004). The joint venture called the *Sakai Project* is being developed by the Indiana University system, the Massachusetts Institute of Technology, Stanford University, and the University of Michigan at Ann Arbor, which leads the effort. The

project is jointly funded by the institutions (by providing services) and The Andrew W. Mellon Foundation. As of January 2004, thirteen other universities - including Carnegie Mellon, Northwestern, and Yale Universities; and the University of California at Berkeley have expressed interest in accessing the courseware tools. More information on the Sakai project can be accessed at: <http://www.sakaiproject.org/>.

### The OSCu Project in Finland

The Open Source Courseware (OSCu) project is a cooperative effort by three Finnish universities – Tampere University of Technology, Oulu University and the University of Tampere whose main aim is to increase universities cooperation in course development. The project started in 2001 – some months before the MIT Open Courseware (OCW) project. The main factors that motivated launching of the project were (Ala-Mutka & Mikkonen, 2002):

- Increasingly more students need to be educated in IT skills but there aren't enough qualified senior academic staff to meet the demand. As a result, more and more courses are being taught by teaching assistants.
- Teachers need to invest lots of time in an attempt to catch up with rapidly evolving knowledge and skills in IT. This leaves less time for course development and learner support.
- High turn-over of professors and teaching assistants with knowledge in IT due to competing demand from industry. OSCW allows teachers to collectively utilize the comparative strengths of the three universities to offer new courses and to improve cooperation among universities.

Experience with implementation of this project within the three Finnish universities suggests that open source courseware can be successfully used in regular courses. The main advantage is that even without the qualified senior staff, a participating university can launch a new course developed by another university in the network provided that there are teaching assistants to support learners. As the authors point out, however, good coordination among the participating universities is crucial for success.

### **3.3 University- Industry Partnerships**

Initiatives like Rice University's *Connexion* and MIT's OCW that started as partnerships between individual universities and industry have now grown to be part of larger consortia involving more than one university. The William and Flora Hewlett Foundation and the



Mellon Foundation have distinguished themselves as the most active industry partners in OSCW.

#### The William and Flora Hewlett Foundation OCSW Initiative

The Hewlett Foundation is one of the pioneers of the Open Content Initiative which has now grown to be part of a movement - a movement that seeks to equalize the distribution of high-quality knowledge and educational opportunities for individuals, faculty, and institutions throughout the world. Over the past several years the Foundation has been working to make high quality academic content freely available worldwide through its Open Content initiative. Started in 2001 with the MIT OpenCourseWare project <http://ocw.mit.edu/>, the initiative now includes a portfolio of full courses developed by Carnegie Mellon University <http://www.cmu.edu/oli>, a community-based learning 'objects commons' developed by Rice University <http://cnx.rice.edu/> and special collections made available by Harvard University Library <http://ocp.hul.harvard.edu/>. Other supported projects include content for the high school and community college student audience and a variety of tools for making access to the content easier for the user audience.

#### The Mellon Foundation

The Mellon Foundation is the main sponsor of the Cornell/Virginia Fedora Project and the LionShare initiative. [The Fedora Project](#) is an initiative of Red Hat Inc. that aims at working with the Linux community to build a general purpose operating system exclusively from free software. Development is being done in a public forum. According to plan, the project intends to produce time-based releases about 2-3 times a year. So far, there have been three releases of its Fedora Core software. LionShare is essentially peer-to-peer networking with authentication which is better known for its application in music sharing (Napster etc.) and video conferencing, has recently found new applications in the open source courseware arena.

### **3.4 Global Coverage**

Outside the USA and Europe, developing countries in Africa, Asia and Latin America have demonstrated unprecedented interest in OSCW. Several universities in China, Vietnam, Africa and Latin America have acquired or are in the process of negotiating acquisition of mirror servers hosting the MIT OCW. China has launched its own initiative – the China Open Resources in Education (CORE). The aim is to leverage existing talent in the country in

collaboration with US universities to develop open source resources to be shared among educational institutions.

### FOSSFA

In Africa, the Free Open Source Software Foundation for Africa (FOSSFA) is leading a continent-wide effort to develop open source educational resources. In a conference held in Cape Town in January 2004, FOSSFA set up a group to spearhead this effort.

In India, the Department of Information Technology has expressed an intention to introduce Linux as the de facto standard in academic institutions – a clear indication of an intention to mainstream use of open source resources in teaching and learning.

### The Open Society Initiative

In a wider scale, the Soros Foundation through its Open Society Initiative (OSI) is supporting two key efforts that are likely to have a major thrust to the development of open source resources: the *Open Access Project (OAP)* and the *Intellectual Property Rights (IPR) and Knowledge Governance Project*.

The objective of the OAP is to assist the international effort to make research articles in all academic fields freely available online through supporting authors and institutions to publish in open journals; support to development of guidelines for open source publishing; spreading awareness on the benefits of open access; and supporting development of tools to assist in the adoption of open access (Hagemann, 2004). The IPR and Knowledge Governance Project aims to assist disadvantaged countries to shape IPR regimes to their needs and interests, with an emphasis on copyright issues as they relate to access to information and knowledge and free expression. It also supports experimentation with new models for the production, financing, and dissemination of information-based goods (Franz, 2004).

### uPortal

uPortal is a free shared web-based portal which is currently under development by various institutions of higher learning all over the world. The majority of participating institutions are US based. The list of members varies widely from community colleges to leading universities like Princeton and Yale; developing country institutions like the Vietnam National University; and institutions from all continents except Africa and Antarctica. The objective is to develop a unified web portal through which all participating institutions can

publish learning materials using a common standard. Participants are free to download and customize uPortal to suit their local needs. More information on uPortal is available at <http://www.uportal.org/>.

#### The UNESCO Free Software Portal

UNESCO hosts a portal whose objective is to provide a single interactive access point to information for users who "wish to understand and follow the free software movement, to learn why it is important and to apply the concept." The portal can be accessed at: [http://www.unesco.org/webworld/portal\\_freesoft/index.shtml](http://www.unesco.org/webworld/portal_freesoft/index.shtml)

There are several other open source CMS portals available on the web. These can be accessed at: <http://www.opensourcecms.com/>

#### The IMS Global Learning Consortium

The largest existing consortium in open source resources for higher education is the [IMS Global Learning Consortium](#) (IMSGLC). Established in 1997 to support the adoption and use of learning technology worldwide, this non-profit organization has about 50 members and affiliates, including educational institutions, hardware and software vendors, publishers, government agencies, systems integrators, multimedia content providers, and other consortia. The list of members on November 25, 2004 is attached as Appendix 2.

Although the consortium started with an aim to serve the higher education community, it has now developed open source shareware specifications for a wide range of learning contexts, from K-12 schools to corporate and government training. IMSGLC specifications have now become the global standards for open source learning products and services. A list of the specifications developed so far is attached as Appendix 3. These specifications (34 already released to the public) relate to not only web-based learning contexts but also the traditional (face-to-face) and multimedia-enhanced contexts.

### **3.5 Private Enterprises**

Private companies that develop/sell educational software are positioning themselves to enter the open-source courseware initiative by offering open-source software at highly discounted prices. In 2003, for example, two companies that sell software and services compatible with the open-source operating system Linux Red Hat, of Raleigh, N.C., and SUSE Linux, of Nuremberg, Germany announced major discounts on their products for educational

institutions (Foster, A. 2003). Like all open-source products, the source code is open for users to modify to suit their situations as well as to fix bugs. Both companies offer major discounts on their software on the condition that users provide feedback to the companies when they experience bugs or implement modifications of the software.

Microsoft Corporation – the software giant of the world - has developed a special version of its Windows Operating System called [The Microsoft® Windows® CE Shared Source Academic Curriculum License \(SSACL\)](#) that is intended to assist researchers, professors, and graduate students by allowing them to use Windows CE source code to create curriculum and other teaching materials. Use of Windows CE comes with some hefty restrictions. Users are prohibited from using Windows CE for profit or commercial purposes; sub-licensing or distribution of the source code; inclusion of any third-party code in modifications; or inclusion of any source code in modifications.

Despite these restrictions, the involvement of leading software companies like Microsoft suggests that commercial vendors see a potential future business opportunity in OSCW. And this would not be surprising. Whereas universities have the talent and space to experiment with new ideas, they lack the capacity to support a network of users and to ensure a timely and orderly maintenance of the product. This is precisely where commercial vendors could add value. The challenge is how to develop a partnership that is a win-win for both HE institutions and commercial vendors while maintaining the underpinning 'free' and 'open' characteristics of OSCW.

#### **4.0 Benefits and Risks**

From the fore-going, the main benefits of Open Source Courseware can be summarized as follows:

- It offers an *opportunity for faculty of the offering institution to learn* from colleagues and from others around the world;
- *Students of offering institutions have free and expanded access*. This makes it possible for these institutions to handle more students through online or flexible learning. It also offers an opportunity to enhance constructivist teaching and learning approaches and hence increase learners' motivation;
- *Faculty publicize themselves*. By opening up their courseware to peers around the world, faculty publicize themselves among peers, students and other interested parties. This

might attract funding for research and/or more students to the university;

- *Lowers costs of developing courses.* This is especially true of institutions in resource constrained environments who might not have the requisite faculty to develop courses in certain key areas;
- *Flexibility and Cost-effectiveness.* No need to invest in commercial CMS. Savings on licenses for commercial versions of CMS could be significant (up to 25% of total cost). Also, since the source code is available, one has the flexibility to modify the platform to suit local needs;
- *Ease of integration and interoperability.* While commercial-vendor offerings primarily use proprietary code, open-source software is based on open standards that foster integration and interoperability, reducing an institution's dependence on a single vendor and its costs;
- *Allows timely sharing of new knowledge* in a seamless manner as IPR constraints are minimal or non-existent;
- Offers a *healthy balance* between working within sustainable IT economics and addressing the requisite frontiers of innovation (Wheeler, 2004);
- *Future Proofing.* Unlike commercial software, with an open-source solution (e.g. for CMS), the reliance on a single vendor for all support and upgrades is eliminated. Even if a product is terminated, full access to the code allows for ongoing in-house development.

There are, however, some risks/weaknesses too.

- *Exposes offering institution* to potential negative image if materials are perceived to be sub-standard. By exposing itself to the world, the offering institution might earn a bad name if materials are not subjected to adequate quality control and continuous updating.
- *Offering institution loses control* after material is translated to other languages. The identity of the offering institution becomes obscured as others modify the materials though the materials continue to be associated in part, to the source university. This could have a negative reputational effect;
- *Materials not adapted to some cultures* – export foreign cultures? Examples and illustrations used in course materials could be more attuned to the culture of the source institution. Due to the tendency to trust materials from brand-name institutions, OSCW might serve as a very effective vehicle for exporting foreign cultures and values. This might have some

positive effect but more often than not, it has a negative effect;

- *Sustainability*. How will one cover the costs? The perception that OSCW is free might result in reduced budget allocation. There must be adequate funding for support and maintenance;
- *Lack of structured support system*. Who do you go to when it is not working? Since there is no “vendor” responsible for OSCW, there is no one specifically responsible for fixing problems (e.g. bugs, spam overload and viruses) or implementing upgrades on existing materials. This places extra responsibility on the institutional technical staff to ensure that the learning platform remains functional, up-to-date, relevant and meaningful to their specific needs;
- *Poor usability* (Bernard, 2002; Concoran & Concoran, 2002; Williams, 2000). Most open source Content Management Systems used to host open courseware have poor usability when compared to commercial CMS products. This is an area that requires improvement; and
- *Insufficient Documentation*. Pre-occupied with the intensive development work involved, most existing OSCW systems provide limited documentation, particularly for the CMS used.

In view of the above, there are doubts as to whether Open source is suitable for everyone and all situations. Gregory A. Jackson of the University of Chicago suggests that the decision as to whether to go for open source or commercial software should be made using the same procurement considerations used in purchasing commercial products (Jackson, 2004). He states “Open source can be the right answer when colleges and universities base their decisions on careful, complete analysis of relative costs and benefits, avoid unnecessary heterogeneity, specify integration requirements carefully, and avoid ‘religious’ arguments”. I cannot agree more.

## 5.0 Cost Considerations

Using OSCW does not require a license and, therefore, there are significant cost savings since one need not pay license fees. But this does not imply that there are no costs. According to a recent study by [Soreon Research](#), licensing fees alone comprise about 20-25% of the total cost of ownership of any software (Soreon, 2004).

Carl W. Jacobson, director of management-information services at the University of Delaware thinks that the ‘free’ part is often misunderstood (Olsen, 2003) and adds: “As with any software

project, the largest portion of the cost of open-source software is spending on local expertise -- learning how to install it and then training people to use it".

According to the Soreon Research study (titled Saving Cash: A Comparison of Open Source and Proprietary Software' <http://www.researchandmarkets.com/reports/c4117/>) which analyzed case studies carried out in Germany (Germany is one of the pioneers in the use of open source software), there are considerable costs that users of open source software have to bear. The report is based on interviews with, and analysis of data from over 50 software developers, vendors, users (including training institutions) and system retailers as well as more than 50 German companies and organizations. The study sought to establish the total cost of operations (TCO) of using Open Source Software (OSS), advantages and disadvantages of using open source, its economic viability and plans for the years ahead. The following were the main findings.

## **5.2 Main Findings from Case Studies**

- Cost savings from license fees and operating costs can be as high as 30% (compared to proprietary software), depending on the size of the organization.
- Large organizations have greater potential for cost savings (compared to small and medium size organizations). This is because large organizations would typically have already some internal know-how on using OSS (limited need for training). In addition, license costs for proprietary software are higher for large organizations. The report cites as an example that, with a Million-Euro budget Open Office instead of MS Office, one would have a 20% cost advantage.
- The largest, absolute savings potentials were found in organizations with a variety of office applications. According to the results of the SOREON model calculation covering a three year period, a large-scale enterprise with 2,000 jobs saves € 525,000 with office applications, € 57,000 with servers, € 32,000 with content management systems and € 21,000 with databases.
- The report cautions that each organization has to undertake a detailed, individual TCO analysis for itself since there are significant variations even among organizations of the same size. The main drivers of savings apart from license costs were found to be volume of data and the extent of data migration required in transitioning from proprietary to open source software.

- In the short to medium-term (Soreon estimates within the next five years), use of OSS will increase substantially among large enterprises and public authorities, putting pressure on vendors of proprietary software to open themselves to the OSS model.

A full copy of the report can be accessed (at a fee) at:

[http://www.researchandmarkets.com/reportinfo.asp?report\\_id=222226&t=d&cat\\_id=4](http://www.researchandmarkets.com/reportinfo.asp?report_id=222226&t=d&cat_id=4)

There is good reason to assume that the lessons from OSS would also apply to OSCW since both are based on communal development of software products and making them available to any taker for free. The difference, however, lies in the fact that OSCW has to be more mindful of quality, support and maintenance if it is to be mainstreamed in institutions. Students pay fees and they expect quality courses delivered in a timely manner and with adequate support. The savings realized from licensing might, therefore, go into increased operational costs to ensure that the 'communal' product is adequately tailored to local requirements and to put in place the necessary support and maintenance capacity.

## **6.0 Markets and Research**

A considerable number of publications on OSCW have been produced over the short time that OSCW has been around. The Chronicle of Higher Education has published a number of short articles, primarily presenting reflections from faculty and university managers involved on OCSW and to a lesser extent, corporate users. Except for the studies by Newmarch (2004) and Sereon Research, there is little documented information on the experience in using open source courseware, including issues of cost and impact on the quality of learning. The most comprehensive list of open source courseware publications is available at:

[http://www.wu-wien.ac.at/~koch/forschung/sw-eng/oss\\_list.html](http://www.wu-wien.ac.at/~koch/forschung/sw-eng/oss_list.html)

## **7.0 Issues**

### **7.1 Standards**

Two of the key principles of the university based projects described above are *unbundling and interoperability*. The underpinning approach is that all OSCW material has to be freely compatible with commercial software except those that exercise strict monopolies. This principle follows from an established tradition in the open



source software movement. Unbundling and interoperability allow choice and flexibility for users to choose to mix different applications to achieve the best performance for a particular purpose and at the best price. And, when a new, better version becomes available, one can swap out that piece, rather than waiting until the whole system is intolerably outdated, and then undertake vast, transition from one system to another.

The real question and challenge is in the enforcement of these principles. Though the IMS Global Learning Consortium has emerged as the *de facto* standard bearer for the open source movement, the organization has no mechanisms to enforce adherence. It remains a, "*honor system*" that is subject to abuse/misuse by unscrupulous users. As the number of contributors and users grow, there will be need for a mechanism for enforcing compliance with principles and specifications.

## **7.2 Copyright and IPR**

Jan Newmarch (2000) of the University of Canberra in Australia in his paper titled: "Who owns the University Courseware" was among the earliest that raised the issue of ownership and copyright of Web-based courses. In his paper, Newmarch argues that by putting courses on the web, the power of ownership shifts from the authoring academic to the University management without any compensation to the author. He therefore proposed the development of an institutional policy that provides for a distinction between authorship and delivery whereby the academic staff retains the copyright but the course delivery rights rest with the university management. For this he also proposed incentives for authors similar to those existing for research publications.

Since Newmarch's first publication, the discussion on IPR has evolved and grown in complexity (Newmarch 2001). The problem of copyright and intellectual property rights ownership has been compounded by the open sharing of courseware across institutions in very different geographical locations, language blocks, levels of development and cultural contexts. This was probably the motivation behind the development of the *Creative Commons* concept by Stanford University.

### *7.2.1 Creative Commons Concept*

[Creative Commons](#) is an initiative of, by and based in the law School of Stanford University. Under the initiative (established as a non-profit organization), a set of licenses for regulating collaboration in OSCW has been developed. These licenses take the

place of similar ones in the commercial software industry but are available for free to developers and users of open source courseware. Altogether, there are 11 types of licenses. For each of these licenses, the author retains the copyright of the courseware but offers some of his/her rights to others *under certain conditions*. The most common license types are:

- *Attribution license*: allows others to copy, distribute, display and perform one's copyrighted material and derivatives thereof – but only if they give credit to the author.
- *A Non-commercial license* : allows others to copy, distribute, display and perform one's copyrighted material and derivatives thereof – but only for non-commercial purposes.
- *No Derivative Works license*: allows others to to copy, distribute, display and perform one's verbatim copies of copyrighted material but not derivative works based upon it.
- *The Share-Alike license*: allows others to distribute derivative works of one's copyrighted work but only under a license that is identical to the author's license.

One cannot have both the Non-derivative Works and the Share-Alike licenses.

The principle underlying feature in creative commons is freedom to modify, distribute and display without the fear of being sued, provided one adheres to some seemingly simple principles. It must be stated, however, that Creative Commons licenses are legitimate legal documents and violation is prosecutable in court.

### **7.3 Language**

In the 'free' spirit of the OSCW movement, institutions are free to translate courseware developed in one language into another language of their choice. In a seminar I attended recently, a presenter from the MIT revealed that their partner institutions in China, Vietnam and India intend to translate MIT's OCW into their national languages. Though this move is perfectly legitimate and desirable, it raises questions regarding IPR ownership when materials are translated into other languages, completely alien to the original author. It also casts doubt on the principle of open sharing unless agreement is reached on a common sharing language (e.g. English). From a different perspective, it begs the

question: will OSCW eventually be organized around language blocks?

#### **7.4 GATS**

The [General Agreement on Trade in Services \(GATS\)](#) is an attempt by the global community to regulate cross—border trade in services, in this case, higher education. With the advent of online learning and open source courseware, the definition of cross-border education has taken a new meaning as students do not need to cross any physical borders to study. Undoubtedly, the simplification of IPR that goes with OSCW is a positive contribution towards making higher education more of a public good. There is, however, no framework in GATS at it currently stands to regulate OSCW. As John Daniel, former Assistant Director General of UNESCO put it recently, "... it is an open question whether a framework for exchange is needed and what form it should take" (Daniel, 2003).

#### **7.5 Licensing**

One of the emerging trends that have partly been brought about by the open source movement is the emerging trend to shift from the long-term model of perpetual licensing--where software rights are purchased up front to subscription-licensing plans, in which vendors and customers adopt a pay-as-you-go arrangement that extends over several years. Under subscription licensing, emphasis is more on support and maintenance rather than on licensing. Despite the fact that OCSW is available for free, the need for software maintenance will continue to be there, especially as more and more users sign-on to OSCW.

According to a recent survey of software vendors (Keizer, 2004), customer perception that open-source software is less expensive even when in the long run it may not be, has given customers considerable leverage in dealing with vendors on licensing. This pressure from customers, coupled with the apparent failure of OSCW developers to provide robust maintenance and support to users might be the trigger point for partnership between the emerging consortia and major software vendors with world-wide coverage.

#### **7.6 Support and Maintenance**

In her article titled *The Muscles, Aches, and Pains of Open Source*, Stunden (2003) argues that though the collaborative design and development of OSCW is 'fun', the real challenge is in coming up with creative ways to deal with the issue of support and

maintenance. As Stunden puts it “We need to develop creative collaborative solutions to the dilemma of maintenance and support in our shared software-development initiatives”.

### **7.7 Will they Use it? - Lessons of Experience**

Lessons from experience suggest that OSCW can be either a valuable addition or a nightmare depending on needs and circumstances. Rob Reynolds (2003) offers the following advice:

- OSCW is not for everyone. Even though content is available for free, its effective use requires considerable development resources (e.g. skilled java programmers) available on a full-time basis.
- Decide on the standard to be used upfront, based on current and future institutional needs. In particular, pay attention to interoperability with other existing software/courseware.
- Scalability of the system vis-à-vis institutional needs. Some OSCW has been developed for small colleges and might not be efficiently scalable for use by large systems. Also consider IT infrastructure requirements and limitations, including matters of network security.
- Institutional pedagogical vision should be the driver for OSCW, not the other way round (Zhao & Elbaum, 2000; Reigeluth, 1999). Matters to consider include: Teacher-centric versus learner-centric model; distributed/collaborative versus centralized learning model.
- Decide on the functionality to be supported by OSCW and select courseware accordingly. That is, selected courseware must be responding to an observed learning need.
- Reflect on how learning activities will be integrated with assessment. What kind of assessment method will be used and how compatible is it with selected OSCW?

### **7.8 Will it widen the digital divide?**

As stated in section 3, developing countries have demonstrated a strong interest in OSCW, much the same way as they reacted to open source software. Given the resource constraints that exist, developing country institutions stand to benefit immensely if the courseware is appropriately adapted to individual needs and circumstances. But there are two risks in my view: (i) students might get carried away by the (brand) name of the institution behind the content irrespective of the quality of learning actually going on in the course and (ii) brand-name institutions in developed

nations might use institutions in developing countries as guinea pigs to test new open source content before mainstreaming it in their own institutions. It is too early to conclude whether the benefits will outweigh the risks.

## **8.0 Future Trends**

### **8.1 Likely Scenarios**

In my view, the future of OSCW rests on two key aspects: success in achieving sustainable economics in the design, development and operation of OSCW infrastructure; and the extent to which OSCW is successful in advancing the frontiers of innovation in teaching and learning. To this end, three possible scenarios might emerge:

- (1) OSCW becomes mainstream in higher education worldwide with full interoperability with commercial application software;
- (2) Only a few OSCW initiatives become successful, mainly because contributing institutions fail to agree. The most likely causes of failure to agree are:
  - differences among participating institutions in adopting new technology architectures, requiring new functionality, and implementing changes to match the ever evolving requirements of the OSCW shared platform;
  - inability to coordinate institutional talent (such as developers, usability specialists, and database specialists such as developers, usability specialists, and database specialists) which is distributed across several institutions towards a shared view of what ought to be done;
  - misunderstandings within large OSCW consortia, either among participating HE institutions or between HE institutions with their 'public good mission' and sponsoring industrial partners who may have business motives.
3. OSCW fails completely as a result of HE institutions' failure to sustain the costs, complexity and demand for support and maintenance of OSCW users. A likely outcome would be that commercial vendors would take over, offering free courseware but requiring users to pay for maintenance and support.

As stated earlier in this report, engaging effectively with OSCW requires considerable development resources on a full-time basis. Not all institutions will be in a position to afford these resources. Thus, though it is early to conclude on the future outcome, it is evident that OSCW is not for everyone – at least in the foreseeable future.

## **8.2 Course management Systems**

Another likely development with OSCW relates to commercially available CMS. Already, Blackboard has started allowing universities to partially modify its source code for use with OSCW. Both Blackboard and WebCT – the two major suppliers of CMS to universities – have agreed to adopt the Open Knowledge Initiative (OKI) standard developed by the MIT (Olsen, 2004). Though might be early to conclude on the direction that commercial CMS vendors will take vis-à-vis OSCW, the move by Blackboard suggests they will likely adopt the same strategy as commercial software vendors and move away from licensing to support and maintenance.

## **9.0 Conclusion**

Open Source Courseware has undergone impressive developments in the short period since MIT made public its intention to put all of its courses on the web for free access by all. These developments have not only strengthened the capacity of individual higher education institutions, but have also resulted in the formation of powerful consortia and coalitions between and among institutions as well as with corporations. The concept of *creative commons* is a major innovation towards resolving issues of copyright and ownership. But there are several unresolved issues:

- The issue of intellectual property ownership is yet to be fully resolved, particularly as applies courseware that is translated to other languages and further adapted to local needs;
- The cost of support and maintenance is considerably high. This might limit effective participation by less-endowed institutions, particularly those in developing countries;
- More research is needed to establish the impact of OSCW on quality of learning at the offering institutions as a justification for the costs involved.
- Poor usability of open source content management systems;
- Insufficient documentation to support the courseware as well as the CMS platforms used; and

- Lack of an 'open source' support and maintenance system for OSCW. This could be an opportunity for commercial service providers.

## 10.0 Recommendations

- Open source courseware can be a value-added or a distraction, depending on circumstances. It is recommended that institutions considering adoption of OSCW conduct a thorough analysis of their capacity do further development or customization of the product and to support users over time before deciding to get involved;
- Interoperability and scalability should be key considerations in selecting the type of OSCW to adopt. Adherence to IMS Global Learning Consortium Specifications ought to be a fundamental consideration as this is now the *de facto* standard in OSCW;
- The decision to adopt OSCW ought to be based on a clear pedagogical vision, rather than OSCW for its own sake;
- The OSCW community needs to develop creative ways to offer support and maintenance to OSCW users. One option worth considering is to develop partnership with commercial software vendors who have world-wide coverage to provide this service; and
- There is need for more research on OSCW, particularly as regards the potential value-added to quality of learning, cost management and intellectual property rights when courseware developed in one language is translated to other languages.

## References

**Note:** For a comprehensive bibliography on OSCW, go to [http://wwwai.wu-wien.ac.at/~koch/forschung/sw-eng/oss\\_list.html](http://wwwai.wu-wien.ac.at/~koch/forschung/sw-eng/oss_list.html)

Ala-Mutka, K. And Mikkonen, T. 2002, 'Experiences with Distributed Open Source Courses', *Proceedings EUNIS 2002, The 8<sup>th</sup> International Conference of European University Information Systems*, University of Porto, Faculty of Engineering, Portugal, ISBN 972-752-051-0, pp. 19-22, June.

Bernard, M. 2002, 'Optimal Web Design' [Online], Software Usability Research Laboratory, Department of Psychology, Wichita State University, Retrieved 1 April, 2004 from <http://psychology.wichita.edu/optimalWeb/print.htm>.

Carlson, S. 2004, 'Cornell Will Offer Open-Source Package for Producing Electronic Journals', *The Chronicle of Higher Education: Information Technology*, Volume 51, Issue 6, Page A35, October. Available at: <http://chronicle.com>. [Accessed October 1, 2004].

Corcoran, C.K. and Corcoran, D.S. 2002, 'Accessible web sites: Why they are important and where to begin', *About Campus*, March 2002, Vol. 7 Issue 1.

Daniel, J. 2003, 'Globalisation and Higher Education: Implications for North - South Dialogue: *Trading to Learn, Learning to Trade: Where is the Public Good?*' Oslo, Norway, Paper presented at the Conference on *Globalization and Higher Education: Implications for North-South Dialogue*, Oslo.

Foster, A. 2003, '2 Companies Offer Colleges Discounts on Open-Source Software', *The Chronicle of Higher Education: Information Technology*, Volume 50, Issue 17, Page A32, December. Available at: <http://chronicle.com>. [Accessed August 31, 2004].

Foster, AL. 2004, '4 Universities Join to Create Open-Source Software for Professors to Manage Courses', *The Chronicle of Higher Education: Information Technology*, Volume 50, Issue 21, Page A28, January. Available at: <http://chronicle.com>. [Accessed August 31, 2004].

Franz, V. 2004, 'Intellectual Property and Knowledge Governance' [online]. Available at: [http://www.soros.org/initiatives/information/focus\\_areas/intellectual](http://www.soros.org/initiatives/information/focus_areas/intellectual). [Accessed on November 25, 2004].

Hagemann, M. 2004, 'Open Access Project' [online]. Available at: <http://www.soros.org/openaccess/index.shtml>. [Accessed on November 25, 2004].

Head T. et al. 2003, 'Setting a Next-Generation CMS Strategy', Paper presented at the EDUCAUSE Annual Conference, Anaheim, Calif., November.



Jackson, GA 2004, 'Open Source Is The Answer: Now, What Was The Question?', *The Chronicle of Higher Education: Information Technology*, Volume 51, Issue 5, Page B17, September. Available at <http://chronicle.com>. [Accessed on November 26, 2004].

Keizer, G. 2004, 'Software Licensing Said To Be Set For Dramatic Shifts', *TechWeb News*, March.

MIT 2002, 'MIT Open Courseware' Available at: <http://ocw.mit.edu/index.html>; (Viewed on August 5, 2004)

Newmarch, J. 2000, 'Who Owns the University Web Courseware?', [AusWeb2K](#), the Sixth Australian World Wide Web Conference, Rihga Colonial Club Resort, Cairns, 12-17 June.

Newmarch, J. 2001, 'Lessons from Open Source: Intellectual Property and Courseware', *First Monday*, volume 6, number 6, June. Available at: [http://firstmonday.org/issues/issue6\\_6/newmarch/index.html](http://firstmonday.org/issues/issue6_6/newmarch/index.html).

Olsen, F. 2002, 'U. of Michigan Open Up Homegrown Software', *Chronicle of Higher Education*, Vol. 49, Issue 7, pp. A38. October. Available at: <http://chronicle.com>. [Accessed August 31, 2004].

Olsen, F. 2003, 'Sharing the Code: More colleges and universities see open-source software as an alternative to commercial products', *The Chronicle of Higher Education: Information Technology*, August. Available at: <http://chronicle.com>. [Accessed October 31, 2004].

Olsen, F. 2004, 'Course Management: Colleges Push for an Open Approach', *The Chronicle of Higher Education: Chronicle Review*, Volume 50, Issue 21, Page B10, January. Available at: <http://chronicle.com>. [Accessed November 25, 2004].

Reigeluth, C.M. 1999, 'The Elaboration Theory: Guidance for scope and sequence decisions', in Reigeluth, C.M. (ed.), *Instructional Design Theories and Models: A New Paradigm of Instruction Theory*, Lawrence Erlbaum Associates, Mahwah, New Jersey.

Reynolds, R. 2003, 'Open Source Courseware: Evaluation and Rating'. Available at: [http://www.xplana.com/whitepapers/archives/Open\\_Source\\_Courseware](http://www.xplana.com/whitepapers/archives/Open_Source_Courseware).

Soreon Research 2004, 'Saving Cash: A Comparison of Open Source and Proprietary Software - Update 2004', Soreon Research Report, October - (95 pages; 31 figures and tables). Extract available at: [http://www.soreon.de/site1/index.php/english/soreon\\_studien/kassensturz\\_open\\_source\\_und\\_propriet\\_re\\_software\\_im\\_vergleich\\_update\\_2004\\_95\\_seiten\\_31\\_abbildungen\\_und\\_tabellen](http://www.soreon.de/site1/index.php/english/soreon_studien/kassensturz_open_source_und_propriet_re_software_im_vergleich_update_2004_95_seiten_31_abbildungen_und_tabellen)

Stunden, A. 2003, 'The Muscles, Aches, and Pains of Open Source', EDUCAUSE Review, Vol. 38, No. 6, pp. 100-101, November/December.

Unsworth, JM 2004, 'The Next Wave: Liberation Technology', Chronicle of Higher Education, Vol. 50, Issue 21, pp. B16. January. Available at: <http://chronicle.com>. [Accessed August 31, 2004].

Wheeler, B. 2004, 'The Inevitable Unbundling of Software and Support,' Syllabus, March. Available at: <<http://www.syllabus.com/article.asp?id=9026>> [Accessed November 25, 2004].

Williams, T. R. 2000, 'Guidelines for designing and evaluating the display of information on the web', Technical Communication, vol. 47, no. 3, August.

Zhao, L. and Elbaum, S. 2003, 'Quality assurance under the open source development model', The Journal of Systems and Software, 66: 65-75.

## Appendices

### Appendix 1: Key Open Source Application Projects in Higher Education

#	Project	Institution(s)	URL
1	Chandler/Westwood	Open Source Applications Foundation; 30 universities	<a href="http://www.osafoundation.org/">http://www.osafoundation.org/</a>
2	DSpace	MIT Libraries; Hewlett-Packard (HP)	<a href="http://www.dspace.org/">http://www.dspace.org/</a>
3	Fedora Project	Cornell; Virginia	<a href="http://www.fedora.info">http://www.fedora.info</a>
4	LionShare	Penn State	<a href="http://lionshare.its.psu.edu/main/">http://lionshare.its.psu.edu/main/</a>
5	Open Knowledge Initiative (O.K.I.)	MIT	<a href="http://web.mit.edu/oki/">http://web.mit.edu/oki/</a>
6	Open Source Portfolio Initiative (OSPI)	Carnegie Foundation for the Advancement of Teaching; Delaware; Indiana; Michigan; Minnesota; Rhode Island; the r-smart group	<a href="http://www.theospi.org/">http://www.theospi.org/</a>
7	Pubcookie	Washington	<a href="http://www.pubcookie.org/">http://www.pubcookie.org/</a>
8	Public Key Infrastructure (PKI)	Dartmouth	<a href="http://www.dartmouth.edu/~pkilab/">http://www.dartmouth.edu/~pkilab/</a>
9	Sakai Project	Indiana; Michigan; MIT; Stanford	<a href="http://www.sakaiproject.org/">http://www.sakaiproject.org/</a>
10	uPortal	JA-SIG member institutions	<a href="http://www.uportal.org/">http://www.uportal.org/</a>
11	Visual Understanding Environment (VUE)	Tufts	<a href="http://vue.tccs.tufts.edu/">http://vue.tccs.tufts.edu/</a>
12	WebWork	Indiana; Rochester	<a href="http://webwork.math.rochester.edu">http://webwork.math.rochester.edu</a>
13	IMS Global Learning Consortium	12 universities and corporate partners.	<a href="http://imglobal.org/">http://imglobal.org/</a>

## Appendix 2. Members of the IMS Global Learning Consortium

1. [ADL CoLab \(Department of Defense\)](#)
2. [Apple Computer](#)
3. [Blackboard](#)
4. [British Educational Communications and Technology Agency \(BECTA\)](#)
5. [California State University](#)
6. [Carnegie Mellon University](#)
7. [Centre for Research and Technology Hellas \(CERTH\)](#)
8. [Cisco Learning Institute](#)
9. Cisco Systems
10. [Cocoon Technologies Software AG](#)
11. [Committee on Institutional Cooperation](#)
12. [Department of Education, Training and Youth Affairs - Australia](#)
13. [DigitalThink](#)
14. [Educational Testing Service](#)
15. [Educause](#)
16. [European Schoolnet](#)
17. [FD Learning](#)
18. GIUNTI Interactive Labs S.r.l
19. [IndustryCanada](#)
20. [IVIMEDS](#)
21. [Joint Information Systems Committee](#)
22. [Massachusetts Institute of Technology- Open Knowledge Initiative](#)
23. [Microsoft](#)
24. [NHSU](#)
25. [Open Universiteit Nederland](#)
26. [Open University](#)
27. Oracle
28. [Pearson Education](#)
29. [QuestionMark](#)
30. [Saba Software Inc.](#)
31. [Scottish Ui Ltd.](#)
32. [SCT Inc.](#)
33. [Stichting SURF](#)
34. [SumTotal Systems](#)
35. [Sun Microsystems](#)
36. Texas Instruments
37. [Thing](#)
38. [Thomson Learning](#)
39. [Ufi Limited](#)
40. [University of California - Berkeley](#)
41. [University of Cambridge](#)
42. [University of Michigan](#)
43. [University of Ulster](#)
44. [University of Wisconsin - Madison](#)
45. [Virginia Tech](#)
46. [WebCT Educational Technologies Corporation](#)

### Appendix 3: IMS Global Learning Consortium Specifications

The list contains both active (completed) and draft (under development) specifications as of November 27, 2004. Specifications already released to the public are indicated as active hyperlinks.

#	Date	Document	Status
1	2004-November-1	<a href="#">IMS Content Packaging</a>	Version 1.1.4 Final Specification
2	2004-October-12	<a href="#">IMS ePortfolio</a>	Version 1.0 Public Draft
3	2004-October-12	<a href="#">IMS ePortfolio</a>	Version 1.0 Public Draft
4	2004-August-23	<a href="#">IMS AccessForAll Meta-Data</a>	Version 1.0 Final Specification
5	2004-August-24	<a href="#">IMS Enterprise Services</a>	Version 1.0 Final Specification
6	2004-July-30	<a href="#">IMS Shareable State Persistence</a>	Version 1.0 Final Specification
7	2004-June-24	<a href="#">IMS Question and Test Interoperability</a>	Version 2.0 Public Draft Specification
8	2004-June-14	IMS Resource List Interoperability	Version 1.0 Public Draft Specification
9	2004-June-14	IMS AccessForAll Meta-Data	Version 1.0 Public Draft Specification
10	2004-May-26	<a href="#">IMS Meta-Data</a>	Version 1.3 Public Draft Specification
11	2004-March-26	IMS Shareable State Persistence	Version 1 Public Draft Specification
12	2004-March-22	<a href="#">IMS Vocabulary Definition Exchange</a>	Version 1 Final Specificatbn
13	2004-February-3	IMS Enterprise Services	Version 1 Public Draft Specification
14	2003-September-3	IMS Vocabulary Definition Exchange	Version 1 Public Draft Specification
15	2003-July-25	<a href="#">IMS Learner Information Package Accessibility for LIP</a>	Version 1 Final Specification
16	2003-June-12	<a href="#">IMS Content Packaging</a>	Version 1.1.3 Final Specification
17	2003-April-28	IMS Learner Information Package Accessibility for LIP	Version 1.0 Public Draft Specification

18	2003-March-26	<a href="#">IMS Question &amp; Test Interoperability</a>	Version 1.2.1 Final Specification
19	2003-March-20	<a href="#">IMS Simple Sequencing</a>	Version 1.0 Final Specification
20	2003-February -13	<a href="#">IMS Learning Design</a>	Version 1.0 Final Specification
21	2003-January -30	<a href="#">IMS Digital Repositories Specification</a>	Version 1 Final Specification
22	2002-November-01	IMS Simple Sequencing Public Draft Specification	Version 1 Public Draft
23	2002-October-25	<a href="#">IMS Reusable Definition of Competency or Educational Objective</a>	Version 1.0 Final Specification
24	2002-October-18	IMS Learning Design	Version 1.0 Public Draft Specification
25	2002-August -12	IMS Digital Repositories	Version 1.0 Public Draft
26	2002-July -16	<a href="#">IMS Enterprise Specification</a>	Version 1.1 Final Release
27	2002-May-13	IMS Simple Sequencing Public Draft Specification	Version 0.7.5 Public Draft
28	2002-April-22	IMS Enterprise Specification	Version 1.1 Public Draft
29	2002-February -13	<a href="#">IMS Question &amp; Test Interoperability Specification</a>	Version 1.2 Final Release
30	2001-October-10	IMS Question & Test Interoperability Specification	Version 1.2 Public Draft Release
31	2001-October-01	<a href="#">IMS Meta-data Specification</a>	Version 1.2.1 Final Release
32	2001-August -10	<a href="#">IMS Content Packaging Specification</a>	Version 1.1.2 Final Release
33	2001-June-11	<a href="#">IMS Meta-data Specification</a>	Version 1.2 Final Release
34	2001-May-18	<a href="#">IMS Content Packaging Specification</a>	Version 1.1.1 Update Release
35	2001-May-11	IMS Meta-data Specification	Version 1.2 Public Release Draft
36	2001-April-20	<a href="#">IMS Content Packaging Specification</a>	Version 1.1 Public Release Final
37	2001-March-18	IMS Reusable Competencies Definition Information Model Specification	Version .01 Public Release Draft
38	2001-March-18	<a href="#">IMS Question &amp; Test Interoperability Specification (Lite)</a>	Version 1.1 Public Release Final
39	2001-March-18	<a href="#">IMS Question &amp; Test Interoperability Specification</a>	Version 1.1 Public Release

			Final
40	2001-March-18	<a href="#">IMS Learner Information Package Specification</a>	Version 1.00 Public Release Final
41	2000-December-21	IMS Content Packaging Specification	Version 1.1 Public Release Draft
42	2000-August -25	<a href="#">IMS Question and Test Interoperability Specification</a>	Version 1.01 Public Release Final
43	2000-June-05	<a href="#">IMS Content Packaging Specification</a>	Version 1 Public Release Final
44	2000-June-05	<a href="#">IMS Question and Test Interoperability Specification</a>	Version 1 Public Release Final
45	2000-Mar-20	IMS Content Packaging Specification	Version .92 Public Draft
46	2000-May-05	<a href="#">IMS Learning Resource Meta-data Specification</a>	Version 1.1 Public Release Final
47	2000-Feb-25	IMS Question & Test Specification	Version 1 Public Draft
48	2000-Feb-25	IMS Content Packaging Specification	Version .91 Public Draft
49	2000-Jan-12	<a href="#">IMS Enterprise Specification</a>	Version 1.01 Public Release
50	1999-Nov-04	<a href="#">IMS Enterprise Specification</a>	Version 1 Public Release
51	1999-Aug-20	<a href="#">IMS Meta-data Specification</a>	Version 1 Public Release

Source: Adapted from <http://imsglobal.org/>