LEARNING OBJECTS IN HIGHER EDUCATION

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In May 2002, the Academic Advanced Distributed Learning Co-Lab, located in Madison, WI, on the University of Wisconsin-Madison campus, conducted an informal survey[1] on the utilization of learning objects as instructional components in higher education and levels of familiarity with e-learning resources and standards. This was not an academic study nor did it attempt to evaluate contemporary research on learning object design or application. This white paper is the outcome of the survey which provides WebCT and the Academic ADL Co-Lab partner institutions with 1) an understanding of the current use of learning objects in higher education; 2) reasons why more institutions in higher education are planning to use the SCORM in the future; and 3) recommendations for creating and sharing learning objects in the future.

To capture some sense of what is happening today eleven questions were sent out to more than 40 learning institutions, most of which are partners of the Academic ADL Co-Lab. The questions, which contained a mix of short answer and Likert-scale responses, are addressed in this paper.[2]

The seventeen learning institutions below responded to the survey:

Air Force Institute for Advanced Distributed Learning (AL)
UC Irvine Distance Learning Center (CA)
Brevard Community College (FL)
Broward Community College (FL)
Florida Community College Distance Learning Consortium (FL)
Miami Dade Community College (FL)
Pasco-Hernando Community College (FL)
Purdue University (IL)
Atlantic Cape Code Community College (MA)
University of Maryland at University College (MD)
Capella University (MN)
University of Nebraska at Lincoln (NE)
Rochester Institute of Technology (NY)
Texas A&M University System (TX)
Sheppard Air Force Base (TX)
The Wisconsin Technical College System (WI)
University of Wisconsin, Stevens Point (WI)
Wisconsin Indianhead Technical College (WI)

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[1] The survey is available for viewing at http://partners.academiccolab.org/losurvey/losurvey.htm
[2] The respondent statements that are quoted in this paper are used with permission and reflect the general institutional consensus on each question.

Definitions and Application of Learning Objects

In a familiar Indian fable, several blind men confront an elephant for the first time. They reach out and touch the part of the animal that is closest and then each makes grand assumptions about the nature and identity of the beast based on his own limited and localized explorations. Similarly, there appears to be little consensus from one department, discipline or institution to the next, on the definition of a **learning object**. Like the blind men, academic institutions are "seeing" learning objects with broad and conflicting interpretations based on their own specific academic perspectives, use patterns, and practicing pedagogy.

Defining Learning Objects – Format & Size

In defining learning objects there appears to be the greatest difference of opinion on issues of format and scope/size. Learning objects were variously defined as **digital, non-digital** or **both** by the respondents. There was also a wide range reported in perceived scope and size of learning objects.

According to Merrill (2000), learning objects include any **digital** resource that can be reused to support learning. McGreal & Roberts (2001) broaden the definition, defining a learning object as "any entity, **digital or non-digital**, which can be used, re-used or referenced during technology-supported learning."

In the industry report (2002) on specifications and standards generated by the S3 Working Group, from the MASIE Center's e-Learning Consortium, "learning objects" are described as a learning technology concept with the

> "*Potential to revolutionize the paradigm for organizational learning. The concept is simple: leverage database, Internet, and other digital technologies to prepare learning content as discreet small "chunks," or Learning Objects," that can be used alone or dynamically assembled to provide "just enough" and "just in time" learning. Learning Objects can also enable learners to select the training that is most relevant for them and perhaps even in a media format that matches their preferred learning style (auditory, visual, etc.)".* (11)

Macromedia (2002) defines a learning object as an entity (smaller than a course, unit or section), which represents a small unit of instruction that teaches a focused concept. Similarly, Van Lee (2002) suggests that a learning object might include activities such as a teacher locating, downloading, and then displaying a short video clip illustrating a key historical event for a course or a group of students identifying a weakness in the calculation of sines and cosines within a learning object tutorial.

On the other hand, an article in EDNET News (2001), a distance education newsletter published by the Utah Education Network, revealed that some of its readers think a learning object must contain content as well as practice and assessment components. Expanding from that, it was suggested that a **reusable learning object (RLO)** should contain an introduction, a summary, and between five and nine reusable information objects.

An on-line symposium on learning objects, sponsored by Educational Technology & Society in 2000, was moderated by Clark Quinn, Director of Cognitive Systems, for KnowledgePlanet.com. Several views expressed in the symposium suggested that a learning object could be seen as a whole course since any design for an educational purpose has specific goals in mind and is directed at an identified learner population. The learning design could be applied with success outside that scenario, but any learning that might result would be accidental.

Despite the differing interpretations on the nature of learning objects, the survey revealed that most institutions recognize a learning object as a piece of stand-alone digital content that is used to teach or enhance a learning objective. The survey responses below were typical conceptual definitions of a learning object:

> *"A small, individual portion of instruction. It should be able to stand alone, but can also be combined with other learning objects."*
> Kathie Sigler, Ph.D., Miami-Dade Community College

> *"A learning object can be content (video, audio, text, graphics, etc), or assessment of minimum size appropriate for its use. It may be a short video or a complete lesson. The object must be complete unto itself to allow a user to easily apply it."*
> Art Zygielbaum, University of Nebraska, Lincoln

"The common definition as I know it is that a learning object is any re-usable content used within a lesson or course. I prefer to distinguish re-usable content (which is static) from entities (or objects) that are designed to facilitate learning through some learner activity (test, quiz, assignment, project, discussion, etc.)."
Stanley Trollip, Capella University

Application of Learning Objects

Most institutions are less concerned about exact definitions for learning objects and more concerned about whether these objects are being used in a sound pedagogical manner. The educational strengths of a learning object for application might then include a number of characteristics, such as its **granularity** (can be small, manageable chunks of learning content), its **reusability** (can be applied to different learning objectives) and its **aggregation potential** (can be customized).

What works for one institution in the application of learning objects may not necessarily work in the same way for another institution. There are just too many idiosyncratic aspects of the various campuses of higher education to find common ground on this issue. However, most institutions reported at least a consensus that learning objects can be used in all instructional environments, including campus-based (face-to-face and/or traditional) as well as all types of online instruction which are instructor-led and self-paced.

Patricia Ploetz, a survey respondent from the University of Wisconsin, Stevens Point, might have reflected a common attitude about the design and application of learning objects when she stated:

"The use of learning objects should be dependent upon the instructor, not the environment; whether you're learning online or in the face-to-face environment learning objects can be a part of the teaching/learning experience."

Instructional design issues surrounding learning objects are still being worked out, as are questions surrounding how best to apply these e-learning "chunks" in the instructional process. So the concept of "best practices" is still very much in question and a subject of vibrant debate and ongoing research.

"When we begin to discuss the instructional characteristics of a learning object, the definition gets more difficult. Should a learning object include or address an objective and should it include some sort of assessment? I've been grappling with this question as I design objects; how do I achieve sound instructional design while decontextualizing enough for realistic reusability?"

Mike Rose, Purdue University

Which disciplines on campus use learning objects?

The use of learning objects is still in its introductory stages, more so in some disciplines than in others. More than 65% of the responding institutions cite the use of learning objects in at least one discipline on their campuses. Most of the disciplines using learning objects are, not surprisingly, in the natural and physical sciences, computer sciences, and medical sciences, such as nursing. Many of the institutions reported that they are using learning objects but that these objects are not shared across disciplines due to a lack of indexing, storage or network planning.

How important is customization of learning in higher education?

Survey feedback on this question was limited to written comments, with no definitive percentages to report. But from the comments submitted, it does appear that the use of learning objects as tools to customize individual learning paths for students is in the exploratory stages at many of these institutions. Customization does appear to be a concept that most of the respondents think will, in the future, become a part of mainstream instruction. Some issues that will need to be resolved in order for learning objects to fulfill this promise include the availability of repositories and the long-term return on the investment of money and time.

Trey McCallie, from The Texas A&M University System, seemed to sum up the climate for customization of learning when he wrote that:

"Customization is somewhat important in higher learning but not widely accepted or feasible in the current e-learning environments present on our campuses. In

the future, as our understanding of technology mediated instruction increases, it will become much more important."

What are the barriers to creating and/or adopting learning objects for instruction?
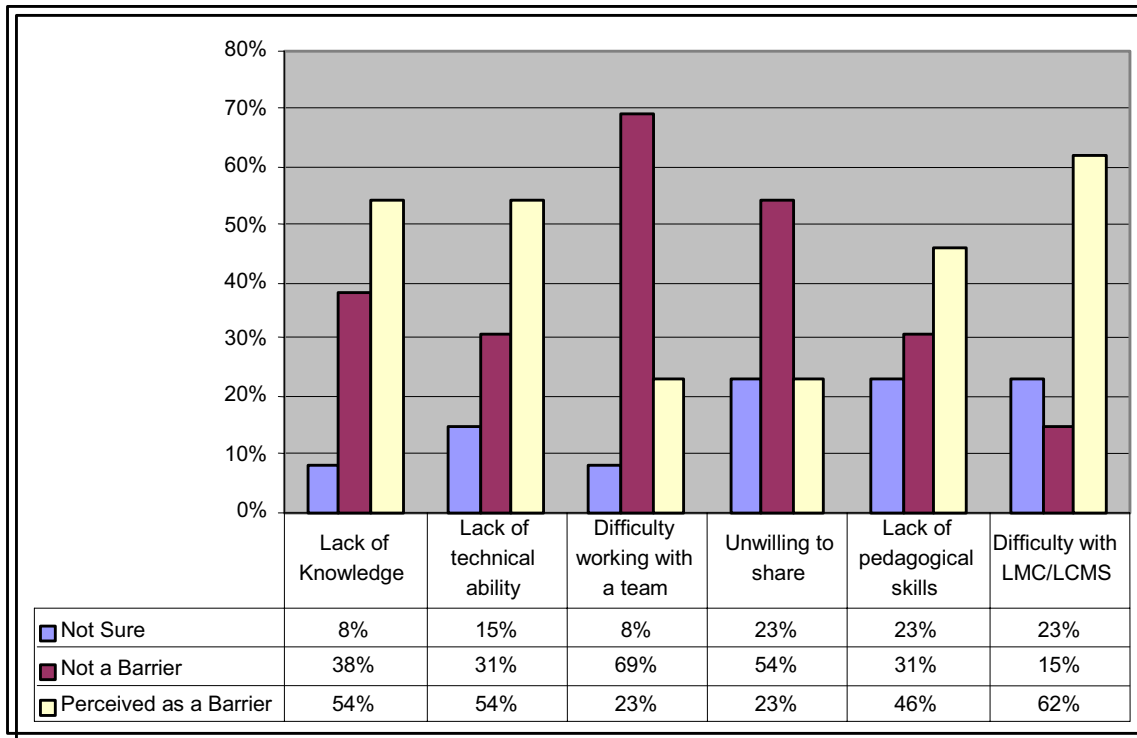
There are some barriers that still exist to creating and/or adopting the use of learning objects. Almost 50% of the respondents indicated that integrating the SCORM learning objects into a CMS (course management system)[3] at the institution was difficult and therefore hindered the use of learning objects in instruction. The second greatest barrier to using learning objects was the lack of a pedagogical model that suggested "best practices". Almost 40% of the responding institutions were concerned about how to teach effectively with learning objects.

Somewhat surprisingly, respondents reported that there was little faculty resistance to sharing learning objects once they were created. More than 75% indicated that their faculties do not see ownership issues, or lack of collaboration to be a barrier in the adoption of learning objects for use in instruction on college campuses. These responses somewhat refute commonly held notions of guarded and proprietary behavior exhibited by faculty when it comes to collaborating or sharing materials and pedagogical strategies.

The graph/table that follows illustrates the results of the survey regarding the nature and extent of the barriers that faculty face in the development and application of learning objects in higher education.

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[3] In the survey "CMS" stood for "course management system", but this was not specified by name in the question to respondents. It is possible that some of the respondents assumed that "CMS" stood for "content management system" instead.

Table 1 – Factors Impacting Adoption of Learning Objects

	Lack of Knowledge	Lack of technical ability	Difficulty working with a team	Unwilling to share	Lack of pedagogical skills	Difficulty with LMC/LCMS
■ Not Sure	8%	15%	8%	23%	23%	23%
■ Not a Barrier	38%	31%	69%	54%	31%	15%
□ Perceived as a Barrier	54%	54%	23%	23%	46%	62%

The Future – The SCORM, Meta-Tagging And e-Learning Standards

Imagine having seamless access to a vast store of "learning objects" such as animations, videos, simulations, educational games, and multimedia texts in the same way that Napster users have access to music files. With the emergence of new internationally recognized meta-data specifications, the peer-to-peer exchange of lessons and courses by learners, instructors, and course developers is becoming possible.   Rory McGreal & Toni Roberts

McGreal & Roberts (2001) described a future that is already a daily reality for some institutions, just one year later, but our survey indicates this is clearly not true for most. The field of e-learning is changing so rapidly that there is a growing need to normalize the development and quality of materials, as well as to provide excellent and effective pedagogical models and assessment programs. The same impetus to standardize for quality teaching and outcomes that has appeared on the K-12 level in

the last decade is also needed for the new environment that e-learning is creating in higher education. As more institutions embrace this potential and the technologies that make this kind of collaboration and conservation of e-resources possible, it becomes imperative that standards be developed which will ensure quality and consistency in their creation and use.

A consortium of international standards and specification organizations, including the Advanced Distributed Learning initiative (ADL)[4], has worked to develop the Sharable Content Object Reference Model (**SCORM**). A reference model developed to promote the interoperability and reusability of content for education, training and performance support, **the SCORM**, is increasingly used in military and private sector training to enhance learning materials' quality and consistency. And with each new version, the SCORM is enhanced by new e-learning standardization efforts from organizations like AICC, ARIADNE, IEEE, and IMS.

As the SCORM extends to serve a broader spectrum of uses, it becomes increasingly significant as a resource for higher education. The SCORM's evolution coincides with a sweeping change in attitudes in higher education toward web-based learning. In a typical academic environment, there may be hundreds, even thousands of content creators using a variety of standards-compliant and non-standards-compliant products to create, customize and store content, sacrificing consistent formatting and meta-tagging.

The SCORM provides all who are working to create on-line courses and learning content a pedagogically-neutral, XML-based specification, which describes a common data model with predefined vocabulary for meta-data tagging and a standard application programming interface that allows browser-based delivery of the SCORM-conformant content to communicate in a predictable way. It is this powerful combination which empowers the resulting content to become **sharable, reusable** and, above all, **interoperable** on all conformant LMS (learning management systems) and CMS (course management systems).

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[4] ADL Initiative Overview, http://www.adlnet.org, December, 2002.

Parallel to these challenges is the current fiscal crisis and general "belt-tightening" that most institutions in this country face. The SCORM shows the way to a better utilization of resources, and a reduction in development time for content and courses, making education more cost-effective.

The SCORM will enhance efforts by academic institutions to conserve resources and to eventually contribute to, as well as draw from, more general digital collections that are already stored and referenced in a number of repositories around the country, such as the University of California's digital repository, (http://repositories.cdlib.org). These repositories act as a kind of "lending library" of e-learning materials such as courses, units, video clips, articles, graphics, etc., many of which already fall under the definition of "learning object". The SCORM provides common meta-tags which can make these types of materials available to academic consumers anywhere and anytime.

Ideally, academic consumers who need to borrow from these repositories will be able to locate what they want because these items will be cataloged and tagged with **meta-data**, which are bits of information describing the item, such as "format", "version", "size", "source", etc., often referred to as **"data about data".**

McGreal & Roberts (2001) point out that meta-data can be objective, such as a file size, subject, or course name, or subjective, such as a cluster of student opinions on the course, or ratings of the course done by other faculty. These bits of information can help consumers to find what they need and/or to make decisions about whether these e-learning materials will meet their needs and be effective.

At this moment, however, there aren't many reliable systems in place for consistent **meta-tagging**, so materials end up not being stored, or are stored, but remain difficult to discover and access. There is also controversy over who should ideally be responsible for meta-tagging materials for storage. Should meta-tagging be done by faculty, developers or by "e-librarians", who are responsible for cataloging, storing, and managing the repositories?

Learning objects must first be created using standards compliant technologies, which offer universal access and interoperability with other LMS (learning management systems). When developers create with uniform specifications and **accessibility** in mind, they are able to draw from and utilize the resources that others have made available in repositories, as well as contribute to this vast store of e-knowledge themselves, reflecting the age-old barter and trade system.
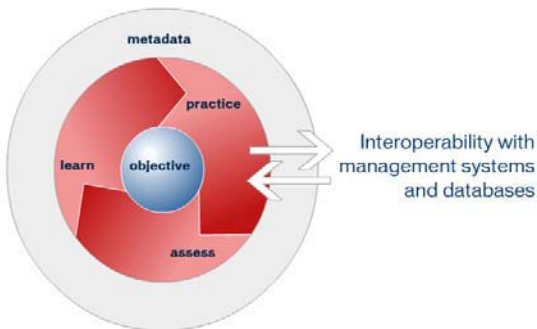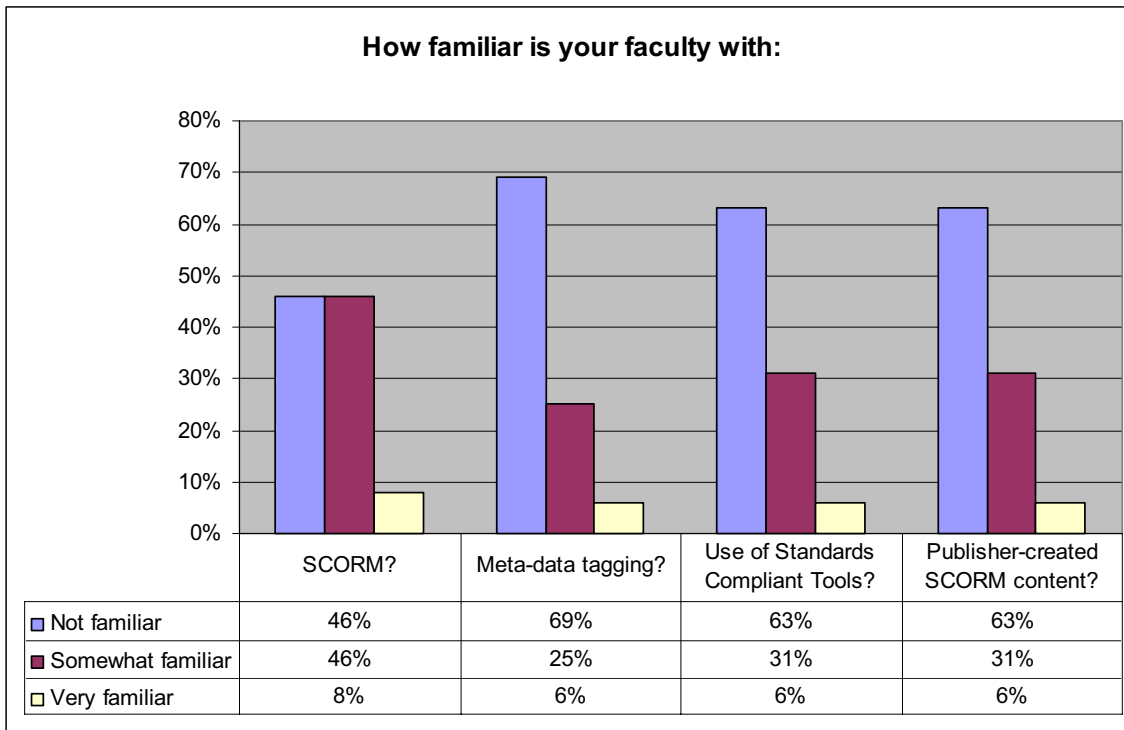

This diagram[5] illustrates the function and relationship between these e-learning elements and underscores the importance of creating learning objects with specifications that allow them to be accessed and utilized by others.

What then are the key elements that faculty members need to be familiar with in this new climate in order to take full advantage of all that is possible? The survey suggests that nearly half of the faculty members from the responding institutions are familiar with the SCORM, but an equal number are not. Less than 10% of the respondents reported that they are "very familiar" with the SCORM reference model, and the tools for creating meta-data.

The graph/table below illustrates the respondents' assessment of their faculty's familiarity with the SCORM and other e-learning elements.

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[5] Macromedia, Inc., http://www.macromedia.com

Table 2 – Faculty Awareness of Learning Object Tools and Availability

How familiar is your faculty with:

	SCORM?	Meta-data tagging?	Use of Standards Compliant Tools?	Publisher-created SCORM content?
■ Not familiar	46%	69%	63%	63%
■ Somewhat familiar	46%	25%	31%	31%
□ Very familiar	8%	6%	6%	6%

Larry Cooperman, a respondent from the University of California at Irvine, pointed out that it is difficult to generalize about whole faculties and their levels of knowledge about e-learning tools, but he summed up what he thought was the general condition on campuses:

> "*There are, of course, some people who are fairly knowledgeable about it. But most campus faculty are happy with the web-based tools provided by our Electronic Educational Environment, because it meets their immediate needs to deliver residential courses with web supplements. Distance Learning, which has greater need of reusability, is still a strongly minoritarian endeavor…*"

How do you envision using learning objects within a Course Management System?

Many expressed learning objects should be incorporated into a course management system's (CMS) design. The CMS must permit discovery, insertion, updating, and deletion of learning objects within a given course, allowing instructors to put the stamp of their own individuality as scholars on the materials they create. Some respondents reported that the ability to customize learning, such as having the capacity for sequencing and tracking of students was very important. These are vital indicators of the time a student spends on a course and it also provides information about the path a student takes to meet their own learning objectives.

> "*Our current vision is not to integrate the objects in the CMS unless that CMS has a mature authoring or development environment integrated into it. Most faculty develop in WYSIWYG html editors external of the CMS. To be successful with learning objects we believe integration of repositories must be with authoring packages versus delivery systems. This is due to our belief that instructors will place high importance on customizing what they use so it will better fit their instructional goal. Integration with CMSs and sequencing will be important in automated systems that handle remediation and individualized learning*".
>
> Trey McCallie, The Texas A&M University System

Reflections And Recommendations

The results of this informal survey on learning objects and their use in higher education indicated several things:

- Normalizing the definition of "learning objects" would be extremely difficult given the diversity of disciplines, philosophies, and pedagogies in higher education.

- The creation and application of learning objects will increase and expand as their pedagogical roles are more clearly defined. The significant percentage of faculty who lack knowledge about learning objects and the technical skills to work with them merely reflects the deliberate and slow-moving adjustments made by many

institutions to prepare for change in the nature and process of teaching and learning.

- Strategies for upgrading systems and for training faculty will need to be developed at the institutional, state and national level. One positive trend is the willingness of faculty and developers to work in a collaborative environment and to share their efforts with others.

- The lack of pedagogical models for effective work with learning objects and teaching in an e-learning environment is significant. Models for "best practices" are constantly evolving, but that process would be greatly enhanced by increased applied research and evaluation in this area.

- Use of the SCORM learning objects have yet to be tested to determine what specifically needs to be done to marry the Course Management System into a workable, instructional process. Faculty want to use their own materials, including learning objects, within the CMS in a way that is seamless to the instructional process.

- Course Management Systems that help to remove some of the barriers to developing, tagging and reusing course materials will improve the process of retrieving and sharing learning objects.

- Most institutions, at this time, lack their own repositories to store learning objects or are unfamiliar with those that are available for storage and retrieval of learning objects.

- The survey results and comments indicated that e-learning technology is much more commonly utilized in the sciences, than in the humanities and social science disciplines. The sciences have historically embodied a greater standardization of curriculum, which better lends itself to sharing curriculum-based content and pedagogical "best practices".

- Meta- tagging required for the SCORM references for learning objects are not widely known and SCORM-compliant applications are not widely used to author and package content. Until a system is in place that makes meta-tagging an easy process, the labeling, and storage of learning objects will be stalled out.

- Additional debate may help define who should do the tagging of e-learning materials -- the creators of learning objects, the developers who collect materials and create course packets, or by "librarians" who are responsible for the collection and retrieval process.

<u>Recommendations for institutions of higher education</u>

"*Learning objects are currently best suited for online asynchronous learning but could be adapted for hybrid classes as well as for lecture presentations. Instructors will show the way learning objects can be used across the disciplines and, I believe, in both online as well as traditional face-to-face learning environments. Scholarly teaching, i.e., those instructors who experiment with teaching strategies and measure their success, will find many ways for learning objects to be used in whatever form instruction and learning takes*."

Michael Kolitsky, Ph.D, Atlantic Cape Community College

Education as a discipline has come through a long period of relative stability, but now the new information and communication technologies offer attractive enhancements to most educational activities. Embracing these new technologies can be inhibited by a number of personal and institutional factors that can be slow to resolve. Institutions of higher education must take into account the potential stress generated by embracing the new technologies when change is not well informed and/or well paced.

For those institutions that are ready to explore the potential of these new technologies there are some early practices that can ease the transition to the development, tagging and storage of reusable learning materials. (1) Developing content in small "chunks" using universal technical specifications and meta-tagging are good first steps in creating sharable content. (2) Copyright and other legal issues must be taken into consideration during this development stage as well. (3) Exploring

opportunities to collaborate within and outside departments, and across disciplines and institutions can help to create "communities of practice" (COP). These "communities", can provide a rich and economical source of learning materials, generate new pedagogies and provide a supportive and challenging collaborative network.

Teaching and learning are evolving at an unparalleled pace, across the globe, advanced by the extraordinary potential provided by these new technologies. Faculty interest and engagement in e-learning are developing parallel to and strongly influencing patterns of institutional acquisition and implementation of appropriate technologies. Faculty and institutions that are just beginning to explore the potential of e-learning will enter a burgeoning field, right on time.

Readers are encouraged to share their plans on developing, retrieving and using learning objects with their vendors. Another means of communicating institutional requirements is through membership in the Academic Advanced Distributed Learning (ADL) Co-Lab (http://www.academiccolab.org) located in Madison, WI, officially established in January 2000. Judy Brown, the Executive Director, in an overview (2002), describes the Co-Lab as

> "*The nation's focal point for academia in distributed learning and serves as an academic partner and link to test, evaluate and demonstrate ADL-compliant tools and technologies to enhance teaching and learning. It also serves as an academic demonstration site for ADL tools and content, including those developed by the federal government, industry and academia. The Academic ADL Co-Lab promotes collaboration in the research, development, demonstration, implementation and evaluation of ADL technologies and products.*"

These new technologies and their potential are only beginning to be tapped in higher education, and this survey demonstrates the need to have a more in-depth study of the barriers which institutions of higher education face in making these transitions and meeting the challenges of this new e-learning age.

Acknowledgements

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