Effective Management of Distributed Educational Content

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It is hard to believe that the World Wide Web is only 12 years old, and yet it has already seen the rise and fall of several technology cycles. One of the most interesting web application technologies is the capability to conduct learning online. There are already at least five generations of e-learning systems that can be identified. These are:

- 1960s to 2000 – development of "computer assisted instruction" (CAI), "computer managed instruction" (CMI), and "computer based training" (CBT), first on mainframe computers (1960s-1980s), then on personal computers with floppy disks and small hard drives (1980s-1990s), followed by much more powerful desktop computers with CD-ROMs (1990-2000)
- 1993 to the present - the building of educational web sites with hyperlinks and automatic feeds
- 1997 to the present - the rise of learning management systems (LMS)
- 2001 to the present - the development of learning content management systems (LCMS)
- 2003 to the present - the trend to comprehensive and adaptable e-learning suites, composed of a set of distinct components built to global industry standards, that are integrated with distributed content strategies

The rapid changes in e-learning technologies are not all that surprising, given the fact that e-learning is just at the beginning of a major technology innovation cycle. Using the example of the automobile industry, Zemsky and Massy (2004) describe several stages of technology innovation. First, there is great fluidity in markets and product designs, where many different solutions and combinations of ideas are proposed. Many of these are dead ends which inevitably die off, as not all innovations can be sustained. Gradually, a dominant product design emerges, and the remaining product vendors produce and distribute relatively similar products with minor variations of the dominant design. Once the dominant design has been settled, a supporting infrastructure is designed and tested. The infrastructure proliferates as standards for connecting the parts of the infrastructure are decided, and the technology is then able to expand into all geographic areas where there is demand and for which potential returns justify costs. The whole cycle repeats itself whenever a significantly new and innovative technology is introduced that promises to correct the failures and disappointments of the current technology.

In the case of e-learning, the Zemsky and Massy argue that the "…overall the experience with e-learning has been disappointing." They conclude that "…the boom-bust cycle in e-learning stemmed from an attempt to compress the process of innovation itself"(p. 57). In another paper, "Where is the learning in e-learning?", Woodill (2004) has argued that the failure of e-learning to date is the result of several factors, including "speed to market" of poorly conceived products, a focus in the e-learning industry on the wonders of new technology rather than good instructional design, boring online materials, a lack of understanding of the learning process by software developers, and a lack of understanding of the unique teaching advantages of electronic networked media.

In the dot-com “gold rush” of the late 1990s, dreams of unlimited wealth and world domination in information and telecommunications technology drove thousands of entrepreneurs to invent and hype e-learning “solutions”. The dot-com crash that started in March 2000 weeded out many silly and non-sustainable innovations and business models, leaving us with a much leaner but more focused e-learning industry.

One recent e-learning innovation that we feel will disappear over the next few years is the closed standalone “learning content management system” (LCMS). These systems usually contain a proprietary authoring system that builds “courses” by stringing together “learning objects” stored in a central database. Sold on the basis that it is “easy to use”, such self-contained systems are doomed to failure. Simply linking a group of de-contextualized objects into a course is poor instructional design. As well, there is usually a trade-off associated with “ease-of-use” in that it is often accompanied by an inability to produce complex and original learning experiences. But perhaps most important is the fact that the emerging product design in e-learning is moving away from the LCMS model, to the management of diverse and widely distributed educational content.

Imagine the early years in the development of railroads. If you could afford it, you could hire a company to build a private, non-standard gauge railway line, and have the rolling stock and engines specially built to run on it. Or, you could build a railway line that connected to the standard gauge grid that was being laid down everywhere, and buy your rolling stock from the same factory as everyone else. As more and more railroaders built standard gauge lines and connected them, the matrix of lines became a continent wide grid, and railway cars (like packets), could be sent anywhere on the network. The standardized railway system still works. Private, non-standard gauge lines mostly disappeared, or are now tourist attractions.

Like the railways, standard gauge “e-learning grids” and “content delivery networks” are now emerging. The technology to manage educational content from a network will be those adaptable learning management systems (LMS) that support open industry standards for authoring and delivery of content, and which can bring together content from many different sources into a meaningful, complex and measurable learning experience. Presently, such an LMS has to contend with diverse data sources, languages, formats, tracking and reporting rules, and security protocols. But standards such as SCORM and IMS specifications are becoming the “standard gauge” for the new e-learning infrastructure. The original excitement over the reusability of learning objects is giving way to recognition that widespread reusability of learning objects, in the strict sense of the word, is an impractical dream. Even the group within Cisco that was strongly promoting “reusable learning objects” (RLOs) four years ago recognizes that most RLOs will be “repurposed” and changed by course authors to fit their needs, and that developing context around each use of an RLO is critical for success (Cisco, 2003).

The idea for learning objects had its origins in the concept of object-oriented programming found in software development processes. While the concept of reusable objects works well for software, it doesn't work very well for human learning. In 2003, Damien Faughan, Charles Schwab's Director of Infrastructure & Technology, addressed this issue at the eLearning Guild's annual conference, and stated that "LCMS technology is still primitive." According to Faughan, Reusable Learning Objects (RLOs) require a really sophisticated training organization, and usually they don't work. After purchasing an LCMS, Schwab found that "its authoring rules proved way too complex to ever support rapid instructional design and development" (Faughan, 2003).

Effective teachers know that "content", used in its broadest sense as an educational task or experience that has some impact on the learner, needs to be placed in context, and needs to be adapted to the learning abilities, interests, and level of the previous knowledge of the learner. Instructors and instructional designers want to be able to draw educational content and experiences from a wide variety of sources in many different formats in order to create online educational experiences geared to the individual needs of learners.

Depending on a client's needs, an adaptable learning management system *may* need to work with an existing LCMS, if it is part of the client's e-learning infrastructure, and if its output can be formatted in non-proprietary e-learning standards such as those from AICC, SCORM and IMS or are written in XML. In this case, the LCMS is just one node in a potential network of educational content repositories.

The Changing Face of Online Educational Content

By educational content we mean any online experience or task that leads to learning. Traditionally, educational content tends to be seen as the stuff in textbooks - words and pictures, sometimes supplemented by the content of educational films and videos. Online content has the potential to be so much more experiential than this. In traditional education, students listen to a presentation or read a book, practice a skill, and are then tested by a teacher. The new model of digitally mediated education goes well beyond this, in that it can immerse the learner in integrated collaborative learning tasks:

> In the case of presentation, the focus is now on learning mental models through the cooperative and collaborative construction of knowledge based on discussion and guided exploration, and on learning cognitive strategies through the observation of experts who demonstrate how to solve non-trivial problems and explain why they are doing what they are doing. When it comes to practice, the focus is on experiential learning from rich learning tasks, and on student guidance and scaffolds to support their problem solving performance. As for tests, formative performance-based assessment is becoming increasingly important

> because this provides meaningful feedback that may help students to improve their learning processes. (Jochems, van Merriënboer, and Koper, 2004, p. 3-4)

Content may be developed by a teacher or instructional designer, or it may be something that is posted to the Internet by a person without a background in education. An instructor or instructional designer may direct a learner to the content, or the learner may be in charge of his or her own learning and find meaningful educational experiences by serendipity, by referral from a peer, or by looking for it using increasingly powerful search engines. Tosh and Werdmuller (2004) argue that online education should be based on the "creation of a learning landscape where learners engage in the whole process both academically and socially [and this] should increase the opportunity to build one's learning instead of just being the recipients of information."

The "online learning landscape" is highly varied, and in a state of flux. A recent report from Brandon Hall (www.brandonhall.com), entitled "*Most Popular" Authoring Tools for E-Learning* (Nov. 2003), supports this contention.

> Earlier this year, we [Brandon-Hall] conducted a Web survey on our site to assess the popularity of various authoring tools. We asked participants to list the tools used within their organization to create e-learning content. Seventy-four authoring products were identified as being used regularly to create e-learning content. The average number of tools used was 3.25 per respondent.
>
> What was immediately evident in analyzing the results of the survey was that the definition of e-learning content is broad and varied. Some organizations produce media-rich, animated content using such tools as Flash. Others provide XML-structured content to their learners. Others provide training content as Acrobat documents. Others provide help documents. Others provide static HTML files. Still others provide pre-recorded movie-like "show me" demos. The list goes on and on and on.

Based on our experience, a review of the e-learning literature, and a survey of e-learning providers, we compiled a list of the types of educational content sources that LMS designers will need to take into account over the next few years. Here are many of the components of the current and emerging "online learning landscape":

- *Advice/Counseling Tools* – programs that give advice or counseling are becoming prevalent, and, in some cases, should be considered as educational experiences. For example, career path analysis software will plot your past and future career, and give advice on decisions you will need to make. Issues of security are paramount when dealing with this kind of content.

Examples: http://www.mcli.dist.maricopa.edu/proj/sw/counseling/
To learn more: Goss, S. and Anthony, K. (Eds.) (2003) *Technology in Counselling and Psychotherapy : A Practitioner's Guide.* Palgrave Macmillan.

- *Arts Based Experiential Tools* – play can be a major path to learning, and computers and networks can be creative play spaces. The tools for creativity on the computer need to be further developed, and the results of a creative session may need to be recorded and evaluated.

  Examples: www.squeak.org, www.pz.harvard.edu/
  To learn more: Dobbs, Stephen (1997) *Learning In and Through Art: A Guide to Discipline Based Art Education.* J.Paul Getty Museum Publications.

- *Automated Online Assessments* – assessment through automated testing is already here. Automatic scoring of essays is now possible. The results of such assessment will some become part of the learning landscape. "Assessment for learning" (formative assessment) will be an important educational emphasis, in addition to "assessment for credentialing" (summative assessment).

  Examples: www.nfer.ac.uk/research/cba.asp
  To learn more: www.learnflex.com/pdf/Online_literacy_assessment.pdf

- *Blogging* – weblogs or blogs are proliferating at a great rate in educational environments because they are so easy to use. A form of online publishing, blogs can be used within a classroom, within a community, or be open to the general public. For teachers, one issue with weblogs is how to evaluate their impact on learners.

  Examples: www.weblogg-ed.com
  To learn more: www.educause.edu/pub/er/erm04/erm0450.asp

- *Collaboration Tools* – the ability to work collaboratively is an increasingly important skill and stimulus to learning that can be facilitated through computer communications. The assessment of both the level and quality of participation in a group may need to be captured by an LMS.

  Example: www.groove.net
  To learn more:
  www.masternewmedia.org/2003/10/26/contextual_online_collaboration_tools.htm

- *Communications Tools and Artifacts* – the use of various online communications technologies such as instant messaging, discussion forums, chat, VoIP, whiteboards and e-mail can result in the production of both educational records and new content documents.

Examples: http://www.aim.com/ , http://eq.janison.com.au/eq/default.asp
To learn more: http://www.llrx.com/features/tools.htm

- *Competency checklists and challenges* – if the educational program is competency-based, then the online software will need to check off competencies as they are accomplished, and to give competency challenges in the form of tests or tasks that would demonstrate that a competency has been attained. The LMS will need to be able to load a pre-defined competency matrix or model.

  Example: http://www.wgu.edu/
  To learn more: http://sundaytimes.careerjunction.co.za/pdf/cbm.pdf

- *Complexity Modeling and Visualization Tools* – As complexity theory develops as an approach to education, new ways of modeling complex phenomena are emerging that will require tracking. The ability to see and move through "the big picture" will be a commonplace educational objective in the near future. Mapping of thoughts ("mind maps") or pathways is one example of this genre of educational materials. Another is the category of "artificial life simulators".

  Example: www.inxight.com
  To learn more: www.complexityandeducation.ca
  www.modelingcomplexity.org/html/readings.htm

- *Computer Assisted Assessment/Computer Based Assessment* – online assessment results can be from manual input by assessors or automatically marked tests, quizzes or performance samples.

  Examples: http://www.loughborough.ac.uk/service/fli/flicaa/index.html
  To learn more: http://www.learnflex.com/pdf/Online_literacy_assessment.pdf

- *Data Mining Tools for Learning* – large data sets are places of discovery, given the right set of tools. For example, OLAP software will navigate through large amounts of financial data. Data mining in e-learning grids will soon become prevalent.

  Example:
  www.spss.com/home_page/wp114.htm?source=homepage&hpzone=white_papers
  To learn more:
  www.cabrillo.edu/services/pro/oir_reports/tkmm_air_2001_final.pdf

- *Digital Galleries and Museums* – interactive exhibits can be viewed online as educational experiences.

Examples: http://mv.vatican.va/3_EN/pages/MV_Home.html
http://www.guggenheim.org/
http://wdcrobcolp01.ed.gov/cfapps/free/displaysubject.cfm?sid=1 ,
www.nasm.si.edu/education/onlinelearning.cfm

- *Digital Libraries* – downloadable books, articles and media files in digital libraries, usually in multiple file formats. Records can be maintained of how often a learner accesses a book or article or downloads a media file.

  Example: http://www.nap.edu/
  To learn more: http://www.dlib.org/

- *Educational Portals* – sites that aggregate many sources of information are known as portals. Portals can be repositories of educational materials, or can link many sources of information.

  Example: http://www.bbc.co.uk/learning/index.shtml
  To learn more: http://www.westga.edu/~distance/downes31.html

- *E-Learning Grids* – the term "e-learning grid" refers to an e-learning content delivery network based on the principles of grid computing. Grid computing is the use of a network to aggregate the power of many computers.

  Example: http://www.zeusconsult.gr/LeGE-WG/program.asp
  To learn more: http://www.lege.ktu.lt/pdf/200211LeGe-WG_ARpaskut.pdf

- *e-Portfolios* – a variety of formats of electronic portfolios will need to be tracked and evaluated. Online portfolios allow a person to store his or her work and make it available online to others.

  Example: http://www.educause.edu/nlii/keythemes/eportfolios.asp
  To learn more: http://www.e-education.psu.edu/portfolios/bibliography.shtml

- *Flash-based educational software* – Flash based educational content is becoming more and more prevalent on the Internet. Assessments constructed in Flash are much more secure than those done in Macromedia Dreamweaver MX.

  Example:
  www.deloitte.com/dtt/cda/doc/content/Deloitte_IFRS_elearning_demo.swf
  To learn more: http://www.learningcircuits.org/2004/jul2004/hess.htm

- *Industrial Informatics* – data from automated industrial processes can be part of a person's educational experience, especially those that involve human-computer interaction. The monitoring of real-time industrial operations can result in the launch of relevant just-in-time information.

Example:
http://www.fe.up.pt/si_uk/disciplinas_geral.FormView?P_CAD_CODIGO=EQ423&P_ANO_LECTIVO=2003/2004&P_PERIODO=2S
To learn more: http://www.aut.vein.hu/english/ipari.htm

- *Integrated Problem-based e-Learning* – in ePBL, or electronic problem-based learning, learners solve complex problems while learning multiple skills.

  Example:
  http://tecfa.unige.ch/perso/vivian/modules.php?op=modload&name=phpWiki&file=index&pagename=ePBL
  To learn more:
  http://www.intermedia.uib.no/cscl/doc/files/Class&Synteta.doc

- *Intelligent Search engines and "Dynamic Categorization"* – the newest intelligent search engines analyze search results on the fly and produce categories and connections among the search hits. These search engines also learn about your interests and choices, and become more personalized through experience with a user.

  Example: www.kartoo.com
  To learn more: http://www.ics.uci.edu/~pratt/pubs/dissertation.pdf

- *Interactive Instructional Programs* – Interactive instructional activities can be built with a scripting language within an HTML page, or it can be generated "on-the-fly" through dynamic programming techniques combined with a content database. There are at least 12 levels of interactivity, using requiring different ways of tracking user responses to the interactive task.

  Example:
  www.bbc.co.uk/history/war/wwone/launch_ani_western_front.shtml
  To learn more: www.intermedia.uib.no/cscl/doc/files/Class&Synteta.doc

- *Just-in-time Performance Support Tools/Embedded Learning/Pervasive Learning* – Embedded content can be available in a workplace and is invoked by a specific trigger such as an error message.

  Example: www.computerworld.com/news/2000/story/0,11280,44312,00.html
  To learn more: www.destinationkm.com/articles/default.asp?ArticleID=18

- *Learning Object/SCO Repositories* – as quality online educational materials are produced, many are ending up in online aggregations of learning objects, usually referred to as "learning object repositories". SCO stands for "shareable content objects", and is the term used by SCORM.

Example: www.merlot.org
To learn more: http://itdl.org/Journal/Jul_04/article02.htm

- *Mobile Content* – content formatted for mobile devices will need to be tracked and evaluated.

  Example: http://www.marcprensky.com/writing/Prensky-What_Can_You_Learn_From_a_Cell_Phone-FINAL.pdf
  To learn more: www.e-learningcentre.co.uk/eclipse/Resources/mlearning.htm
  www.workindex.com/editorial/train/trn0402-02.asp

- *Modding (modifying online games)* – building a custom and personalized online games is becoming an interesting trend, and can be considered an educational activity requiring extensive research and thought. An example is constructing a personalized world using *The Sims* software.

  Example: http://www.machinima.com/
  To learn more: http://www.marcprensky.com/writing/Prensky%20-%20Modding%20-%20The%20Newest%20Authoring%20Tool.pdf

- *Online courses* – a significant amount of educational content will continue to be set up by teachers/instructional designers in traditional course formats, and developed as standalone courses. LMSs will need to be able to find a course, launch it, track it, and produced comprehensive reports. Much of the knowledge on how to do this is already in place and is highly reliable. A more advanced scenario is the dream of "automated instruction" whereby learning objects are assembled on the fly into a course, based on the learner's profile or the results of data from previous interactions of the learner. As long as the results of course assessments and interactions are in SCORM format, they can be tracked by any SCORM compliant LMS.

  Example: www.learnflex.com
  To learn more: www.learnflex.com/pdf/Content%20Development%20LearnFlex.pdf

- *Online publishing* – the Internet is already a site for publishing of original creative work such as books, essays and articles, video, audio and graphics. Writing essays may be displaced by writing to a Blog or Wiki, or by posting a document to an online library or downloadable file on a Web page. Original work can also be shared using peer-to-peer file transfer software, or through content syndication using "webfeeds" (RSS) or webfeeds aggregators.

  Example: http://www.zinebook.com/resource/adobe.html
  To learn more: http://www.press.umich.edu/jep/

- *Parameterized Content and Quizzes* – content for online teaching or assessment can be varied according to a specific "parameter". The parameter

is variable content that can be randomly inserted, or can be added according to a user's profile. The IMS consortium is working on a standard for content insertion in response to a user's profile.

Example: http://infocom.cqu.edu.au/Staff/Damien_Clark/Research/thesis.html
To learn more: http://www2.sis.pitt.edu/~peterb/papers/EDMED01QUIZ.pdf

- *Playing Online Games/Simulations/Scenarios* – playing online games can teach social skills, as well as strategy, coordination, multi-tasking and problem-solving. There are now lots of "non-entertainment educational games" available on the Internet. The types of decisions made in simulations, scenarios and games can be important educational information.

  Example: www.socialimpactgames.com/
  To learn more: Prensky, Marc (2001) *Digital Game Based Learning.* New York: McGraw-Hill. or www.marcprensky.com

- *Rich Site Summary (RSS)* – This method of content syndication allows you to poll a site that has an RSS feed, and see if there are any updates since you last visited. Because the content is entirely controlled by the person who owns/manages the RSS enabled site, this method of finding out what is new is spam free. You need an RSS reader to work with this method of content delivery.

  Example: http://www.downes.ca/edu_rss.htm
  To learn more: www.lo.redjupiter.com/gems/weblogged/RSSFAQ2.doc

- *Semantic Web* – this is an attempt, by Tim Berners-Lee, founder of the World-Wide Web, and many others, to make items on the web more meaningful for search engines and software agents through the use of a Resource Description Framework (RDF).

  Example: www.w3.org/2001/sw/
  To learn more: http://infomesh.net/2001/swintro/

- *Streaming Media* – educational video and audio can be made available to learners in a streaming format.

  Example: http://prairiehome.publicradio.org/programs/20020323/
  To learn more: http://www.syllabus.com/article.asp?id=7769

- *Survey-Feedback* – the results of quick polling and online surveys are valid educational experiences.

  Example: www.learnflex.com
  To learn more: http://www.ethics.org/character/services_surveys.html

- *Virtual Agents* – virtual agents can be used in online education in several ways. They can present content to learners, search for educational materials on demand on behalf of a learner, or can "watch" for new items of interest to a learner and send an alert when one shows up.

  Example: www.codebaby.com
  To learn more: http://pepite.univ-lemans.fr/English/3-ITS-2002-Rasseneur%20et%20al.pdf

- *Web Quests* – Web Quests are guided explorations of a number of web sites with the goal of solving problems or gathering information.

  Examples: http://webquest.sdsu.edu/
  To learn more: school.discovery.com/schrockguide/webquest/webquest.html

- *Web Services* – "Web Services" is the name of a method of connecting a function in one application to a web page in another application so that the function appears to be part of the web page. The application supplying the service, and the web page receiving the service are connected through the Simple Object Access Protocol (SOAP). Web services are an alternative way of accessing educational content that needs to be taken into account by an LMS that is tracking learning activities.

  Example: www.elearnspace.org/resources/webservices.htm
  To learn more: www.bctechnology.com/statics/pstacey-dec0602.html

- *Webinars/Live Online Social Events/Live Online Conferencing* – educational events that occur live in real-time are becoming more prevalent. They may be a combination of web pages, text, graphics, video and/or audio.

  Example: www.interwise.com
  To learn more: http://www.aace.org/conf/site/pt3/paper_3008_148.pdf

The New Learning Landscape

In terms of distributed educational content to be managed, the learning landscape described above will likely persist for the next few years, and may even expand in scope, as new cycles of innovation occur. Faced with such a diversity of formats, and the high degree of distribution of online educational content, successful LMS vendors in the near term will need a content management strategy that is based on an open and flexible architecture that integrates as many different types of content as possible. They need to stay away from a proprietary content management strategy that locks a client into a specific format of learning objects and idiosyncratic authoring. Data bridges need to be built to a wide variety of content types and authoring tools.

Even if educational content is authored as SCORM conformant, in practice, a distributed content strategy will likely still have problems to be solved and issues to be worked out. This is because of the need for strict security between the provider and receiver of such content. Web pages are a place where viruses and other malicious content can be stored and transported, making trusted security arrangements necessary among content sources and content users. Nevertheless, once such arrangements have been worked out and tested, using distributed content to construct learning experiences should be easy for instructional designers, and should be seamless for the learner. As well, because many organizations that are moving to online learning are still working on effective management and administration of face-to-face training, learning management technology needs to support the mix of face-to-face experiences and online materials by tracking all aspects of learning, and providing appropriate collaboration tools.

As demonstrated above, learning activities and educational materials can come from many different sources, both inside and outside modern organizations. An organization's content strategy should focus on the diversity of content offerings, and technology that supports many content sources. Most organizations will require multiple approaches and different authoring tools for putting content online - in-house course development, third-party off-the-shelf courses, custom-built courses, and non-course based educational experiences. Online learning is rapidly becoming a mix of teacher directed activities, and learning that happens due to learners searching for answers to their own questions or following their own interests. At the same time, content integration strategies should hide much of the complexity of the realities of distributed content from the end user.

The LearnFlex™ Content Management Strategy

LearnFlex™, the adaptable learning management system from Operitel Corporation, has been developed to take into account the realities of the changing learning landscape described above. And, as innovations occur, LearnFlex™ will follow the new content formats, while maintaining backwards compatibility with existing content formats. LearnFlex™ is committed to supporting the emerging eLearning industry standards, and will launch and track any AICC/SCORM compliant course content and/or authoring tools, or any educational content that is AICC/SCORM conformant or is packaged with an IMS Manifest file (which describes how to work with the attached content). Operitel has successfully built a number of data bridges for LearnFlex™ to non-standard courses from a wide variety of content vendors, who have used different authoring systems to build their materials.

Online learning does not only take place by delivering excellent well-designed educational content, but includes the use of online collaboration and communication tools for learners to exchange opinions and information, to accomplish tasks together, and to develop supportive online "communities of practice". LearnFlex unites a wide variety of educational content, and then accompanies the content with online discussion groups,

chat, instant messaging, surveys and quick polls, book marking and note keeping. LearnFlex integrates with a number of popular conferencing and knowledge management systems, including SharePoint, Exchange, Interwise, and the HP Virtual Classroom. This level of integration is simply not present in LCMS systems that focus on a single repository and authoring system.

Large organizations will continue to have complex distributed content strategies which will need to work with a variety of communications and collaboration tools. Only a few LMS products on the market today have the capability of supporting such a strategy, and also have sophisticated reporting and analytics capabilities to track and report on the interaction of the learner with the different types of content.

Because multiple instructional design methodologies are needed to achieve various business objectives, LearnFlex™ itself does not have a proprietary content development tool, but rather focuses on facilitating each organization's content strategy, using a wide variety of authoring programs. The LearnFlex™ strategy to integrate with a diverse number of content development tools was recently validated in the 2003 "authoring tools" report from Brandon Hall. LearnFlex™ supports the seven tools on the list with the greatest popularity for creating e-learning content. These are:

- *Flash (Macromedia): 56%*
- *Authorware (Macromedia): 50%*
- *Dreamweaver/Coursebuilder (Macromedia): 42%*
- *PowerPoint (Microsoft): 32%*
- *Word (Microsoft): 25%*
- *Director (Macromedia): 18%*
- *FrontPage (Microsoft): 10%*

As Brandon Hall notes in the report, "Since many organizations turn to their IT departments to assist in the development of their e-learning content, it isn't at all surprising that e-learning content would be created with tools these developers already know and use on a daily basis."

These authoring tools represent most of the educational content that is being developed today. Many of the authoring tools listed above produce SCORM or AICC conformant content. For those that don't, such as Word and PowerPoint, we use the powerful tool from Hunter-Stone called THESIS, that converts the output of a variety of Microsoft Office tools, such as Word and PowerPoint, into SCORM conformant packages. (Note: Operitel is a Value-Added Reseller of the THESIS product).

Summary

The future of electronic educational content is <u>not</u> in proprietary Learning Content Management Systems with product specific "learning object" repositories, but in flexible learning technologies that can handle distributed educational materials from

a wide variety of sources and access methods. While the development of standards such as those offered by SCORM and IMS is laudable, they are insufficient in mapping all of the possible content that could be made available to be tracked by a sophisticated learning management system. Because e-learning is an *emerging* technology, innovation will continue to stay ahead of the publication of industry standards for the foreseeable future. What is needed is a flexible and complex content management strategy that incorporates the standards, but also includes data bridges to all known types of content and access methods, and has ways of extending access points to future types of content.

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