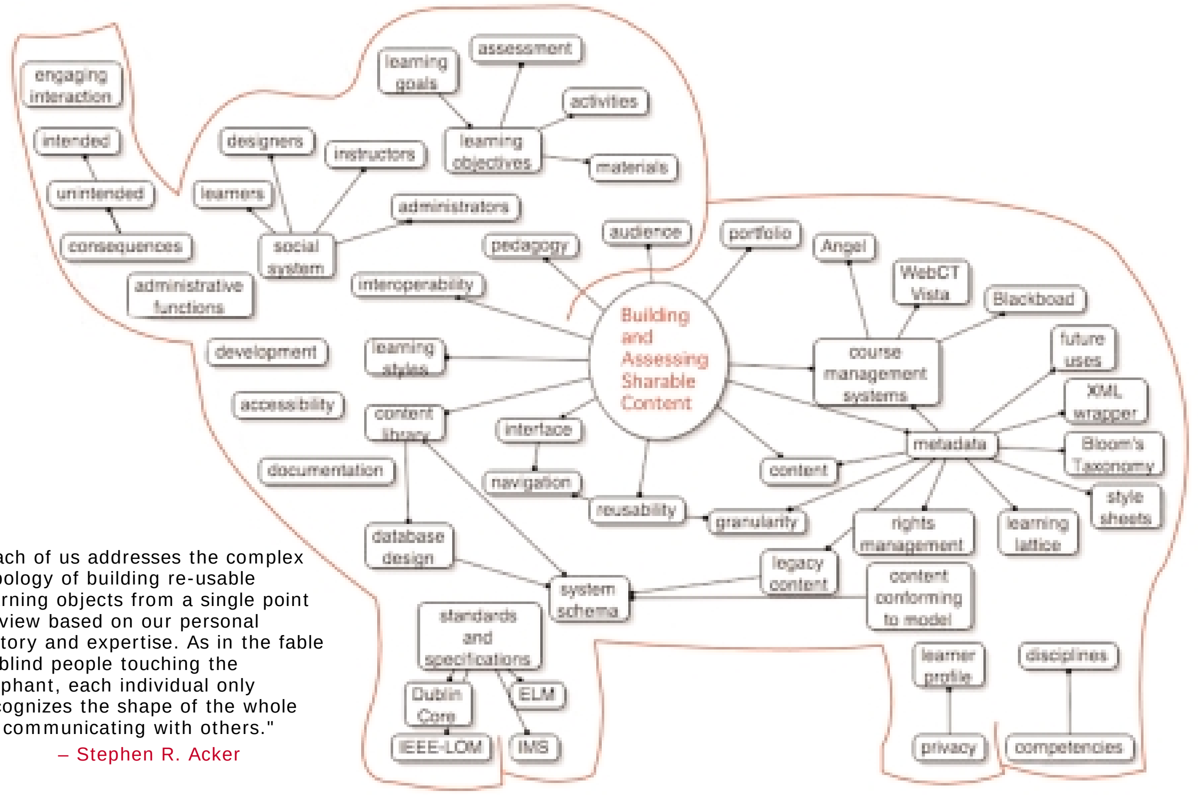
Learning Objects: Contexts and Connections

Catherine M. Gynn and Stephen R. Acker, Editors



"Each of us addresses the complex topology of building re-usable learning objects from a single point of view based on our personal history and expertise. As in the fable of blind people touching the elephant, each individual only recognizes the shape of the whole by communicating with others."
– Stephen R. Acker

The Ohio State University
2003

Acknowledgements

The editors wish to thank the many people who have made this compilation possible. To our friends and colleagues at the Ohio Learning Network, we are grateful for the opportunity to work with you, and we are inspired by your tireless efforts to make education online an affordable reality for Ohio's citizens. To the members of the OLN Learning Communities who attended the Institute from which this volume emerged, we gained much from the opportunity to share thoughts, discuss issues, and reflect on the future with such insightful and diverse educators as yourselves. To our authors, thank you for your good humor as we moved through ideas, to drafts, to re-drafts and more re-drafts, to the works represented herein. To our fellow TELR team members at Ohio State, we are grateful for your understanding and assistance as we undertook this project, and special thanks is due Dr. Victoria Getis for her keen eye and editorial assistance with several chapters in this volume. We also are indebted to Jon Gladden, a talented designer and recent Ohio State master's of fine arts graduate, who boldly took on the web aspects of this project and did not flinch when we extended his duties to print.

Our thanks to all.

S. Acker, C. Gynn

This book is also available online at:
http://telr-research.osu.edu/learning_objects/

Foreword

In the Spring of 2002, inspired by ambitious goals and a constrained timeline, members of the Ohio Learning Network (OLN) took action on a conversation that began two years earlier. That conversation revolved around one primary question: How could OLN best collaborate with campuses, focus on faculty development, and partner in the development and public sharing of pedagogically robust and technologically enhanced programs, courses, modules, and learning objects? We agreed the best answer to this question was the OLN Learning Communities Initiative (LCI). The Initiative goals were to

- catalyze and support the development of technologically-enhanced collegiate programs, courses, modules, and learning objects;
- enable a framework of higher education communities that collaborate, create and share technologically enriched learning resources;
- develop shared learning resources that are portable, scalable, and connected to student competencies; and
- support a diverse cadre of faculty and communities who work together and address learning-centered teaching utilizing advanced technologies

By late March, 2002, details of the OLN Learning Communities Initiative were finalized and the RFP was offered. By May, 2002, 31 Learning Communities were awarded Readiness Grants. These 31 communities represented 25 higher education institutions and partners (including PK-12 schools, other colleges, a hospice, a Head Start agency, and a Vietnamese university). Each was provided a small grant with which to work over the summer to create an implementation plan. Five institutions received grants to offer residential January Learning Institutes. All 31 communities were expected to attend two statewide meetings; attend one of five, two and a half-day residential January Learning Institutes; and provide reflective writings for public review, called Learning From Experience – "Developing Portraits of Practice: Case Records."

The five January Learning Institutes were key to the success of this year’s OLN Learning Communities Initiative. Each Institute was themed (Collaborating, Improving Our Teaching, Preparing Future Teachers, Building and Assessing Sharable Content, and Supporting Student Learning). Five to seven communities attended each Institute. Participants were exposed to deep expertise and were given time for teamwork, networking, idea sharing, and opportunities for peer critique. Most importantly, the Institutes provided time to reflect and receive just-in-time support for mid-cycle improvements.

The Ohio State University provided an absorbing and stimulating January Learning Institute. Tremendous power erupted from the conversations and challenges issued from presenters, facilitators, and colleagues during and between sessions. One of the major outcomes of the Ohio State Institute is the resource you hold in your hands. It is robust and provides the best of the best information from the Institute theme: Building and Assessing Sharable Content. This issue is not only relevant to the seven communities in attendance that January, but to all in higher education.

It is OLN's hope that what we share stimulates and guides new learning, not only for you as individuals but also as you work together with your colleagues, wherever they may be.

Sheryl Hansen
Director, Professional Development Programs
The Ohio Learning Network
www.oln.org

Learning Community Initiative Timeline

October, 2002: Two hundred educators attend the initial statewide meeting.

January, 2003: Five Learning Institutes are held throughout the state.

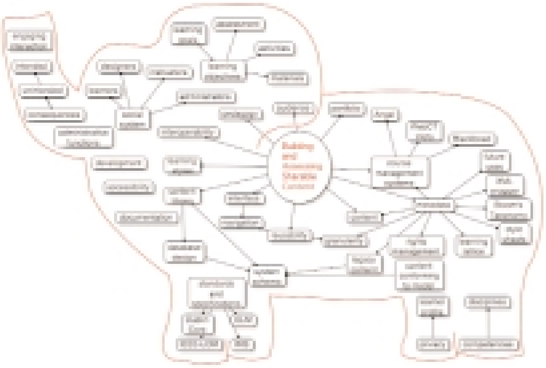
February, 2003: Part I of the "Developing Portraits of Practice: Case Records" are complete and available for viewing.

June 18, 2003: Thirty of thirty-one communities participate in a one-day showcasing of projects at a state-of-the-art computer commons.

Summer, 2003: "Developing Portraits of Practice: Case Records" Part II are collected.

Fall, 2003. Digital resources are finalized and placed in the E-Learning Athenaeum of Ohio and OhioLearns! Ohio's portal to on-line education.

These and other OLN Learning Communities Initiative resources are available at:
http://www.oln.org/teaching_and_learning/learning_communities/
learning_communities.php



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– Stephen R. Acker

The "touch the elephant" learning object concept map is adapted from a collaborative project of the Autumn 2002 Journalism and Communication seminar *Digital learning objects: The building blocks of on-line course design*. Special thanks to Emily Palmer-Jones and Justin Grossman for finishing touches and refinements to the map.

Preface

Under a grant from the Ohio Learning Network, seven funded learning communities gathered for two and a half days of intensive project planning and development on the topic "Building and Assessing Sharable Content." The papers in this volume represent the work of invited speakers at that January, 2003, Learning Communities Institute held at The Ohio State University, Columbus, Ohio, ongoing efforts of one of the seven implementation teams, and an aggregated reading list for those wishing to explore this topic further.

The Ohio Learning Network Learning Communities Initiative is a grant program designed to develop and support Ohio educational communities that are learning to use technology. Throughout the state, 31 learning communities were established at 25 Ohio institutions. Each community included faculty, instructional support personnel, library professionals, K-12 teachers, and others from higher education, schools, and organizations. Seven of the 31 learning communities gathered at Ohio State, under the common theme of "Building and Assessing Sharable Content". The Institute was developed to exchange approaches to building instructional content that efficiently serve different student needs and learning objectives. The challenge in bringing seven diverse groups together was to re-use each other's ideas, solutions, and in some cases content, while minimizing redundancies and re-inventions. This volume represents some of the knowledge developed for, and presented at, the January, 2003 Learning Communities Institute.

For most academic conferences, audience needs are identified, and keynote speakers who can address those needs are invited. As a working conference, the January Learning Communities Institute at Ohio State recruited speakers who would play an additional important role as mentors to the learning communities. More than delivering their talks, the speakers acted as "community consultants" for the entire two and a half days of the conference, and participated actively in the conversations surrounding project development, and in many ways further developing their own ideas in relation to the work at hand. The work in this volume represents the results of this collaborative community working with these mentors and with each other.

At first glance, the chapters may seem only remotely connected, however each paper represents part of the answer to the question asked by learning community participants: "What do we need to know to work together to build and share reusable resources?"

- We need to understand cross-disciplinary conversations.
- We need to know how to work within a virtual community, and what the environment means to our lives as instructors and students.
- We need to understand metadata requirements and processes.
- We need to incorporated accessibility standards.
- We need to know how content interfaces with our learning management systems.
- And, somehow, we need to manage the group, the tasks, and the chaos that results from undertaking the projects we have chosen.

These questions serve to introduce our authors:

Cross Disciplinary Conversations – Building and sharing reusable resources requires that we talk across disciplinary boundaries. Jim Anderson, University of Utah, writes from the perspective of an epistemologist about the organization of knowledge and how we might better label knowledge claims to make them meaningful to different disciplines. At the Institute meeting, Jim also was a great mentor/teacher in leading/cajoling us to consider issues relevant to the complex domain of collaborative problem solving.

Working in a virtual community – How do we do the work, or build relationships, in the environs of a virtual community? Addressing the culture of virtual communities was an immediate and apparent need, complimentary to our concerns of talking across disciplinary boundaries. At the Institute, David Wiley, Utah State University, led a discussion on the sustainability of learning communities and pushed us to consider how we are going to scale our work and how we are going to include important aspects of socialization in our projects. His paper in this volume, "The Coming Collision between Automated Instruction and Social Constructivism," represents those thoughts and provides a provocative examination of scalable, social learning environments in current use on the Web.

Accessibility standards and digital learning objects – Ohio State is home to a leading accessibility expert, and we invited her to lead Institute participants through the world of universal design and its contribution to all students, including those with disabilities. Margo Izzo directs a number of projects to improve educational opportunities for students with disabilities from The Nisonger Center at Ohio State University. She played a key role in facilitating a variety of systems change initiatives in Ohio and nationally, and, with her colleague Alexa Murray, writes in this volume of the challenges such projects entail, their promise, and ways to meet the challenges.

Metadata requirements and processes – The sharing of resources is enabled by proper labeling and storage of the digital resources, aka metadata. To talk about learning objects in the academy, there is a need to be up to speed on the basic concepts underlying this important aspect of managing digital resources. Michael J. Halm, Penn State University, and Kimberly Lightle, Associate Director of the Eisenhower National Clearing House , address this essential area. Mike’s chapter brings home the importance of emerging standards in building learning objects and some of the international work oriented toward describing and using various pedagogies in technology-supported learning environments. Kim’s writing guides us through the thorny issues associated with cataloging and describing digital assets so that their value for instruction is enhanced.

LMS interfacing – Questions of reusability of data and future-proofing our investments are self-evident when we look at how the digital learning objects will be shared. Michelle Lamberson, Director of the University of British Columbia’s Office of Learning Technologies, and her colleague, Brian Lamb, discuss the issues of content management and presentation approaches based on sound pedagogical principles. Michelle’s vast knowledge of course management systems, and Brian’s experience with learning resource management inform the conversation in these pages greatly. They clearly demonstrate that highlighting the LMS interface is not the same as privileging it. The privilege belongs to the pedagogy, as Lamberson and Lamb point out.

Project management, with an exemplar: Often relegated to the periphery as prosaic, managing the group, the tasks, and the chaos that results from undertaking the projects was viewed by this gathering as an integral and central aspect of our work. To this end, a crash-course in project management was offered to the learning communities. Catherine Gynn, coordinator for Technology Enhanced Learning and Research at Ohio State University, shares the project planning approach provided to the learning communities. Steve Acker, Learning Technologies Research and Innovation director at Ohio State University, provides an exemplar of learning community project development in sharing results from the "Rich Media for Science and Humanities" project, results that were informed by the work of the Institute presenters. Steve and colleagues Dennis Pearl, Steve Rissing, Amod Damle, and Jim Bracken end the volume with additional writings, exemplars, and a graduate course structure used to explore this fascinating topic.

We thank the Ohio Learning Network for the opportunity to present the work-in-progress that is our OLN Learning Institute on Building and Assessing Sharable Content.

Catherine M. Gynn
Stephen R. Acker
Editors

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The Challenges of Collaborative Knowledge[1]

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As the study and development of learning objects evolves, evaluation can and should play a critical role in helping users refine their criteria for such objects and their ability to use disciplined inquiry to improve instruction using learning objects. (Williams, 2000)

Evaluation can proceed only from some standpoint that defines the character of the learning object, the methodology of its evaluation, and our common agreement to both. It is this agreement that constitutes the discipline of inquiry. The methods, bright and dark, that impose that discipline are our topic.

There must have been something about the graduate schools of the late 1950s and early 1960s that led to that era's publication of two works that liberated epistemology from the overwhelming success of 18th century science. The two I have I mind, both published in the second half of the 1960s, were Thomas Kuhn's The Structure of Scientific Revolutions and Peter Berger and Thomas Luckmann's The Social Construction of Reality.

What Kuhn did was allow us to see science as a sociological phenomenon marked by coalitions of belief and practice. His work led to a whole series of demystifications, including Latour's (1987) work on decontextualized truth and Prelli's (1989) insight into the rhetoric of science. What Berger and Luckmann did in their treatise on knowledge was to fully undermine the unequivocality of what is claimed as knowledge. Their work, in its part, led to Roth's (1987) epistemological pluralism that joined the postmodern crusade of knowledge as ideology.

What we surrendered in this turmoil was the certainty of truth and the unity of knowledge. What we gained was a veridical diversity that empowered a multitude of voices in the classroom and its attendant halls of knowledge. This diversity may be, in the long run, better for the species. It raises the hope that

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[1] *This chapter is a re-creation of symposium presentation. It attempts to retain much of the oral character of the original.*

we won't be trapped like a bee in an upside down bottle. The bee's straight ahead certainty that up is out keeps forcing it to the sealed bottom and its ultimate doom. It is one of the crazy ideas flitting about like the fly that will eventually find the exit.

In the short run, however, we are forced to recognize that knowledge is not transcendental but rather locally produced and that knowledge is not forever but rather sustained in a community of practitioners (that may be world-wide in its distribution). As Kuhn pointed out, these communities are ideological structures held together and marked apart by certain core beliefs about the world, about the character of our knowledge of the world, and about the nature of the evidence of that knowledge. Inside one of these communities, truth is often certain and knowledge one. Members face "culture shock" when they cross the town boundaries to discover that there are real people with power who don't believe as they do.

The typical classroom functions as an ideological community albeit limited in time and scope. The coercive control exerted by the societally enforced grant of authority and hierarchical structure of instruction can ensure that in this classroom X and only X is the right answer. Alas, next door and down the hall Y and Z are being similarly enforced. The threat of this diversity is quite real to the modernist mind and much of the internecine warfare of the academy conducted under the cover of the "quality of the work" is the result. Most student don't involve themselves in these battles. Students simply adopt a "when in Rome" pragmatism and a six week memory span.

...knowledge is not transcendental but rather locally produced ... knowledge is not forever but rather sustained in a community of practitioners ...

Epistemological Communities

But even in chaos there are patterns and these patterns draw the broad outlines of the territories occupied by different epistemological communities. Each community has a manifest destiny defined by the natural barriers of its core values.

Traditions

Let's begin our exploration of these communities by first envisioning knowledge from the traditional view (adapted from Anderson, 1996). This view, as presented in Figure One, shows knowledge as a central unity in a wide field of epistemological endeavor located in a broader field of ignorance, folklore, superstition, and common sense. The boundary of the greater circle defines the right practices and credentials of practitioners, arguments, evidence, claims, and proofs. Lines leading to the core are the legitimate (or legitimated) avenues of contribution. Contributions move into the central core as they pass certain tests (of time, elegance, parsimony, logic, coherence, instrumentality, and the like).

In the pre-Kuhnian era, these boundaries, avenues and tests were presumed to be foundational—natural if you will—given by the empirical world, the only legitimate object of true knowledge. Now, of course, they are recognized by some as ideological, given in the sociological practices of local knowledge production.

Traditional Divisions

One cannot go on reading the map of Figure One for long without noticing that its representation does not correspond well with what seems to be the territory. There are some prominent features not represented. Figure Two starts the clarification by sectioning the grand circle into quadrants. The quadrants are headed by conceptual boundaries that effectively divide the membership. The four concepts in their paired opposites are methodological individualism/ methodological holism, and foundationalism/reflexivity. We'll spend a little time exploring the character and functions of these conceptual boundaries.

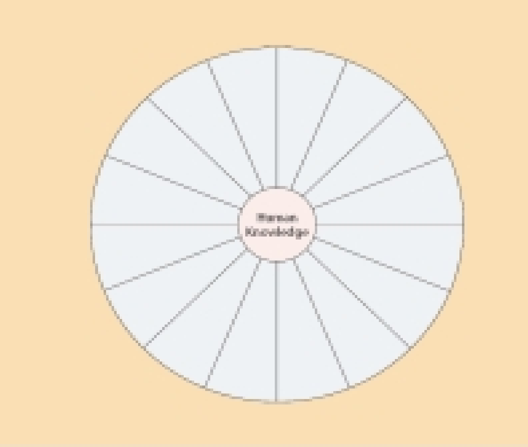

Figure One

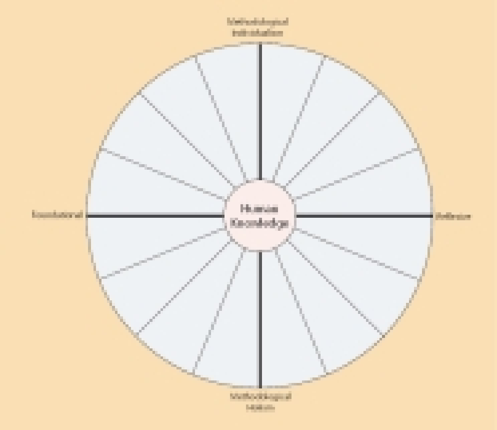

Figure Two

Methodological Individualism--Methodological Holism

The shared term of methodology in this pair makes use of the philosophical meaning for methodology as a foundational practice of knowledge production. An epistemological method identified by individualism holds the world to be divisible and reducible to a finite (and small) number of fundamental building blocks—all matter is composed of molecules, all molecules of atoms, all atoms of particles; the human self is a product of, say, a value structure, intelligence, and personality which themselves are constellations of attitudes, aptitudes and traits.

A holist epistemology focuses on unities rather than parts. In a unity, elements come together in a way that alters them. It is this alteration in the combined state that creates the unity. If one is to know a self, a particular material, a society, a culture, one must study it as a whole, not as a set of components. One cannot predict a sentence by studying a dictionary. And to jump ideologies, a human individual is not a set of scores; a human has a soul.

Methodological individualism is dominant in physics and chemistry and their dominance extends its sway across the other physical sciences, although holism does show up in some factions of the biological. Methodological holism finds its strongest expression in the realms of sentience and semiosis—those fields that study the sign, the mind, and understanding. Boundary battles are evidenced in the fields where arguments over metric (quantitative) and hermeneutic (qualitative) research methodologies regularly occur, such as anthropology, education, psychology, sociology and communication. Boundary battles also show up in Institutional Review Boards that authorize all human subject research in universities, in the social arguments about the humane treatment of research animals, and even in the wilderness debates.

Foundationalism--Reflexivity

Our methodology pair broke across the direction of analysis — bottom up or top down. This pair breaks first across the final resting place of the argument—on a secure foundation either of authority or of an independent, empirical world or on a constructed standpoint dependent on the political strength of its practitioners. It is the validity difference between "It is a scientific law because it is true" and "It is true because it is a scientific law," and the instrumental difference between "It works because it is true" and "It's true because it works."

The first of those two contrasts considers whether the validity of an argument is independent of the methods used to arrive at the conclusions. Is the Oedipus Complex valid without Freudianism? The second considers whether knowledge production can ever be free of purpose. Does personality testing work because of the existence of personality or does personality exist because personality testing serves some disciplinary or social purpose? Similarly modern atomic theory can be said to exist because the purposes of World War II provided the enormous funding to make it possible.

The second break for this pair is across the independence of the observer, the observation, and the observed. In foundational epistemology, all three are independent of one another. Done properly, local conditions, practices, and agents should not affect the evidence generated. The evidence is said to be transcendent. Claims can move across time and place. In reflexive epistemologies, the evidence is always a function of local conditions, practices, and agents. It is said to be historicized. Claims are limited to the who, when, where, why and how of the evidence production. The result is that we can teach Newtonian physics in the start of the 21st century introductory class pretty much the same as it would have been taught in the start of the 20th century without much comment, but all hell would break loose if we did the same in social studies.

Now for some the conclusion is that social studies is not true knowledge, just a hodge podge of current common sense. For others, the conclusion is that knowledge claims about the social are time-bound in ways that claims about the material are not. And for yet others the conclusion turns to the question of why doesn’t all hell break loose if we are still teaching Newtonian physics. The first of these is a foundational conclusion, the second two are reflexive.

From an epistemologist’s point of view, reflexivity changes things in interesting ways. The object of our science now participates in the science itself and even works to undercut the scientific conclusion. For example, the strategies and tactics of *The 60-second Manager* by Blanchard was followed within 6 months by The *59-second Employee* by Andre and Ward. Both of these books have gone through multiple editions. The knowledge of one set of claims is subverted by the other.

Reflexivity also changes the ethical requirements of knowledge. In traditional epistemology, true trumps good. The claim of what is (the true) can never be modified by what ought to be (the right and proper). In reflexive epistemology, some value will accrue to someone every time an advanced claim is declared true. That someone always includes the scientist/scholar/critic both locally and institutionally and the larger social purposes that empower the scientist/scholar/critic. It is true because it ought (is right and proper) to be true. The conclusion is that advancing a claim—any claim—is in the scientist’s self-interest. The scientist, therefore, becomes responsible for the consequences of the claim. So, if collecting demographic information on surveys serves to promote racism, the scientist is a racist even if inadvertently. It suddenly becomes a tough game to play.

Community Memberships

Epistemological communities become functional when they are populated by practitioners of knowledge work. Figure Three presents the general membership patterns that appear within the quadrants formed by the axis of validity and method.

In common terms, the "hard" sciences and definitive arts (strict representation, perhaps) occupy the quadrant bounded by foundationalism and methodological individualism; the metric arts (architecture & graphics) and social sciences slide toward reflexivity while maintaining individualism as a method; the interpretive arts and social sciences (branches of psychology and sociology, cultural studies, ethnography) cross to methodological holism and in the foundational/holistic quadrant are the authority-based arts and sciences (perhaps much of ethics, law, journalism).

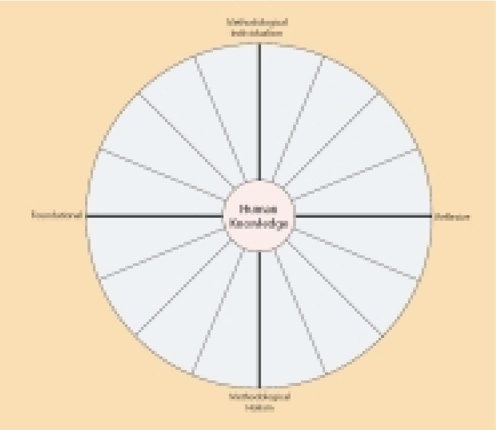

Figure Three

Each of these communities creates its own emblems of membership, barriers to entry, scriptural texts, citizenship requirements and judicial practices of enforcement. These elements translate into the cultural means of knowledge production that in turn define production practices and the character of the resultant product. Where you belong makes a difference in what you can say and how you can say it.

An emblem shared by all is being inside the circle, meaning that they are culturally recognized to nominate some class of claim as true. Those outside the circle are generally denied that right. Being inside the circle is faint recognition, however, when being viewed across the quadrant axes. Quadrant membership requires particular personal and institutional credentials.

It is these credentials, among other things, that create the barriers to entry into membership and constitute the scriptures of membership. Being a member requires that you have achieved certain levels of accomplishment, know certain things, have a certain perspective, understand what questions can be asked and the nature of the right answer. There is little that is egalitarian about epistemology.

Achieving entry and scriptural immersion are socialization processes that imprint the right practices of knowledge production—the behavior of the good quadrant citizen. We see that imprinting in the character of the scholarship—the methods of evidence production, the warrants of claim, the backing that supports it, and the discursive forms in which it is presented. The scholarship of physics is different from the scholarship of cultural studies because of the different sociological practices that support each of these. And when those practices are not sustained, rigorous practice of enforcement come into play to make things right again.

Kuhn was pointing to these sociological practices in *The Scientific Revolution.* These practices create the boundaries of his famous, if ill-understood, paradigms of science. Paradigmatic science or epistemology is highly conventionalized, which means that members are readily identifiable and the rules of performance are well-developed, codified, reproduced, and enforced.

It would be a sweet turn to argue that each of our quadrants was paradigmatic. But, as Figure Four shows, only the covering law arts and sciences have achieved that level of integration. Further, I suspect that the requirements and limitations of reflexivity would prevent that whole right hemisphere from achieving the needed integration. Each time the members would get close to that accomplishment, the practices themselves would become the object of analysis, thereby deconstructing the whole project.

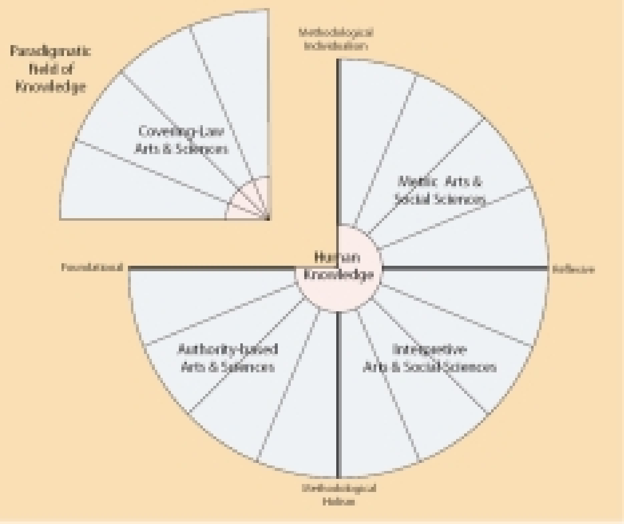

Figure Four

Paradigmatic integration, however, does not mean intra-quadrant homogeneity. There is substantial within-membership variability as the quadrant divides across disciplines, sub-disciplines and interests. The American Physical Society, for example lists 13 different divisions for the field of physics. (Communication on the reflexive side has more than 4 times that number of divisions.)

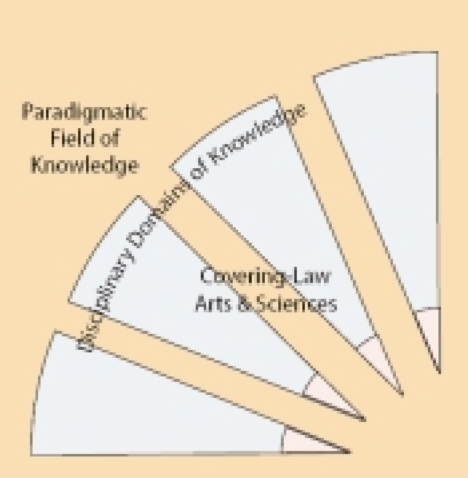

Figure Five

As Figure Five shows, a paradigmatic field splits into disciplinary domains. Disciplinary members claim ownership of certain types of claim and vigorously defend their rights of title. Utah's cold fusion episode was as much a row over chemists making claims about the behavior of atoms as it was about bad science. The fight was both interdisciplinary and paradigmatic.

We have come a long way from our initial representation of human knowledge and its production as an unbroken circle of practitioners with defined avenues of contribution to a unified center of valid claim. I have now redrawn that image in Figure Six in a much more realistic form (given the third quadrant perspective from which I write). That figure shows knowledge boxed in paradigmatic and pseudo-paradigmatic memberships, divided by disciplines whose members are content with and fiercely defend their own slice of the pie.

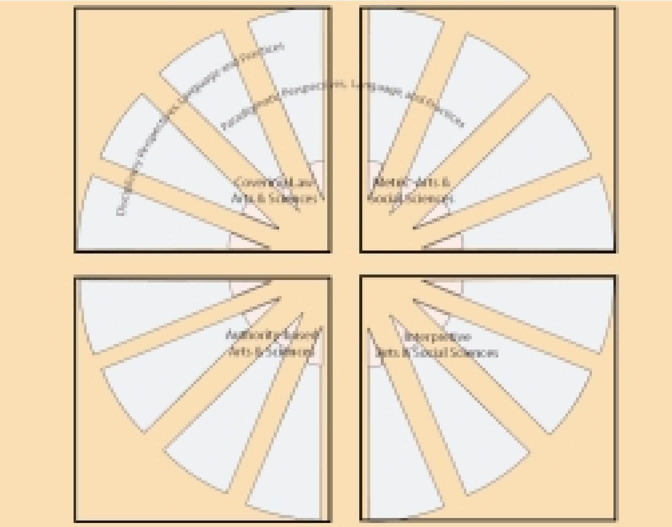

Figure Six

Implications for Learning Objects

David Wiley of this volume defines a Learning Object as "any digital resource which can be reused to mediate learning" (http://wiley.ed.usu.edu/pres/oln.pdf; accessed May 19, 2003). Wiley's definition, as useful as it is, glosses two very important social processes both of which are embedded in plural character of knowledge. The first of these is how any collection of zeros and ones gets nominated, authenticated, accepted, and utilized as a resource in the performances of authorized instruction. The second is in the mediation of learning. It is well beyond the scope of this chapter to finely detail these processes but a few salient points can be made.

Resource Nomination, Authentication, Acceptance, and Utilization

Nominating something as a resource for learning is the same as making a claim for knowledge that is embodied or represented in the resource. The object remains locatable in the epistemological domain of its creation and it carries the assumptive codes of that location. Those codes are the source of its coherence as an object. One can strip away a contextualizing framework (a problem in itself) but not this internal coherence. Knowledge, as we have seen, is both plural and contestable. As creationists and evolutionists so clearly demonstrate, epistemology is not a bloodless sport. Where something comes from marks its value in other locations.

Authentication identifies the object as a "learning object"—an object qualified to be used in authorized instruction. While this process may be local even to the individual decision maker, it is subject to review by agents of the authorizing instructional institution. But more likely the move to qualify the object will be substantially more than local. It will be conventionalized and institutionalized in archives and rules of access. Meta classification, for example, is part of the authenticating process. Classification systems and the larger authentication process are neither ideologically nor politically neutral. They are, however, reductive, which means that whole interest areas can be wiped out.

The instructor who moves a learning object into a field of authorized instruction performs an act of acceptance of the object and its qualities that will mark her or his own instructional performance. Our current, carbon-based system of learning objects (textbooks and the like) is a highly limited and limiting resource. But it does lower the risks entailed by the user. Order any multi-edition textbook for a standardized course and the results are going to be pretty much the same. Assemble a course out of learning objects and the risks of failure and being branded by that failure are pretty high. Learning objects grant freedom but not autonomy. They grant the right to choose but not the right to judge. It is the right of others (such as an instructor in a classroom) to judge that makes freedom risky.

Utilization is the last topic of this section Our discussion on utilization begins with the problem alluded to earlier about the decontextualization and recontextualization of the internal coherence of a learning object. It is a problem that I am most familiar with in the utilization of ethnographic narratives or field notes as evidence in an ethnographic argument. Consider this snippet taken from a long-form interview on relationships:

> So about 1:00 I go to work I get on the computer and I check my e-mails and there is one from her and it is from between 11:30 and 1:00. It's like a three page e-mail; real in depth about how she can't be in a serious relationship right now; how so much is going on in her life; and I'm thinking where is this coming from? We aren't dating. We have been broken up for about two months now. I'm thinking come on, you can't do this to me again. And then it goes on to negate everything, saying, "I really like hanging out with you. I love being together and love your family and maybe we can hang out." She wants to keep me in Limbo. I feel like I was always being placed on a hook. (NR 69)

The internal coherence of this selection is so strong that although it is only 9 lines out of pages, we know the story being told and can immediately form conceptions of the actors and the paradigmatic action in play. But think with me how these lines might be used in a feminist argument on romantic love, in a discussion of relational ethics, in an interpersonal communication class, in a class on the sociology of dating, in a psychology class on double-bind relationships.

The lines would work wonderfully in each, but each case would radically recontextualize them to accomplish its own purposes. And isn't that the point of having learning objects in the first place? The critic of the ethnographic argument would call this "poaching"—the opportunistic selection of material that supports some claim. The user of learning objects is not typically under the restrictions of good ethnographic practice, but at some point the integrity of the learning object can be challenged.

Consider that the intrinsic value of these lines is that they are real. They were really spoken by an individual describing a relationship. The integrity of the lines, then, is in that reality. It is what makes them resonate, engage, and connect with the reader. But they were spoken in the reality of the speaker to accomplish his ends. Now they will be reconstituted in a different reality to accomplish some other ends. This reconstitution is unavoidable if they are to be used at all. The question is how far can they be taken without corrupting that integrity and being exploitive. For the ethnographer, the answer is not far at all. I'm not sure I know the answer for our exemplar cases.

It is crucial to make these four distinctions: instructor, teacher, student, learner as the character and value of the learning object changes in each.

Finally we have two categories—each with two levels--of utilization to consider. First, there is the utilization by the instructor: an individual under contract to produce certain work for an institution in the construction and performance of an authorized course. This is the didactics of utilization. That instructor may or may not be a teacher: an individual who adopts strategies and tactics that guide others to a selected level of performance mastery. This is the pedagogics of utilization. Second, there is the utilization by the student: an individual enrolled in a contractual relationship that exchanges value—principally tuition--for value—principally credit in the construction and performance of an authorized class. This is the mathesics of utilization. That student may or may not be a learner: an individual who adopts strategies and tactics to achieve a selected level of performance mastery. This is the philologics of utilization.

It is crucial to make these four distinctions: instructor, teacher, student, learner as the character and value of the learning object changes in each. We know a lot, for example, about how to construct a competent lecture as an instructional text. We know a lot less about how to apply the instructional text in a teaching strategy. The difference is how to competently fill class periods and how to lead others to competence.

Similarly, students know a lot about taking a course, but may have little knowledge of how to adopt or, indeed, little interest in adopting the implicative changes in perspective and action that learning induces. The difference is the resources to pass a test in science and those needed to be a scientist.

For the instructor a learning object may be no more than an element of an instructional text deemed competent by the institution. For the teacher, the learning object must have strategic or tactical value. For the student, the learning object may be evaluated only for its importance in achieving a desired grade. For the learner, the learning object is a resource for a different life.

Mediation of Learning

Our classrooms are purposeful, bounded social spaces that constrain semiosis and limit interpretation though the deliberate selection of discursive and symbolic forms, the use of paradigmatic relationships between hierarchically located subject positions, the performance of social routines of hermeneutic supervision, and the instantiation of judicial practices of control. (My thanks to cultural studies for that sentence.) These processes are required if the instructor wants to be able to take inherently volatile signs and form them into a question with a single right answer.

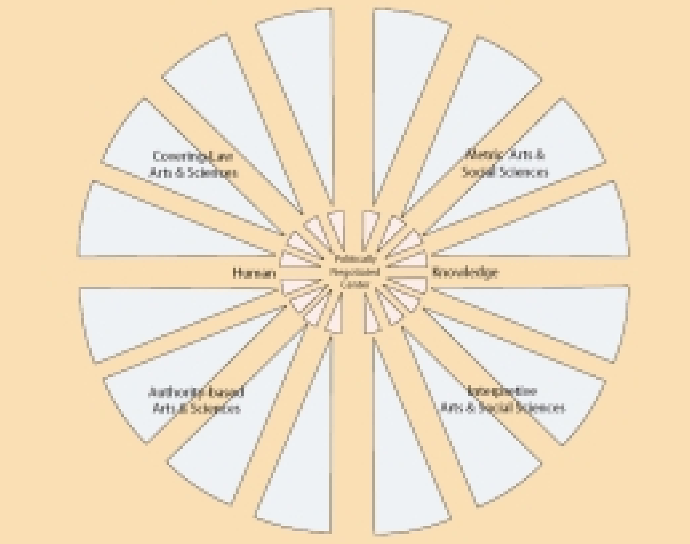

Figure Seven

Return with me to our circular forms to consider Figure Seven. The message of Figure Seven (as I attempt to control your interpretation of it) is that human knowledge is not a unity but discontinuous chunks more or less connected to the process of their creation. The center that we perceive is not secure in any way but is continuously under political negotiation. What one learns depends on where, when, and from whom as well as how and why one learns it. This circumstance is precisely why our classrooms are purposeful, bounded spaces of constraint.

The image that one could take of a learning object from Wiley's definition is that of a free radical coursing through the structurated stream of instruction wreaking hermeneutic havoc. It would have to be controlled with a heavy dose of conventionalization, both in the classroom and across the supervisory unit in charge of instruction. We will not, and cannot as instructors, allow our students to draw their own conclusions. For, as Greimas (1990) points out, every conclusion is perfect according to the time, place, conditions, and circumstance of its construction. The institutional agent immediately takes exception. Students will draw our conclusions, so that we can maintain ourselves as instructors.

I understand that all of this sound incredibly suppressive and it is. Knowledge appears only in the discipline of its domain. That discipline has to create the conditions of its validity and repel all competitors to its claims. It has to provide the terms of right interpretation and good practice. A learning object will not by itself mediate learning because learning occurs only inside a discipline of understanding. It is this requirement for learning that accounts for the classroom's continued existence despite the several centuries of the book and the last 100 years of technological advancement. We do not trust the autodidact. They do not play well with others.

Contemporary epistemology sees knowledge as a set of community practices that are established, sustained, and advanced though social action.

Playing well with others raises my final point. The language that surrounds the excitement of learning objects is filled with individualism. The individual learner is celebrated; individual strategies of knowledge acquisition are underscored; learner-centrism looks to everyone having their own personal set of learning objects. This discourse reifies knowledge itself as a object--one with material-like boundaries and stable structure that can be acquired, stored, distributed.

Contemporary epistemology sees knowledge as a set of community practices that are established, sustained, and advanced through social action. The peculiar success of the human species has not been its individuality but its sodality. The grand signs systems of language and action on which our species has advanced are not individual inventions. The mind is a social product. Knowledge becomes knowledge through social process. In right order, objects become learning objects in the social processes of teaching and learning not through any intrinsic characteristics of their own. And people become learned not on the basis of their private storehouse of knowledge, but on their ability to competently perform as a member of an intellectual community. It is only then that teaching and learning reaches its payoff.

I believe that the licensing of intellectual property in smaller and smaller units is both a technological and economic imperative. Technology and the market are converging to one of those flash points where ten years from now, the textbook will be an anachronistic emblem of the highly specialized or affected. The danger lurking is that the automation of instruction, particularly at the lower levels, will develop so quickly as to outstrip the concurrent development of teaching and learning. The market for the latter is much less dynamic, is much lower in its initial impact, requires a higher level of investment and has a slower rate of return, but in the end teaching and learning--learning and teaching—that conjoint pair must be what it is all about.

Implications and Conclusions

Knowledge is not the product of the great mind thinking well. There is no thinking outside of social interaction because there is no accessible mind outside the social processes of a disciplined sign usage. To know is to belong to a communal process of knowing.

A student is given a set of hyperlinks—an index of learning objects. S/he clicks on one of them; a unit of symbolic material appears. "What does it mean?" s/he asks. What does s/he mean when s/he asks that question? S/he means at least the following: What are physiological requirements of engagement? What is required of the instruments of sentience and semiosis? What perceptual resources does the material provide? What is the perceptual context? From what perceptual frame am I perceiving? What valences are in play? What is relevant, activated? What interpretive strategies do I have for understanding this signifying material? What is my interpretive frame? What resources do I have: Can I give it a name; classify it; connect it to something else? What experience have I had with it? What analogies can I draw from experience? How is it coherent with what else I know? What permissions do I have to conduct the interpretation? What are my freedoms? How much risk can I entail? What are the conditions of autonomy? What controls are in place? What motives are in play? What is my commitment to the interpretive work, the interpretation? What are the immediate, durable, local, global, instrumentalities of the interpretation? What is the social context of understanding? How do I know when I know? Who or what will tell me? What social contracts are in play? What is my standpoint of engagement? What is my subject position in the on-going power-relations entailed by this interpretation? What are the terms of the correct interpretation? Who controls those terms? Who or what will tell me right from wrong? Finally, what form is the interpretation to have? Into what genre does it fall? What conventions will govern its formulation? How will the interpretation be made public?[2] What will be the terms of the exchange?

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[2] *Private knowledge has no epistemological value per se. Knowledge has value only when it can be exchanged either symbolically or in action.*

The achievement of meaning, and therefore of knowing, moves through all of these processes which can be labeled starting from the most local (individual) and moving to the most global (social) as sentience (interactability with an environment), semiosis (recognition of signs) engagement (intentional focus) perception (use of sign and cultural systems of meaning) interpretation (naming, classifying, drawing implications) integration (connecting, building coherence), formulation (creating the exchangeable object), exchange (putting meaning into action). Figure Eight gives a graphical representation of the process.

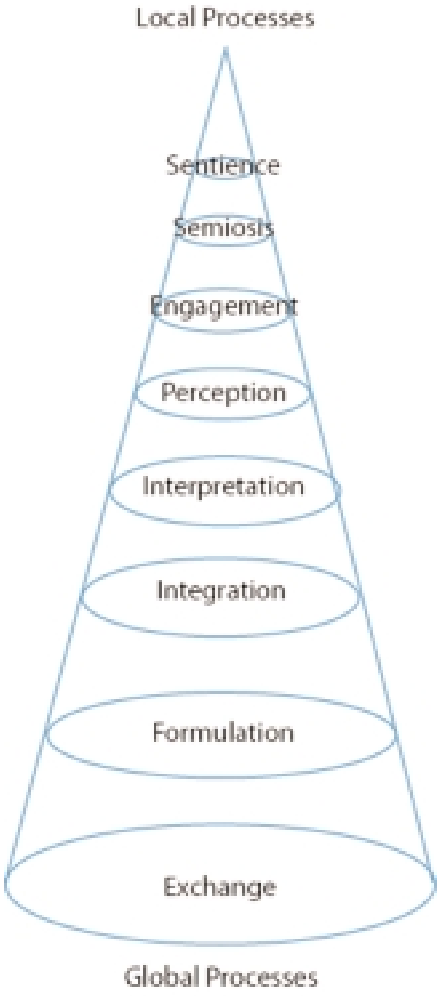

Figure Eight

This is an impossibly complex and difficult list to consider in any sort of knowledge building activity. We manage the complexity by institutionalizing many of our answers through the organizational structures of instruction and research. Eliminating those structures does not liberate knowledge workers (teachers, learners, scholars). It tremendously increases their burden of work. Now, they not only have to make sense of things; they have to make sense of the sense-making as well.

Much of the work that goes on in our epistemological quadrants is directed toward providing and maintaining the resources of this sense-making. An individual faced with a knowledge object that is outside of those resources will encounter difficulties very early in the process. S/he will not have the semiotic resources to form an adequate intentional engagement. Perceptions will be poorly formed and interpretation may be limited to "This is something I do not and cannot know." Exposure does not broaden understanding nor is it the first step of understanding something new. The skills and strategies of engaging something new must be in place first.

The excitement of learning objects is not that we can now efficiently develop, classify, and distribute little bits of content. That is pretty ordinary didactics. The excitement is in developing the epistemological, pedagogical, and philological resources and strategies by which we can span the quadrants. Unless we do that, learning objects will not cross those boundaries (except in the acts of increasing semiotic violence of poaching, appropriation, and excorporation). That we develop only intra-disciplinary libraries of learning objects is not a bad thing. It is simply so much less than what could be.

If we do develop these boundary spanning resources and strategies, there is a genuine opportunity for a critical revolution in knowledge production--the sort of revolution that may be occurring now as our new-found knowledge of genetics begins to consort with the social action of experience. But to accomplish this change, scholars, teachers, and learners will have to give up the certitude and security of what has been effective in the past. Many will fail. The hope is in those who succeed.

References

Anderson, J. A. (1996). Communication theory: Epistemological foundations. New York: Guilford.

Berger, P. & Luckmann, T. (1966). The social construction of reality: A treatise in the sociology of knowledge. New York: Doubleday.

Kuhn, T. S. (1967). The structure of scientific revolutions. Chicago: University of Chicago Press.

Latour, B. (1987). Science in action. Cambridge, MA: Harvard University Press.

Prelli, L. J. (1989). A rhetoric of science. Columbia: University of south Carolina Press.

Roth, P. A. (1987). Meaning and method in the social sciences: A case for methodological pluralism. Ithaca, NY: Cornell University Press.

Williams, D. D. (2000). Evaluation of learning objects and instruction using learning objects. In D. A. Wiley (Ed.), The Instructional Use of Learning Objects: Online Version. Retrieved June 17, 2003, from the World Wide Web: http://reusability.org/read/chapters/williams.doc

The Coming Collision between Automated Instruction and Social Constructivism

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Introduction

There are currently two groups of individuals in instructional technology research that are pursuing a research agenda aimed at making education scale to very large numbers of students and improve in effectiveness. These two groups are pursuing almost orthogonal paths.

After years of trying to preserve the traditional classroom teacher-to-student ratio in online instructional settings, the first group surmised that including humans in the instructional feedback loop simply makes instruction too expensive. To work around this bottleneck, these researchers employ technology in the form of reusable educational resources ("learning objects") and automated instructional ("intelligent tutoring") systems. The role previously filled by teachers (providing feedback and scoring assignments) is filled by computer, and the computer can support as many students as its resources permit.

Another group of instructional technology researchers are championing sociocultural approaches to learning, specifically interested in the role of community in learning, claiming that human-to-human interactions are not niceties that make learning more interesting or fun, but that every kind of learning simple rote memorization requires complex social negotiations and structures to support the development of meaningful understanding. Technologies employed by these researchers include Wikis, Blogs, and other democratic collaborative media.

These two groups are walking down diverging paths, the first toward driving humans out of the instructional loop, and the second toward adding more humans to the instructional loop. This chapter explores these research paths in more depth and proposes a manner in which they may be reconciled.

Learning objects

A "learning object" is "any digital resource that can be reused to mediate learning" (Wiley & Edwards, 2002). The two main goals behind learning objects research and development are:

1. To improve the economics of online instruction, and
2. Enable pedagogical innovation.

These two goals may not be equal in importance in the minds of learning objects researchers. Each is described in more detail below.

Improving the economics of online instruction

When instruction first moved online, the traditional classroom model of instruction went with it, including assumptions from the face-to-face realm about the ideal teacher-to-student ratio. As online offerings filled up, the Open University and others devised plans to hire armies of Teaching Assistants to preserve this ratio and provide much needed learning support to individuals taking online courses. Eventually it was discovered that this model did not scale well to the large numbers of learners, especially for the very large numbers for-profit instructional development firms hoped to reach.

From this point of view, having a human in the loop is a severe bottleneck. For years proponents of online instruction have declared that "once we have enough bandwidth" online education will really take off, with two-way interactive video, etc. As it turns out, "teacher bandwidth," or the number of students an individual teacher can service, turns out to be the most significant bottleneck in the online learning space. Like much of the computer-based instruction research before it, learning objects research has been filled with individuals describing varying ways in which automated systems can take the human out of the loop while still providing the necessary learning support to individual students (e.g., Martinez, 2002; Merrill, 2002; Hodgins, 2002). Like other pieces of software, this step to an automated system, which can be sold and distributed electronically, moves instructional technology companies into the area of "write it once, sell it often" economics which has transformed companies like Microsoft and Oracle into commercial powerhouses. This interest is represented by a statement of purpose from the IEEE’s *Learning Technology Standards Committee’s* Learning Objects Metadata specification:

> *To enable computer agents to automatically and dynamically compose personalized lessons for an individual learner.*

Complaints regarding economically-improved online instruction generally center around notions of learner isolation and the dehumanization of learning. Wiley and Edwards summarized, "Why would we put learners in front of the most advanced communications system of all time and not have them communicating?" (Wiley & Edwards, 2002).

Enable pedagogical innovation

A secondary interest in learning objects is the ability to build new pedagogies on top of the learning objects platform. While several groups have claimed innovation within the area of instructional approaches facilitated by the use of learning objects, all of these claims have in fact brought existing "alternative" pedagogies to online learning, and the innovation has been technical in the nature of the automation of the pedagogy (e.g., "pre-test and omit" in L'Allier, 1998; "discovery and inferential learning" in Sonwalkar and Arnone, 2002). Little truly innovative work has occurred in the pedagogical realm to date that can be credited to the existence of learning objects. However, such novel work remains a goal of some members of the movement.

> ***"Why would we put learners in front of the most advanced communications system of all time and not have them communicating?" (Wiley & Edwards, 2002)***

Learning communities

Because research indicates the human-to-human interaction increases retention of information and skills learned (e.g., Clark, 2002), and decreases drop out rates in online courses (e.g., Shea & Boser, 2002), there has recently been significant emphasis on adding social interaction to online courses. From popular sources such as John Seely Brown's *The Social Life of Information* to academic works like Lave and Wenger's *Communities of Practice*, more and more researchers are positing that social interaction isn't an option that makes learning fun, it is a necessary condition for effective learning to occur. Generally there have been two means of promoting this social interaction in online courses:

1. Requiring student-to-student interaction (generally in the form of web board or other threaded discussions), and
2. Requiring teacher-to-student interaction (whether in weekly chats or by e-mail or web board).

Requiring student-to-student interaction

Students in university programs will likely graduate into jobs requiring them to function as problem-solvers in the context of a project team (Jonassen, 2002). In order to keep the context of practice as close to the context of performance as possible, it is important for students to learn to work as members of collaborative teams. Meaningful collaborative assignments pull real-world problems out of authentic contexts. A significant portion of this authenticity is that these problems are too complex for individuals to solve, requiring students to collaborate to succeed in problem-solving and learning.

Unfortunately the majority of requirements for student-to-student interaction in online courses seems to stem from the idea that collaboration is "the thing to do." Even well-structured collaborative assignments for online students can be subverted in a number of ways if attention is not paid to a significant number of extracurricular variables (e.g., students that have other outlets for communication such as regular face-to-face meetings for other courses will frequently perform their collaboration in these “higher bandwidth“ channels). In other words, using online collaborative assignments effectively is "really hard" in online courses as currently conceived.

Requiring teacher-to-student interaction

Teachers of online courses frequently require students to participate in regular synchronous chats or asynchronous discussions in which the teacher takes part. The teacher is available to answer questions related to course content, process / administration, and technical difficulties (as their skills permit).

Unfortunately, requiring students to show up for synchronous interactions removes many of the benefits that lead students to sign up for online courses in the first place. Additionally, a policy or culture of providing every student with multiple individualized accesses to an instructor over the duration of the course forces class sizes to be very small, ensuring that we never experience a qualitative change in the number of students we are able to serve even when we employ instructional technology.

The Coming Collision

While it may not realize it, the learning objects community (as exemplified by specification bodies like IEEE, SCORM, and IMS and corporations like NetG and Click2Learn) and the learning communities group (as represented by individuals like David Carter-Todd, David Davies, and David Wiley) are on a collision course, as represented in Table 1.

In an ideal world the goals of the research camps whose aims are making instruction as efficient as possible and as effective as possible would not be at odds with one another. However, in terms of the means of reaching these goals, the research communities seem to be drifting farther apart from each other.

Community	Learning Objects	Learning Communities
Primary Goal	Make learning as scalable, economically viable, and effective as possible	Make learning as scalable, economically viable, and effective as possible
Primary Means of Achieving Goal	Automation: Design to remove humans from the loop	Collaboration: Design to bring humans into the loop

Table 1. Two R&D Communities, Their Primary Goals, and Means of Achieving Them

Such a rift in the field of instructional technology harkens back to the days of the Instructivist / Constructivist debates, during which more time was spent defending fiefdoms than working to integrate valuable contributions into a pragmatic superstructure which would provide Voltaire's "best of all possible worlds."

The remainder of this chapter explores an integrative framework that brings many of the valuable components of the learning objects movement together with many valuable contributions from the body of research around learning communities.

Decentralized Learning Communities

The Internet provides multiple examples of very large groups of people (30,000+) who work together to support each other in their own learning, employing reusable digital resources as the main building block of their efforts. In other words, these groups have found a way to create a hybrid learning-objects-driven-learning communities model, which only required one "small" change in the overarching educational superstructure: the deconstruction of centralized control. Two mini-cases are presented as examples of the types of systems implied, followed by a discussion of the characteristics of the integrative framework.

Mini-case 1: Slashdot (http://slashdot.org/)

This case is taken from Wiley and Edwards (2002).

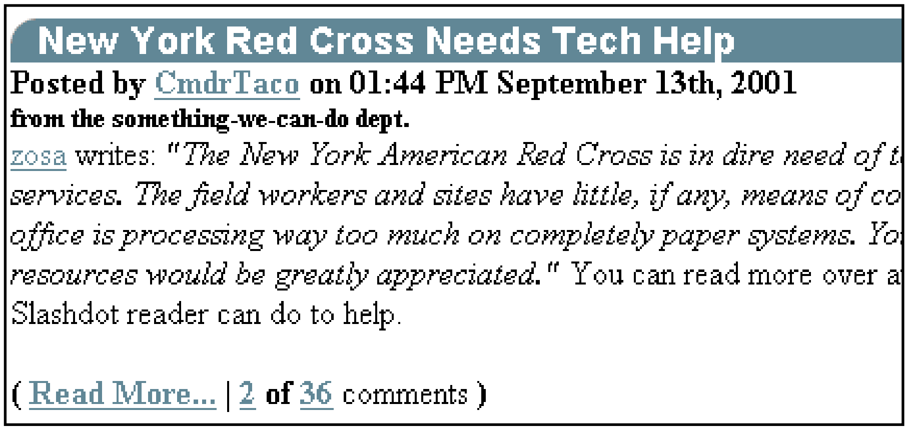
Slashdot is a news site, carrying stories of interest to "geeks" and "nerds." Frequent topics include bleeding edge hardware and software developments, intellectual property law and lawsuits, Japanese anime, and reviews of science fiction books and movies. Users contribute "news stories" – which are frequently summaries of stories, reviews, and other information found on other sites across the web, along with links to the original content – for the editors to approve. Editors review the material for appropriateness (alignment with Slashdot's content areas) and originality (is this story already running on the front page?) and then either approve or discard the submission. Accepted submissions run in a box on the site's front page (see Figure 1), and each story box contains a link to an area where threaded discussion dedicated to the story occurs (see Figure 2).The threaded discussion itself is equally interesting.

Community members meeting certain criteria have the ability to "moderate" or evaluate the quality of individual comments. These evaluations are aggregated to produce scores from –1 ("Flamebait") to 5 ("Insightful"). Using these comment ratings and an infrastructure that dynamically generates HTML, Slashdot allows users to set thresholds for the quality of comments to which they want to be exposed. Generally speaking, I have found that using the website with this threshold set at 4 or higher is an intellectually satisfying experience (see Figure 2).

Figure 1. A screen capture of the Slashdot website located online at http://slashdot.org/

"Meta-moderation" allows other members of the community to evaluate the appropriateness of moderators' ratings. For example, if a moderator with an axe to grind against Microsoft moderated an informative comment regarding the XP operating system down to –1, meta-moderators would mark this moderation as "Unfair." This system of meta-moderation provides the larger community a powerful balance against "the tyranny of the moderators."

The combination of Slashdot's moderation system with its meta-moderation system creates a powerful infrastructure for *real-time peer review*. This infrastructure supports the community's efforts to bring the best information, questions, and answers to the attention of the community, while making it difficult for misinformation and half-baked ideas to propagate across the network. In short, it functions much like the peer review process that provides the gateway to academic journals. It impressively fills this role a) in real-time, b) with input from a larger proportion of the community, and c) with meta-moderation checks in place to prevent abuse.



New York Red Cross Needs Tech Help

Posted by CmdrTaco **on 01:44 PM September 13th, 2001**

from the something-we-can-do dept.

zosa writes: *"The New York American Red Cross is in dire need of t*
services. The field workers and sites have little, if any, means of co
office is processing way too much on completely paper systems. Yo
resources would be greatly appreciated." You can read more over a
Slashdot reader can do to help.

(Read More... | 2 **of** 36 comments)

Figure 2. A screen capture of the Slashdot website showing the total of all comments and those comments above the quality threshold.

Mini-case Two: kuro5hin (http://kuro5hin.org/)

Kuro5hin (K5) is similar to Slashdot in many respects: users submit questions and content to appear on the site, users participate in threaded discussions regarding individual pieces of content, and users rate the quality of each other's comments. The K5 infrastructure differs from Slashdot in two important ways:

1. Question, stories, and other material submitted to K5 are accepted or rejected based on open review by the entire community, not a handful of editors, and
2. Comments on K5 are typed: some are topical (comments about the opinions expressed in a story, answers to a question asked, etc.) and others are editorial.

These architectural differences manifest themselves in significant differences in the culture and practice of the K5 and Slashdot communities. For example, editorial comments frequently point out weaknesses in arguments, typographical errors, and provide a host of other editorial functions. This has led to a culture on K5 that values well-developed writing; as a consequence, the average story on K5 is significantly longer than that on Slashdot. Recent stories such as a 3500-word exposition of String Theory for beginners, or the 2200-word Geek's Guide to Brain Chemistry are exemplary of this trend.

Characteristics of Decentralized Learning Communities Pertinent to Learning Environment Design

Decentralization of power

If these communities and others like them (e.g., http://perlmonks.org/) don’t seem like any online course you have ever seen, it is because they aren’t online courses. The biggest difference between these communities and courses is that these communities are decentralized, meaning there is no one with a syllabus or other agenda telling the community, "today you’re going to learn about this." The notion of us and them, or expert and novice, is decentered (Wilson & Ryder, 1998), and expertise lives in the community rather than in a super-person vested with authority in a manner asymmetric with their peers (Hewitt & Scardamalia, 1996). This is why real-time peer review is a key component of these systems.

As with offline communities of practice, these online communities are not engaged in "just talking about" content, but are engaging in practice as a group. The majority of the activity involves the discussion and solution of real-world problems, selected by the participants from their everyday lives – as authentic as the contexts for problems get. In addition to work in their content areas, each of the communities is more or less aware of their existence as online learning communities, and (particularly members of K5 who dedicate an entire section of the web board to "Meta" discussions about K5) are reflexive in their participation.

Again, the key difference between the ability of decentralized learning communities (DLCs) and traditional courses to integrate both learning objects and learning communities research lies in the DLC’s distribution of power. A useful comparison can be made between the power structures in traditional online courses and those found in decentralized learning communities, as in Figure 3, with some language borrowed from the political lexicon.

In formal (higher ed / corporate training) learning environments, power over what will be studied, the sequence of study, what counts as exhibition of mastery, to what extent it must be displayed, etc., is controlled by one individual: the teacher, trainer, or designer of the automated system. Some teachers attempt to share power with students (which of these five topics should we study next week?), just as some systems allow learner control in the sequencing of some of the content, but the power structure of the situation is always asymmetric – with the vast majority of participants on the bottom end. Along these same power lines, Wertsch (1998) has argued that speaking with the authoritative voice typical of teachers quashes critical thinking and prevents the construction of new knowledge.

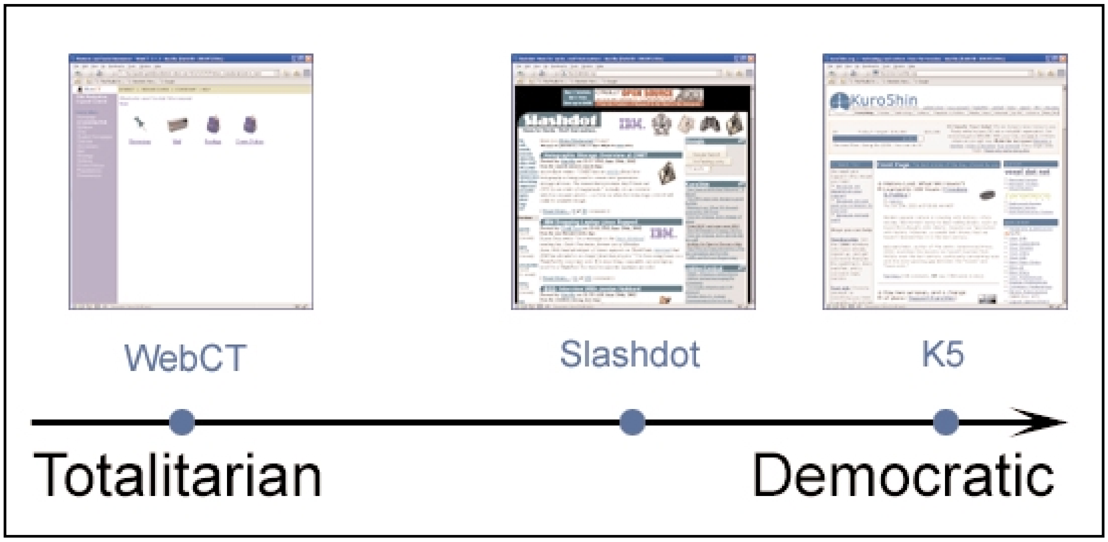


Figure 3. A continuum representing the centralization of power in online learning environments.

Finding, using, and creating learning objects as a community

The manner in which DLCs reap the benefits of learning communities research is rather obvious, but how do they take advantage of reusable educational resources, a la’ learning objects, without central repositories, standardized metadata with controlled vocabularies, etc? Wiley and Edwards (2002) provide the follow list of the way members of these communities find, utilize, and evaluate learning objects:

- Indexing and Discovery: Learning objects are not cataloged with metadata and submitted to a central curator repository. Community members know of existing resources and local resource collections. Individual resources are discovered through "community queries" in which community members respond with pointers to resources they know about personally. When a sufficient portion of the community responds in this manner, the learner locates satisficing resources.

- Combination: Learning objects are not automatically populated into one of many instructional templates. Without the direction of any single grand architect, peers contribute relevant resources and descriptions of how they might be employed within the context of the initiator’s problem. much like a colony of ants, peers autonomously build on one another’s work and create a satisfying resource structure without centralized direction (Bonabeau, Dorigo, & Theraluaz, 1999).

- Use: Learners do not sit through a temporal sequencing of resources and assessments linked to decontextualized instructional objectives. They employ resources provided by peers as mediational means in the solution of a self-selected problem or accomplishment of another self-selected goal.

- Evaluation: Learning objects are not critiqued out of an instructional context; learners evaluate the relevance and suitability of resources within a specific learning context. (Williams [2002] contains an excellent description of the impasse created by attempting to apply current context-dependent evaluation methodologies to extremely decontextualized educational resources.)

Implicit in this discussion is the creation and design of new learning objects. Any software infrastructure that captures conversations and exposes them to later search and linking (reuse) allows members of communities such as K5 to participate in knowledge creation. These threaded conversations are highly contextualized learning objects of just the right grain size for later reuse by the community, or within formal educational contexts.

Landmarks and port towns

Landmarks of important historical significance receive hundreds of thousands of visitors each year. However, these individuals return rarely, if at all, because the "content" of the site never changes. Because they do not interact regularly, these individuals never transform into a community *per se.* Personally, I’ve been to Mt. Rushmore twice, loved it, and will probably go again. But I doubt I’ll ever form any lasting relationships with the people I meet there.

Port towns, on the other hand, receive constant shipments of the newest, latest, and greatest, as well as the necessities. People from around the region visit port towns regularly, week after week, picking up the things they need. In areas like this where there are multiple opportunities for interactions among the same individuals, community can emerge. And so it is online.

A few years ago I edited a book about learning objects, posted the contents of the book online for free, and made a meager attempt to build a learning objects community around the book. The community portion of the project failed miserably, because the book was a landmark: never any new content, never any reason for people to return. Each of the DLCs described above thrives because there is a substantial amount of new content, questions, and other dialogue prompts posted regularly.

Distribution of labor

It takes a significant amount of effort to make a community thrive. In the initial stages when the community is small, individuals must shoulder huge amounts of responsibility. However, as the community grows in size, additional people can be recruited to be responsible for smaller and smaller units of work, as the work/users ratio decreases. The relationship between the number of community members and the community-sustaining work for which each is responsible is depicted in Figure 4.

Knowledge Sharing

Restricting access to individuals' expertise, information, and resources does not promote the development of a DLC. Whatever the incentive structure may be that inspires individuals to freely offer up 3,500-word expositions on theoretical physics, they have to continue to do so, and share the results freely with one another. The economics of the DLC port town are still unclear and a matter of much research (e.g., http://opensource.mit.edu/); nonetheless, "free and open access" is the mantra by which the communities live and die. This is because any kind of restriction decreases the amount of goods available in the port town, or the number of store open in the mall, or what have you. People will simply not come if there is no value in going.

While not yet a DLC, this thinking is best exemplified by MIT's OpenCourseWare initiative (see http://web.mit.edu/ocw/). This bold initiative will eventually put the instructional content (lecture notes, syllabi, problem sets and exercises, etc.) from every MIT course online for free, available to anyone, for any use. MIT obviously recognizes that the institution's primary value is not in its content as much as it is in the social interactions that it facilitates. Once these materials become available (beginning Fall 2002), we can expect to see massive DLCs spring up around them to support informal learning that re-utilizes the materials.

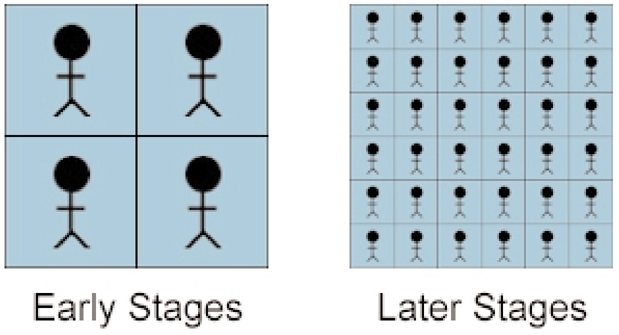


Figure 4. The relationship between work unit size and number of community members.

Summary

There is the potential for a great rift to occur in e-learning between those looking to remove social interaction from courses and those looking to add more social interaction to the experience. Decentralized learning communities provide one way of bringing together the best of each of these approaches. Of course, the Gagne Assumption that different types of content will have different optimal methods of instruction continues to hold, and DLCs are not the best instructional approach in every instance. But they have already proven successful "in the wild," and there is much for instructional designers to learn about the ways in which online learning can be **both** scalable **and** social.

References

Bonabeau, E., Dorigo, M., & Théraulaz, G. (1999). *Swarm intelligence: From natural to artificial systems.* New York: Oxford University Press.

Clark, D. (2002). The pros and cons. Retrieved June 12, 2003, from http://www.nwlink.com/~donclark/hrd/elearning/proscons.html

Hewitt, J. & M. Scardamalia (1996). Design Principles for the Support of Distributed Processes. Symposium on Distributed Cognition: Theoretical and Practical Contributions, American Educational Research Association Annual Meeting. New York, NY.

Hodgins, W. (2002). The future of learning objects. Retrieved June 12, 2003, from http://www.reusability.org/read/chapters/hodgins.doc

L'Allier, J. J. (1998). NETg's precision skilling: The linking of occupational skills descriptors to training interventions. Retrieved June 12, 2003, from http://www.netg.com/research/whitepapers/pskillpaper.asp

Jonassen, D. H. (2002). Toward a Meta-Theory of Problem Solving. Retrieved June 12, 2003, from http://tiger.coe.missouri.edu/~jonassen/Design%20Theory.pdf

Martinez, M. (2002). Designing learning objects to mass customize and personalize learning. Retrieved June 12, 2003, from http://www.reusability.org/read/chapters/martinez.doc

Merrill, M. D. (2002). Knowledge objects and mental models. Retrieved June 12, 2003, from http://www.reusability.org/read/chapters/merrill.doc

Shea, R. H. & Boser, U. (2002). Locating quality. Retrieved June 12, 2003, from http://www.justcolleges.com/elearn/index.phtml?el=locating.htm

Sonwalkar, N. & Arnone, M. (2002). Logging in with... Nishikant Sonwalkar. Retrieved June 12, 2003, from http://chronicle.com/free/2002/03/2002030401u.htm

Wertsch, J. V. (1998). Mind as Action. Cambridge: Cambridge University Press.

Williams, D. D. (2002). Evaluation of learning objects and instruction using learning objects. Retrieved June 12, 2003, from http://www.reusability.org/read/chapters/williams.doc

Wilson, B. & Ryder, M. (1998). Distributed learning communities: An alternative to designed instructional systems. Retrieved June 12, 2003, from http://carbon.cudenver.edu/~bwilson/dlc.html

Applying Universal Design for Learning Principles to Enhance Achievement of College Students

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Building Access to Learning

"One of the greatest challenges facing colleges and universities today involves creating and maintaining a campus community that reflects the rich diversity of this country" (Anderson & Williams, 2000, pg. 1). Increasing numbers of international students, individuals from under-represented groups, and students whose first language is not English are enrolling in American colleges and universities. National data indicate that more students with disabilities are going on to college. The percentage of college freshmen with a disability has more than tripled in 20 years. According to the survey of college freshman conducted by the HEATH Resource Center, the share of college freshmen who self-reported that they had a disability increased from just under 3% in 1978 to over 9% in 1998 (HEATH Resource Center, 1999). Students with learning disabilities are the most common type of disability reported by college students (Brinckerhoff, McGuire, & Shaw, 2002).

Clearly, faculty across the country are teaching a more diverse student population, presenting new challenges on how to assure that their critical course objectives are met by students who bring cultural, linguistic, and accessibility issues to the classroom. One approach to instructional design that has received increasing attention from our researchers, federal legislators, and national associations is called universal design for learning (UDL). UDL is an approach to creating course instruction, materials, and content to benefit people of all learning styles without adaptation or specialized design. (The Ohio State University Partnership Grant, 2000b; Stahl, 2003). UDL makes essential course content accessible to all students by making curricula flexible and customizable (Higbee, 2003). UDL does not remove academic challenges, it only removes barriers to access (Izzo, Hertzfeld, & Aaron, 2001). It does not water-down the curricula in any way or adjust academic standards; rather, it allows for essential course content to be taught or expressed in multiple ways. Basically, UDL is a new name to an old concept: good teaching. Good teaching involves sensitivity to the different ways students learn. All students, especially students with disabilities, students who speak English as a second language, international students, and older students, benefit from instructors who use multiple methods in their teaching. Methods that engage the senses and include relaying information visually, auditorally, and kinesthetically tend to produce the best instructional outcomes (Izzo, Hertzfeld, & Aaron, 2001). Making course content accessible to all students, regardless of disability or learning style, maximizes learning.

A Spotlight on UDL

As diversity in the classroom and in the U. S. population at large increases, the benefits of UDL to all students and in particular to students with disabilities are gaining in prominence on elementary, secondary, and postsecondary levels. Recently, in the reauthorization of the Individuals with Disabilities Education Act (IDEA), an amendment to establish a Commission on Universal Design and the Accessibility of Curriculum and Instructional Materials has passed a Senate Committee Hearing. This Commission would "study, evaluate, and make appropriate recommendations to Congress and to the Secretary on universal design and accessibility of curriculum and instructional materials for use by all children, with a particular focus on children with disabilities in elementary schools and secondary schools" (Senate Bill #S. 1248 as cited in Jones, Rose, Stahl, & Hitchcock, 2003, p. 10). Included in its mission would be to define and examine UDL in the context of educational objectives and resources, available technologies, technical standards, and intellectual property rights (Jones, Rose, Stahl, & Hitchcock, 2003). Though targeted specifically at the K-12 grade level, such legislation would bolster UDL, not as a panacea for the accommodation needs of students with disabilities, but as a formal means of acknowledging diversity in learning and improving educational outcomes via instructional technology. While UDL is more than just the utilization of available technologies – many good UDL practices do not require the use of any technology – instructional and assistive technologies can be highly effective strategies to promote learning access.

On the postsecondary level, the many different faces of UDL – in particular, instructional and assistive technologies, web design and accessibility, and multi-modal teaching – have become hot topics on which faculty want more training (Izzo & Yurcisin, 2002; see also project abstracts for 21 Office of Postsecondary Education grantees, 1999 and 2002, at http://www.ed.gov/offices/OPE/disabilities/grantees.html). The push to improve teaching quality, meet more students' learning needs, and integrate greater use of technology into courses (e.g., posting course materials to the web, using multi-media lectures, etc.) has created a thirst for more information on UDL. In response to heightened awareness about UDL and the need for more training, organizations such as AHEAD (Association on Higher Education and Disability) and CEC (Council for Exceptional Children) have created pre-conference workshops and conference tracks focusing on UDL and learning access, including in-depth sessions on promising technologies and teaching practices.

The Fundamentals of UDL

The term universal design has its roots in the field of architecture (Higbee, 2003; Stahl, 2003). The concept of universal design in architecture is "the design of products and environments to be used by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Center for Universal Design, 1997, p. 1). Applied to learning, this concept is extended in two ways:

1. Building an educational curriculum that is flexible to meeting students' diverse needs; and
2. Building a curriculum that provides not only information access, but also access to learning.

As differentiated from mere information access, access to learning means that students have access to course content without reducing or eliminating the challenges or resistance essential to learning (Stahl, 2003). As mentioned earlier, the goal of UDL is not to minimize the effort the student needs to put forth in the classroom. Rather, the goal is to make the curriculum accessible so that students have the opportunity to view, process, and retain information in a variety of ways that maximize student strengths and promote engagement in the learning process. Such engagement is likely to produce better outcomes for both student and instructor.

Based on neurological research that identifies three major brain networks integral to the learning process – recognition, strategic, and affective networks – the Center for Applied Special Technologies (CAST) has articulated three basic principles of UDL (Rose & Meyer, 2002; Stahl, 2003):

1. Provide multiple representations of information (recognition)
2. Provide multiple means of expression (strategic)
3. Provide multiple means of engagement (affective)

Recognition networks are related to pattern recognition – being able to identify basic patterns such as letters, words to more complex patterns such as paragraph structure, themes, and relationships between formulas or concepts. Recognition networks bring cohesion to sensory stimuli and allow a person to perceive information as a whole rather than as a jumble of indiscriminate parts that have no organization or relationship to each other. When instructors delineate what information or course content students need to master, learning becomes prioritized and organized as a cognitive schema through recognition networks (Stahl, 2003).

Strategic networks are responsible for a person knowing how to do things such as riding a bike, speaking, reading a book, planning a trip, etc. Because actions, skills, and plans are highly organized and patterned activities, strategic networks work in conjunction with recognition networks to perform academic tasks such as learning to read, writing an essay, completing a project, computing a formula, etc. When instructors require students to learn how to do something, the domain of strategic networks is tapped (Stahl, 2003).

Lastly, affective systems are devoted to emotion and motivation. Rather than playing a role in recognizing patterns, they dictate which patterns are important to us and which strategies we should pursue by attaching meaning to them. The affective networks are pivotal in engaging and motivating the student to set goals and establish priorities to master the learning objectives. People are more likely to learn when they are interested in what they are learning, when it has relevance to their lives, and when they understand why what they are learning is important (Stahl, 2003).

All of these networks work together in learning. While some learning may rely more on one network than another, much of learning involves the whole brain as an integrated unit. The three basic principles of UDL noted above tap into these interrelated brain networks:

- Providing multiple representations of information allows students to learn content in their preferred means. For example, placing course content on the web (and ensuring web accessibility) provides a visual avenue of access to information in addition to the traditional auditory form of classroom lecture.
- Providing multiple means of expression allows students to demonstrate mastery of course content in a variety of ways, such as allowing a student with a fine motor disability to take an oral exam instead of an exam that requires writing.
- Providing multiple means of engagement allows students more options to choose methods that support their interests and skill levels, such as allowing students to select topics of interest for final projects and allowing them to be creative in how their projects are presented (The Ohio State University Partnership Grant, 2000b).

Given this brief discussion of the importance of UDL, its basic principles, and their relationship to brain functions, seven guidelines are provided so faculty can integrate and apply the UDL principles into their face-to-face and/or online classroom environments.

Applying UDL in College Classrooms: Seven Key Guidelines

The three basic principles described above can be translated into seven recommended guidelines for implementing UDL in college environments. Compiled from three sources – the University of Minnesota's Curriculum Transformation and Disability Grant awarded from the U.S. Department of Education (#P333A990015), Chickering and Gamson's (1987) Seven Principles for Good Practice in Undergraduate Education, and North Carolina State University's Principles of Universal Design (1997) – these guidelines integrate the brain's recognition, strategic, and affective networks in the learning process. To illustrate each guideline, examples are presented of how faculty can apply the guideline to course design.

Table 1: Seven Guidelines for Implementing UDL

Guideline 1: Create a classroom climate that fosters trust and respect.
Guideline 2: Identify the essential course content.
Guideline 3: Clearly express the essential content and any feedback given to the student.
Guideline 4: Integrate natural support for learning.
Guideline 5: Use a variety of instructional methods.
Guideline 6: Allow multiple methods of demonstrating understanding of essential course content.
Guideline 7: Stay current on new and promising instructional technologies.

Guideline 1: Create a classroom climate that fosters trust and respect.

Faculty can create a climate that fosters trust and respect by creating a syllabus that clearly delineates the course objectives, textbooks/readings, course schedule, assignments with due dates, grading, and course policies. Such delineation prioritizes learning and taps into the recognition network of the brain. The syllabus serves as a contract between the faculty member and the student, outlining expectations and requirements for successful completion of the course (The Ohio State University Partnership Grant, 2000a).

A statement placed on the syllabus indicating a faculty member's willingness to provide reasonable accommodations to a student with a disability is a policy that many universities and college administrators require faculty to include in the course policies section of the syllabus. This statement is an invitation to students who have disabilities to meet with the faculty member in a confidential environment in order to review course requirements and to discuss their need for accommodations. A statement on the syllabus as well as an announcement in class normalizes the accommodation process by treating the disability accommodation policy in the same manner that the faculty member treats attendance, late assignments, and academic misconduct policies. A recommended disability statement to include on the syllabus could read as follows: "Any student who feels he/she may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs" (The Ohio State University Partnership Grant, 2000a). The disability statement opens the lines of communication with the faculty member, creates a climate that fosters trust and respect, and treats disability and accommodations as a normal element of the course. By encouraging students to contact the faculty member with any questions or concerns, the classroom climate is welcoming and thus enhances the learning process. For students with disabilities, being acknowledged through the disability statement may activate the affective network. The student may respond with an increased level of motivation to engage in the course because the faculty has acknowledged that some students will need accommodations – even in the best universally designed course. (For more information, see http://www.osu.edu/grants/dpg/fastfact/syllabus.html)

Though successful implementation of Universal Design does not have to rely solely on technology, technology is a useful medium for creating maximum access to course content.

Though successful implementation of Universal Design does not have to rely solely on technology, technology is a useful medium for creating maximum access to course content. For example, putting one's syllabus on-line allows students with visual impairments to use assistive technologies such as screen readers or magnifiers. Students with learning disabilities can use text-to-speech software programs so they can hear the syllabus information and process it aurally as opposed to visually. The web can be a powerful tool for increasing access and meeting students' diverse learning needs, especially when principles of web accessibility are employed (for more information on web accessibility, see http://www.osu.edu/grants/dpg /fastfact/webcontent.html)

However, only to view technology and Universal Design in the context of disability limits the widespread impact of digital media. Closed captioning can help a student who relies on English as a second language, a person with hearing impairments or impaired auditory processing, and a person with a visual learning style. Digitizing existing materials can also provide useful resources for students with disabilities, older students, and students who use English as a second language because it allows for editing and formatting consistent with learning strengths and strategies. Additionally, using word processing programs to enlarge the font of course handouts and to highlight critical ideas benefits all students because it provides a means of greater organization and prioritization of learning as well as increased visual access to the text.

Guideline 2: Identify the essential course content.

The most challenging aspect of designing a course is to determine exactly what we want the students to be able to know and do by the end of the course. Described as learning objectives, the essential content of a course ideally represents a balance across six domains: knowledge, comprehension, application, analysis, synthesis, and assessment (Anderson & Krathwohl, 2000; Bloom, 1956; available at: http://www.coun.uvic.ca/learn/program/hndouts/bloom.html). While updated in 2000, the original Bloom's Taxonomy still provides a useful structure to organize course objectives and assignments to assure that students are learning competencies across the six domains of the taxonomy (Anderson & Krathwohl, 2000; Bloom, 1956):

1. Knowledge – observe and recall information: list, define, identify, who, when, etc.
2. Comprehension – interpret facts and grasp meaning: compare, contrast, discuss, etc.
3. Application – use information and solve problems: demonstrate, calculate, relate, etc.
4. Analysis – recognize patterns: order, explain, connect, classify, infer, arrange, etc.
5. Synthesis – use old ideas to create new ideas: integrate, modify, rearrange, create, etc.
6. Assessment – assess values of theories: evaluate, decide, rank, convince, judge, etc.

Balancing course content across Bloom's Taxonomy as well as across the recognition, strategic, and affective networks direct faculty in developing a class that is universally design. Designing assignments and evaluation activities that provide choice and an adjustable level of challenge will help students engage in learning objectives and ultimately maximize students' achievement.

Once essential course content is identified, technology can help faculty deliver it in creative ways. For example, essential course content can be delivered via a course web site for 24/7 access for students by posting class notes and supplemental readings, by using videos and incorporating related links for additional content exposure, or by taking the classroom experience outside the classroom via online field trips or video teleconferences with expert speakers. Assessing student competencies with technology also can be enhanced beyond quizzes and exams to include assignments such as online discussion boards, chat sessions, collaborative projects or assignments that include the use of multimedia tools. Using different types of assignments allows more students to demonstrate knowledge through their preferred learning style. Simply put, more choices empower more students to engage the essential course content when barriers to understanding content are removed.

Guideline 3: Clearly express the essential content and any feedback given to the student.

Faculty can clearly identify the essential course content in the syllabus in a print-based and/or on-line format, review the course content verbally during the first class session, and clarify the learning objectives and assignments in subsequent class sessions. However, some students may miss the essential content because of numerous reasons including, but not limited to, a hearing processing disorder, a language barrier, or Attention Deficit Disorder (ADD). Instructors can implement several classroom procedures to assure that students have numerous opportunities to gain the essential course content. Two of these procedures include putting course content on-line, allowing students to "pick up" material that might have been missed in lecture, and using guided notes to enable students to listen for essential content without copying all the points off the overhead, chalkboard, or PowerPoint slide.

Lecturing is one of the most common teaching methods used in the classroom because it is versatile and efficiently uses the instructor’s time (Heward, 2002). However, the lecture method also presents some challenges to students who are not auditory learners and/or who are poor note-takers. By putting course notes on-line in a web accessible format, students have access to the material they need. David Rose, Professor at Harvard University and founder and co-director of CAST, suggests having three students post lecture notes to the class web site for each class. This strategy gives all students the opportunity to compare their notes with other students’ notes, most likely increasing their understanding of the essential content of the course (personal communication, November, 2002). Peer feedback via discussion boards can also enhance this aspect of learning.

Guided notes -- instructor-prepared handouts that provide all students with background information and standard cues with specific spaces to write key facts, concepts, and/or relationships during the lecture (Heward, 2002) – are also helpful either in class or posted to the web. Guided notes require students to engage actively and respond during the lecture, increasing retention of course content and providing a means of organizing and enhancing lecture content. (For more information about guided notes, see http://www.osu.edu/grants/dpg/fastfact/notes.html.)

Guideline 4: Integrate natural support for learning.

Faculty can integrate many natural supports within the classroom to enhance the teaching-learning process. Peer mentoring, cooperative learning, students sharing and discussing their notes in small groups or posting them to a common web site, are all strategies to integrate natural support for learning. In many situations, student-to-student interactions are a more effective teaching tool than even the most dynamic lecture. Offering both a choice of who students would like to work with and the type of product students can use to express their learning engages the affective networks, ultimately increasing the student’s motivation to achieve.

Faculty can structure both in-class, out-of-class, and online activities as natural supports for learning. Guided notes can be a catalyst for increasing students’ interaction with the essential course content. Encouraging students to select a study buddy for quizzes, developing study guides of course material, and providing self-paced study modules or exercises online facilitates student interaction with the learning objectives of the course. Online discussion boards and study chat rooms can also serve as a natural support, creating for students a venue outside of class in which they can react to course content through questions and dialogue.

Guideline 5: Use a variety of instructional methods.

As we learn more about the teaching-learning process, we realize that learning is a very individualized process; therefore, we need to use many different instructional methods to assure that we reach all students. Different instructional methods are better at tapping into the different neural systems (recognition, strategic, and affective), and successful teaching and learning requires the interaction of these three systems. Table 2 provides instructional techniques and examples related to each neural system.

Guideline 6: Allow multiple methods of demonstrating understanding of essential course content.

This guideline is an extension of how to engage students’ affective networks and create the motivation for learning. Providing flexibility and opportunities for student choice is an excellent method to increase students’

Table 2: Instructional Techniques by Neural System*

Instructional Technique	**Examples**
Neural Network: Recognition	
Provide multiple examples of a concept	Use text in conjunction with pictures, diagrams, photos, definitions, contrast, metaphor, visual models
Highlight salient points such as similar characteristics	Use voice tone, volume and pitch, body language, expressions, large font, italics, bolded text, icons, and repetition of main points; be careful of using color to highlight key information (screen readers and color blind individuals may not be able to recognize)
Present information in multiple formats via technology or multimedia	Use multi-media representations such as video, graphs, text, audio, or kinesthetic exercises
Support background context by showing how new concepts relate to old concepts	Contrast similarities with non-examples to provide a context of how and when to apply the knowledge
Neural Network: Strategic	
Provide flexible models of skilled performance	Use multiple testing modes (e.g., oral vs. written), web-based exercises, kinesthetic lab experiences, out-of-class study or recitation sessions, expert testimonials through video teleconferencing, and web-based broadcasts
Provide opportunities to practice with supports	Use peer mentoring, group discussions, cooperative learning opportunities, guided practice in which students are asked why they answered or demonstrated in a particular way, field or community-based experiences outside class (Cook, Trevino, Cook, & Tankersley, 2001)
Provide ongoing, relevant feedback	Use email, simulations (with or without computers), video recording of a student's performance to provide constructive critiques, word processing software with "tracking changes" or embedded editorial comments
Offer flexible opportunities for demonstrating the skill	Use web based exercises, simulations (with or without technology), group demonstrations, enrichment activities for those who want more practice. For example, when teaching a foreign language, offering online options so students can practice fluency at a reading level appropriate for them

Instructional Technique	**Examples**
Neural Network: Affective	
Allow student-to-student interaction and peer feedback targeting the emotional and motivational components of learning	Use peer mentoring, cooperative learning, allow students to select projects or topic areas of personal interest or relevance
Offer students choice in course content and tools	Offering students choice of assignment, including assignments that involve technology mediums such as: Power Point, article or information searches via databases, and web page design Offering students choice of choice of software programs to complete assignments (e.g., Word, Word Perfect, Power Point, Excel, Inspiration, Assistive Technology programs such as Kurzweil or Wynn, etc.) Offering students choice of communication mediums (e.g., email, phone, chat, discussion boards, and instant messaging)
Challenge students but not beyond their individual reach	Offering students range of assignments that includes basic recall as well as critical thinking skills – i.e., assignments that touch upon the different levels of Bloom’s taxonomy [knowledge, comprehension, application, analysis, synthesis, & assessment] Providing students ample opportunity to give feedback about the course throughout the semester via in-class discussion, email dialogue, electronic or hard-copy surveys, discussion boards, etc. Pacing instruction so that students do not have the opportunity to lose interest, but "chunking" instruction so that students are not overwhelmed (Cook, Trevino, Cook, & Tankersley, 2001)
Offer choice of learning contexts	Offering students choice of assignment formats – e.g., in-class assignment, homework, small/large group discussion, etc. Offering students choice in how they deliver a presentation Structuring rote memorization lessons into games with teams and virtual points

**Techniques adapted from Rose & Meyer, 2002 available at www.cast.org/teachingeverystudent/, and Stahl, 2003.*

enthusiasm for completing a project. One way to build student choice into a course is to allow students to express mastery of course content in multiple ways. For example, without compromising academic rigor, completing an oral presentation instead of a paper may provide the motivation to apply oneself to extend the energy needed to learn the essential content. Similarly, giving students the option to write a paper or to create a PowerPoint or video presentation in lieu of a formal exam can allow students other ways to demonstrate knowledge.

Multiple methods of demonstrating knowledge of course content may have particular relevance for students with disabilities by providing opportunities for students to demonstrate what they know based on their strengths. For instance, an oral exam may be more appropriate for a student who has dyslexia because the information processing disorder may prevent demonstration of essential course content in a written exam. Additionally, placing tests or quizzes online may increase student access because then students can use screen readers or other assistive technologies to view and understand the material.

Guideline 7: Stay current on new and promising instructional technologies.

The various technological mediums expanding the capabilities and reach of Universal Design for Learning are increasing at an exponential rate. How can an instructor keep up? There are several obvious but powerful ways. A good place to start is subscribing to professional journals or newsletters, either hard copy or online, that highlight advances in instructional technology. Visiting software company web sites, exploring technological simulations online, and attending technology fairs sponsored by the information technology office on campus are also effective means of obtaining up-to-date knowledge on technology and instructional practices. In addition, joining a listserv and staying current with discussions and trends in the field is a good way to stay up to date. For example, the Center for Applied Special Technologies (CAST) has a national consortium on Universal Design for Learning (see http://www.cast.org/udl/index.cfm?i=359). Another way to obtain current information is by attending computer courses and faculty development trainings offered at your institution as well as attending or presenting at regional and national conferences. Though it may be difficult to fit courses, trainings, and conferences into an already overbooked schedule, the information obtained from these professional development activities can not only benefit your instructional style and teaching effectiveness but also your resume and field knowledge, allowing you to stay competitive with your peers. Finally, if faculty are to rely on media to deliver content, it is vital that they understand the principles of web accessibility, only posting course material to the web that observes these principles (see http://www.osu.edu/grants/dpg/fastfact/webcontent.html for more information).

Conclusion

The increasing diversity of students in the college population calls for greater flexibility in instructional design, if faculty are to teach effectively. To help meet the variety of learning needs of students, universal design for Learning has been formalized as the essentials of good teaching. While universal design will not replace some students' need for accommodations, it has the potential to reach a wide range of students and to produce better learning outcomes. By providing multiple representations of information, multiple means of expression, and multiple means of engagement, faculty can create a versatile teaching approach that is sensitive to all students' abilities and learning strengths.

References

Anderson, L., & Krathwohl, D. (Eds). (2000). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. New York: Longman.

Anderson, C.A. & Williams, D. (2000). A diversity action plan for Tthe Ohio State University. Retrieved July 29, 2003 from http://www.osu.edu/diversityplan/index_.html

Bloom, B.S. (Ed.). (1956). Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain. New York: Longmans, Green.

Brinckherhoff, L., McGuire, J., & Shaw, S. (2002). Postsecondary education and transition for students with learning disabilities (2nd ed.) Austin, TX: Pro-Ed.

The Center for Universal Design. (1997). The principles of universal design (version 2.0) [Brochure]. Raleigh, NC: North Carolina State University.

Chickering, A., & Ehrmann, S. (1996). Implementing the seven principles: Technology as lever. AAHE Bulletin, October, 3-6.

Chickering, A., & Gamson, Z. (1987). Seven principles for good practice in undergraduate education. AAHE Bulletin, 3-7.

Cook, B., Trevino, C., Cook, L., & Tankersley, M. (2001). Instructional Strategies. In R. Flexer, T. Simmons, P. Luft, & R. Baer (Eds.), Transition planning for secondary students with disabilities. Upper Saddle River, NJ: Prentice-Hall, Inc.

HEATH Resource Center, American Council on Education. (1999). College freshmen with disabilities: A biennial statistical profile. Washington, DC: American Council on Education.

Heward, W. (2002). The Ohio State University Partnership Grant. Fast facts for faculty series: Guided notes – improving the effectiveness of your lectures. [on-line] Available: http://www.osu.edu/grants/dpg/fastfact/notes.html Entire series available: http://www.osu.edu/grants/dpg/fastfact/index.html Publications funded by the Office of Postsecondary Education, U.S. Department of Education under project #P333A990046.

Higbee, J. (Ed.). (2003). Curriculum transformation and disability: Implementing universal design in higher education. Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy, University of Minnesota's Curriculum Transformation and Disability Grant. Funded by the U.S. Department of Education under Project #P333A990015. Project information available at: http://www.gen.umn.edu/research/CTAD/default.htm

Izzo, M., Hertzfeld, J., & Aaron, J. (2001). Raising the bar: Student self-determination + good teaching = success. The Journal for Vocational Special Needs Education, 24(1), 26-36.

Izzo, M., & Yurcisin, A. (2002, July 10). The Ohio State University Partnership Grant: Collaborating with administrators and faculty. Poster session presented at the 2002 Association on Higher Education and Disability (AHEAD) Conference, Washington, DC.

Jones, B., Rose, D., Stahl, S., & Hitchcock, C. (2003, July 10). Universal design and students with disabilities: The national file format (NFF). Paper presented at the 2003 Office of Special Education Programs (OSEP) Research Project Directors' Conference, Washington, DC.

The Ohio State University: University Registrar Trend Tables, Retrieved July 25, 2003 from http://www.ureg.ohio-state.edu/ourweb/srs/srscontent/trends/trends.html

The Ohio State University Partnership Grant. (2000a). Fast facts for faculty series: Guidelines for creating a complete and accessible syllabus/Syllabus disability statement. [on-line] Available: http://www.osu.edu/grants/dpg/fastfact/syllabus.html Entire series available: http://www.osu.edu/grants/dpg/fastfact/index.html Publications funded by the Office of Postsecondary Education, U.S. Department of Education under project #P333A990046.

The Ohio State University Partnership Grant. (2000b). Fast facts for faculty series: Universal design for learning – elements of good teaching. [on-line]. Available: http://www.osu.edu/grants/dpg/fastfact/undesign.html Entire series available: http://www.osu.edu/grants/dpg/fastfact/index.html Publications funded by the Office of Postsecondary Education, U.S. Department of Education under project #P333A990046.

Rose, D. & Meyer, A. (2002). Teaching every student in the digital age: Universal design for learning. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD). Available on-line at: http://www.cast.org/teachingeverystudent/ideas/tes/

Stahl, S. (2003). Faculty and Administrator Modules in Higher Education: Universal design for learning. Unpublished manuscript, Ohio State University. Publication funded by the Office of Postsecondary Education, U.S. Department of Education (CFDA 84.333) under project #P333A020033-03.

Using Metadata Standards to Support Interoperability

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Metadata can be used to describe a digital learning object so that it can be found, managed, reused, and preserved. Descriptive metadata can be used to facilitate resource discovery and identification. The metadata can also be administrative in nature. These data support resource management within a collection. Structural metadata describe how the components of complex learning objects are bound together. Preservation metadata describing the hardware requirements, operating system, and rendering software of the object can be used in the migrating and archiving of the object. All of this information, as well as other forms of description and documentation, can be part of the metadata associated with a learning object.

The implementation of metadata standards that support the discovery, use, and integrity of digital resources can significantly enhance the effectiveness of searching, sharing, managing, and preserving a collection of digital resources. Rich, consistent metadata also make it possible to search across multiple collections and to create collections from materials that are distributed across several repositories. Well-structured metadata can also facilitate an almost infinite number of ways to search for information, present results, and even manipulate learning objects without compromising the integrity of those learning objects that match the user's educational situation and context (Greenberg, 2000; Zia, 2001). If all resources are defined with a common set of terms, and if there are enough terms and dimensions to differentiate the resource well, then powerful discovery methods yielding small, focused sets of results are possible (Wason & Wiley, 2000).

Objects, metadata, and collections should be viewed not only within the context of the projects that created them but as building blocks that others can reuse, repackage, and build services upon (IMLS, 2001). Unfortunately, the collections that have good metadata, using preferred standards, are vastly outnumbered by those that have poor or idiosyncratic metadata, or none at all.

Even those collections that claim to follow a metadata standard often have local variations. Metadata created only to describe the objects in an individual collection without the thoughtful consideration of existing metadata standards goes against the ideas of searchability, extensibility, reusability, and scalability.

The adoption of a metadata standard is necessary to ensure that different kinds of metadata are able to interoperate with each other and with metadata from non-bibliographic systems of the kind that the data management communities and metadata creators are generating. Metadata must support the desired focus of a collection of digital resources by using appropriate content-value standards and providing resource descriptions at a level useful to the project's audience.

Interoperability

A traditional approach to interoperability is for all participants to agree to use the same standards. If each collection developer implements a comprehensive set of standards, then interoperability follows. However, experience has shown that interoperability through comprehensive standardization is hard to achieve. Adoption of common standards provides digital libraries with valuable functionality, but at a cost. Some costs are directly financial: the purchase of equipment and software, or hiring and training staff. More often, the largest costs are organizational. Introducing a new standard requires inter-related changes to existing systems, altered work flow, changed relationships with suppliers, and so on (Arms, 2002).

The adoption of a metadata standard is necessary to ensure that different kinds of metadata are able to interoperate with each other ...

Levels of interoperability can include federation, harvesting, and gathering. Federation provides the strongest form of interoperability, but places the greatest burden on participants. The bottom level, gathering, requires essentially no effort by the participants, but provides a poorer level of interoperability. Federation can be considered the conventional approach to interoperability. In a federation, a group of organizations agree that their services will conform to certain specifications (which are often selected from formal standards). The underlying concept of harvesting is that the participants agree to take small efforts that enable some basic shared services, without being required to adopt a complete set of agreements. The Open Archives Initiative (OAI, http://www.openarchives.org/OAI_protocol/openarchivesprotocol.html) is based around the concept of metadata harvesting. In other words, if a collection builder is looking for high levels of interoperability, then the adoption of existing metadata standards is required and the cost can be high. The ability to accept lower levels of interoperability will guarantee lower costs but will decrease the ability of users to discover resources that best fit the user's needs.

Descriptive Metadata Standards

OCLC and the IMS Global Consortium have both developed common metadata specifications. The OCLC specification was developed for the library community and is known by Dublin Core. The Dublin Core (DC) is a set of 15 metadata elements intended to facilitate resource discovery of resources in general (Dublin Core Metadata Initiative, 2003). A Working Group on Education in the Dublin Core Metadata Initiative is working to extend the Dublin Core metadata scheme to better describe educational resources (DCMI Workgroup, 2003). The Education group recommends adding the following educational elements to DC:

- Audience – teachers, authors, learners
- Standards – organizational, professional, province/state, national, international
- Interactivity Type, Interactivity Level, and Typical Learning Time – the DC-Education group recommends adopting the corresponding LOM data elements (see below).

The IMS Learning Object Metadata (LOM) specification builds on the work done by the Dublin Core group and was designed to describe educational digital objects. It has a wide variety of elements (almost 80 elements and sub-elements) that can describe digital objects in a detailed way. The purpose of the development of the LOM standard is to facilitate search, evaluation, acquisition, and use of learning objects by learners or instructors. The purpose is also to facilitate the sharing and exchange of learning objects, by enabling the development of digital libraries and catalogs, so that users can create and publish educational material.

An elaborate hierarchical metadata scheme has been developed that includes the categories of general, lifecycle, meta-metadata, technical, educational, rights, relations, annotation, and classification. Especially relevant is the educational category with includes elements such as:

- Interactivity type – active versus expositive
- Learning resource type – exercise, simulation, questionnaire, etc.
- Interactivity level – from very low to very high
- Intended end user role – teacher, author, learner, manager
- Context – primary education to vocational training
- Typical age range
- Difficulty – from very low to very high
- Typical learning time
- Language of the typical intended user
- Description – ideas on how the object could be used

LOM also includes a rich set of data elements in the other categories (IEEE, 2002).

LOM was originally developed specifically for the domain of education and training and is becoming more and more deployed outside this specific domain.

The DC metadata element set was originally developed for general resources and is now being adapted for the fields of education and training. LOM provides a far richer structure with more detail but at a higher cost.

Implementing a Metadata Standard

In 1996, the National Science Foundation (NSF) began studying the development of a national digital library (DL) for science, technology, engineering, and mathematics (STEM) education. Since then, NSF has developed the National Science, Technology, Engineering, Mathematics Digital Library (NSDL) program to develop a national DL that will constitute an on-line network of learning environments and resources for STEM education at all levels (Zia, 2001). The first ENC project funded through NSF NSDL in 2000 was the Learning Matrix. This collection, launched in February 2002 and found at http://thelearningmatrix.enc.org, focuses on improving the preparation of math and science teachers by supporting faculty who teach math and science courses in 2- and 4-year colleges (Roempler, 2001).

Three other ENC collections were funded in 2001. The Gender & Science Digital Library (GSDL) (http://www.gsdl.org), covering K–16, is a collaboration between ENC and the Education Development Center, Inc. (EDC), Gender & Diversities Institute. The International Technology Education Association (ITEA) and ENC are collaborating on the K–12 National Digital Library on Technological Literacy (called ICON, the Innovative Curriculum Online Network), which can be found at http://icontechlit.enc.org/. A third ENC collaboration, also K–12, is with the Pacific Regional Education Laboratory (PREL) to develop the Ethnomathematics Digital Library (EDL) collection of resources (http://www.ethnomath.org/). The GSDL, ICON, and EDL became available in the fall of 2002. At that same time, a K–12 collection building proposal was also funded by NSF to allow ENC to work with selected federal agencies to create both collection-level and object-level metadata and to map object-level metadata elements used by the project to a normalized NSF NSDL metadata set.

Many decisions had to be made before the work of building these digital collections could begin. ENC staff members worked with collaborating project staff members to determine who would select resources for each collection, what metadata specification would be followed, what metadata extensions would be needed, who would enter the metadata and at what level of granularity, how the content management system would be used, and how the data would be stored. ENC chose the IMS LOM schema as its base schema for cataloging digital resources with metadata for all the ENC NSF-funded digital library collections entered through a web-based Cataloging Tool (http://fedrl.enc.org/cat_tool/demo). Additional metadata elements and extensions have been added based on each collection's content and audience needs. The indexing protocols for each NSF-funded digital collection cataloged by ENC and its collaborators follows a modified POOL-IMS Version 1.0 (Fisher, 2001) that is in turn based on the IMS Learning Resource Metadata Specification, an XML-compliant schema for indexing learning objects. The POOL-IMS Version 1.0 is a modification of the CanCore Learning Resource Metadata Specification (Fisher, Friesen & Roberts, 2001).

In addition to traditional bibliographic data such as title and author, resources described using LOM metadata include a wide range of metadata that conveys their possible educational use. For example, in the case of software, the description might include how interactive the resource is; other data cataloged might be the audience for whom a resource was developed, where the learning will take place, or the level of difficulty of the material.

ENC's decision regarding adoption of an educationally rich metadata standard support educators who would like to use educationally significant search limiters, such as learning time, learning context, and level of interactivity. In addition, the fact that resources are cataloged on the learning object level makes it easier for educators to find the specific resource that they want and reuse it for their individual needs. For example, if a second-grade teacher is looking for an image of a star, a map of its location, and an informal assessment about stars, she would be able to locate and access exactly what she wants and organize it into her own lesson. ENC has also been able to generate different flavors of XML records based on a variety of metadata standards so that objects cataloged by ENC can be accessed through different search interfaces.

Conclusion

The decisions about how to use metadata that lead to interoperability require a cost/benefit analysis. Because it is a labor-intensive task to build records richly described with specific metadata, some people choose schemas that are less specific and easier to assign, choose to not add object-level metadata, or assign no metadata at all. In addition to using many metadata elements to describe a resource, the value of the record's description also relies on choosing elements that are relevant to the resources and audience as well as assigning the terms uniformly. If the record's description is irrelevant to the user or if the catalogers assign the terms inconsistently, the cost of adding metadata to the record is not balanced by its payoffs to the users. It is labor intensive to have consistent, richly described resources, but the potential benefits available through a digital library are significantly increased when the most precise metadata schemas are implemented.

References

Arms, W. (2002). A spectrum of interoperability: The Site for Science prototype for the NSDL. D-Lib Magazine, 8 (1). Retrieved August 4, 2003 from http://dlib.org/dlib/january02/arms/01arms.html.

Dublin Core Metadata Initiative: Dublin Core Metadata Element Set, Version 1.1: Reference Description. Retrieved August 4, 2003 from http://dublincore.org/documents/dces/.

Dublin Core Metadata Initiative: Education Working Group: Draft Proposal. Retrieved August 4, 2003 from http://dublincore.org/documents/2000/10/05/education-namespace/.

Fisher, S. (2001). POOL indexing guidelines – draft version 1.0. Retrieved August 4, 2003 from http://www.cancore.ca/documents.html.

Fisher, S., Friesen, N., and Roberts, A. (2001). CanCore schema 1.0. Retrieved August 4, 2003 from http://www.cancore.ca/documents.html.

Greenberg, J. (2000). "Metadata Question in Evolving Internet-Based Educational Terrain." In J. Greenberg (Ed.), Metadata and Organizing Educational Resources on the Internet (pp. 1-11). Binghamton, N.Y.: Haworth Metadata Press.

IEEE. (2002). IEEE P1484.12.1/D6.4 Draft Standard for Learning Object Metadata Document. Retrieved August 4, 2003, from http://ltsc.ieee.org/doc/wg12/LOM_WD6_4.pdf.

IMLS. A Framework of Guidance for Building Good Digital Collections. November 6, 2001. Retrieved August 4, 2003 from http://www.imls.gov/scripts/text.cgi?/pubs.

Open Archives Initiative. Retrieved August 4, 2003 from http://www.openarchives.org/OAI_protocol/openarchivesprotocol.html.

Roempler, K. (2001). Digital libraries for you. ENC Focus: A magazine for classroom innovators, 8(4). Retrieved August 4, 2003 from http://enc.org/focus/horizons/document.shtm?input=FOC-002309-index.

Wason, T. D., & Wiley, D. (2000). "Structured Metadata Spaces." In J. Greenberg (Ed.), Metadata and Organizing Educational Resources on the Internet (pp. 263-277). Binghamton, N.Y.: Haworth Metadata Press.

Zia, L. (March, 2001). Growing a national learning environments and resources network for science, mathematics, engineering, and technology education. D-Lib Magazine 7, 3. Retrieved August 4, 2003 from http://www.dlib.org/dlib/march01/zia/03zia.html.

Beyond the LOM: A New Generation of Specifications

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Introduction

This paper seeks to provide a vision of how the current and future direction for specifications and standards will influence the design and delivery of learning objects. It first provides a brief introduction to the factors leading to the development and standardization of learning object technologies and a discussion of some of the shortcomings of these early technologies. Second, it will discuss the recent specification development activities and what these activities will mean to the design and delivery of learning objects.

Just having learning resources available in a standard format does not in itself leverage all the potential of these objects for interoperability and reuse.

In general, learning object repository efforts around the world, in both the public and private sector, have led to increased accessibility to learning content that can be shared. The development of common metadata specifications, such as the IMS Meta-data Specification (IMS, 2001) by the IMS Global Consortium (http://imsproject.org) in the e-Learning market sector and the development of the Dublin Core (http://dublincore.org) by OCLC (http://oclc.org) in the library community support these efforts. The adoption of these specifications as part of broader national initiatives, such as the ADL SCORM (http://www.adlnet.org), the Industry Canada's CanCore (http://www.cancore.ca) efforts and MERLOT (http://www.merlot.org), have energized the research and development of learning object repositories infrastructure. Furthermore, the success of the IMS Metadata specification has led to the standardization of that work by IEEE LTSC in the Learning Objects Model (LOM) (IEEE, 2002). As a result of these efforts, and others, digital repositories of learning objects have proliferated in the past few years.

This process of moving from specifications to standards continues to gain momentum. For example, there are currently discussions underway to standardize the method of packaging learning content developed in the IMS Content Packaging Specification (IEEE, 2003a). The process of evaluating stakeholder needs, development of specifications to meet these needs and the testing of these specifications in the marketplace will lead to further standards activities.

But just having learning resources available in a standard format does not in itself leverage all the potential of these objects for interoperability and reuse. There are still some important technology details that are necessary to address before learning objects are widely used in our educational communities from K-12 through life-long learning. A few areas where existing learning object technologies need additional work are listed below:

First, for those contributing resources to learning object networks, metadata creation process needs to be less onerous. Without progress in this area, adoption of these technologies will be slow. There are a number of initiatives in this area that show potential – harvesting metadata from files or from like objects, use of templates and user profile and the ability to connect to services like Lightweight Directory Access Protocol (LDAP) to mine metadata that can be associated with a particular resource – to name a few.

Second, qualitative information about learning objects is still largely missing. This information is critical for making judgments on the use of a particular resource. Qualitative information needs to be linked directly to the resource to help potential educators make decisions on the incorporation of such materials into a learning experience. To date, efforts like MERLOT have used the academic peer review model. But this model seems a bit too restrictive in that the process of creating qualitative information is limited to how quickly experts can evaluate new resources. The ability to rate the quality of an object, comment on its usefulness or provide specifics on how it is integrated into a specific learning experience would increase the immediate usability and adoption of repositories and learning objects. The ability to evaluate learning objects should be something that anyone can do but the process needs to be streamlined to be successful. Furthermore, metadata about content quality are currently not adequately supported in the existing metadata specification. Clearly, more work needs to be done in this area.

Third, there is a need for better methods for communities of practice to identify and create their own metadata structures specific to their particular community. This user-created metadata has meaning within the community and is better suited for the community to locate and manage common resources. Metadata schemas need to be more flexible to accommodate this community specific metadata strategy.

Finally, a learning object generally has a context that is specific to its use. The same object may be used in multiple contexts. Much can be learned about the usefulness of an object if there is an understanding of the many contexts in which an object is used. To make this possible, metadata associated with the object would need to articulate its relationship with surrounding objects and report that relationship to the repository. This has the potential to make learning objects more universally useful.

New Specifications

There are a number of new specifications that are aimed at broadening access to learning objects and that support a wide range of pedagogies in e-Learning delivery that should be discussed. These specifications have the potential to greatly influence the design and delivery of learning objects in the future. These include the IMS Digital Repository Interoperability, the IMS Learning Design, and the IMS Accessibility for Learner Information Package: Access for All specifications. The following discussion summarizes the capability and identifies how these specifications offer new potential to the online learning and learning object repository communities.

Table 1: Learning Objects Technology Details to Work on

Metadata creation process needs to be less onerous for those contributing resources to learning object networks.
Qualitative information needs to be linked directly to the resource to help potential educators make decisions on the incorporation of such materials into a learning experience.
Communities of practice need better methods to identify and create their own metadata structures specific to their particular community.
Metadata associated with learning objects needs to articulate and report relationships with surrounding objects to the repository.

IMS Digital Repositories Interoperability Specification

The IMS Digital Repositories Interoperability (DRI) specification defines a specific set of functions and protocols that enable diverse components to communicate with one another. The functions supported provide the capability to *search/expose* and *gather/expose* learning objects stored in various repositories. Additionally, the DRI specification allows functions for an individual or system to *submit/store* and *request/deliver* resources. These functions and protocols leverage a variety of already proven technologies including XML technologies, such as SOAP (Simple Object Access Protocol) (W3C, 2000) and XQuery (W3C, 2003), as well as established technologies such as Z39.50 (International Standard Maintenance Agency, 2001) and the Open Archive Initiative (OAI) (2002) protocols, developed by the library community. The DRI specification acknowledges a wide range of content formats and is applicable internationally to both learning object repositories, as well as to other traditional content sources, such as libraries and museum collections.

To achieve interoperability, the DRI specification development took a slightly different tact than former IMS working groups. The working group chose to develop much of the specification around existing technologies and build a specification that identified how these technologies are used to achieve interoperability. The specification tends to look more like a best practice guide which details how existing specifications are used to achieve interoperability.

DRI Functionality: DRI specifies how core functions within the specification are supported. For example, the *search/expose* functions are supported with either the Z39.50 protocol when used within the library community, or by XQuery, when searching learning object repositories developed using the IMS Metadata or Content Packaging data structures. XQuery is an XML technology developed by the W3C (http://www.w3.org) to exploit the explicit structure of XML documents. Z39.50 is a protocol developed for searching library resources and is most useful when querying libraries collections.

The *gather/expose* functions are supported through the work of the OAI. This functionality provides the capability for a user to query multiple repositories held in databases. Query results from an OAI query can be aggregated into an entirely new metadata repository that can be queried by information seekers as an entirely new entity.

The *submit/store* functions refer to the way an object is moved to a repository from a given network accessible location, and how the resource will be represented in the repository for access. The specification recognizes that the location from which the resource is being moved can be another repository, a learning management system, a developer's hard-drive or a variety of other locations. Two recommendations are provided for the *submit/store* function. First, the File Transfer Protocol (FTP) is a generally acceptable way to achieve the *submit/store* functions. Second, it also recognizes that recently developed repositories that support the IMS Content Packaging Specification define interoperability between systems that wish to import, export, aggregate and disaggregate packages of content. A Content Package is a compressed file (usually a zip file) that contains the learning object, its metadata record, and a manifest describing the contents of the package. Thus, another way to support the *submit/store* functionality is to exploit the Content Packaging Specification.

Having located resources, there still needs to be a way to *request* the resource and then have it *delivered*. There are two methods specified for this *request/deliver* function. First, if the object is contained in an IMS compliant system, then the IMS Metadata <location> element is used to store a pointer to the location of the resource. Second, if this is not the case, a location independent URL alternative, like OpenURL (2000) is used. Objects are delivered using basic transportation protocols like http or ftp and resources are wrapped in an IMS Content Package.

One additional piece of the work needs to be discussed. This is the passing of messages and other instruction between systems. For this IMS DRI recommends the use of SOAP with Attachments. SOAP with Attachments, another W3C technology, was developed to provide a mechanism for exchanging structured and typed information between decentralized, distributed systems.

Importance of this specification: This specification adds new, powerful functionality that previously was not available. Specifically, DRI provides the capability to bridge various repositories with a single query. Thus, networks of resources can be federated together and accessed using one of the supported functions. Additionally, the location of repositories of resources can include, not only learning object repositories using IMS Metadata and CP, but libraries and museum, anything that support Z39.50, and databases that are harvested for information using OAI. No longer does a user have to go to multiple repositories to get the learning resources they require.

Furthermore, this new functionality allows the ability to create learning object repository networks (LORnets). By incorporating such functionality, national and international efforts to create learning object collections, can be federated into a single virtual collection accessible through a single user interface. The Canadian *eduSource Project* (2003) is an effort to build the next generation of learning object repository network.

Finally, functionality provided by this specification provides the capability to build new kinds of learning object repositories that are created by automated processes. Repositories can be created by harvesting resources from the network and building new collections. This new functionality allows for the creation of niche collections within a specific discipline or area of study. Thus, these new features provide the support for communities of practice.

IMS Learning Design Specification

The IMS Learning Design (LD) Specification is a broad and effective way to design on-line learning experiences. Not only is it robust, it provides a great deal of flexibility in designing the learning experiences and supports the reuse of design strategies and content. The development of the LD specification stems from work conduct at the Open University of the Netherlands (OUNL) (http://www.ou.nl/info-alg-english-introduction/index.htm) on the Educational Modeling Language (EML) (http://eml.ou.nl/eml-ou-nl.htm). The LD specification work differs from the original OUNL work in that the LD specification leverages previous IMS specification work by incorporating the specifications such as the IMS Metadata, Content Packaging (CP), Question and Test Interoperability (QTI) (IMS, 2003a) and the Simple Sequencing (SS) (IMS, 2003b) specifications into the design of the LD specification.

Learning Design Functionality: One of the primary goals of the IMS Learning Design specification (and EML) is to support a wide variety of pedagogical approaches to learning. To understand this problem, the OUNL researchers looked at over 100 different pedagogical models to determine if there were common elements. As a result of that effort, the OUNL found that basic conceptual elements could be abstracted from this process and used to describe the different pedagogical approaches. The Learning Design specification might be described as *people* participate in a *Unit of Learning*, and have a particular *Role* (e.g. teacher and learner), and a *Method* then requests a number of *Activities* in a specific order. This all takes place within an *Environment* that contains *objects* (e.g. text, audio or pictures) and provides *services* (e.g. chat, conference).

The term Unit of Learning is used in the Learning Design specification to describe the "smallest unit providing learning events for the learner, satisfying one or more learning objectives." The components of a Unit of Learning include *resources* (such as web pages, programs, paper documents, etc.), *instructions* for learning activities, *templates* for structured interactions, *conceptual models* (e.g., problem-based learning), l*earning goals, objectives and outcomes, and assessment tools and strategies.* In developing a Learning Design, an educator can direct all these elements in a theatrical, play-like structure with acts, roles and parts.

Another goal of the LD effort was to support portability and content reuse. This was accomplished by separating the pedagogical design description (play or sets of plays) from the content used in the learning experience. This approach allows for the learning objects used within a Unit of Learning to be separated from the description of the learning design. This enables reuse of both the pedagogical prescriptions and the content used in the design.

A further goal of the LD work was to enable support for collaboration, personalization and adaptability without a great deal of complexity. The development team chose to achieve this by developing three progressive XML Schemas instead of one. Each additional schema was used to support greater degrees of complexity in the design of the learning experience. For example, Level A provides the basic element needed for a learning design. Level B adds support for personalization and adaptability and Level C adds assistance for collaboration including the ability to communicate outcomes of a specific learning activity.

Importance of this specification: The IMS Learning Design Specification is a huge step forward in providing a truly rich environment for on-line learning. Prior to the creation of the Learning Design specifications, existing specification such as the Content Packaging and Metadata specification provided little support for pedagogical strategies for delivering learning. The view prior to the creation of the LD specification was on-line learning was very content-centered. Additionally, prior specifications had no capability for structuring the learning process other than as a hierarchical model for delivering the content, nor did they have a way to support group or collaboration or group learning. The LD specification now provides support for these activities.

With the creation of the LD specification the learning designer can now include one or more individuals in a Unit of Learning, each having a role as a teacher or a learner, with a specific set of activities. Learning designers also can provide a set of resources (learning objects) and services to be used as part of the learning environment, which can be orchestrated in a specific manner. Units of Learning can be stored and reused, and designed in accordance with specific, recognized pedagogical strategies. Since content is separated from the design, content can be reused, as can the pedagogical design. An added advantage with the LD specification is the ability to include multiple players at the same time in a learning experience, to personalize the learning experience and allow the adaptability of the experience to different learners or different situations.

IMS Accessibility for LIP: Access for All

New functionality has been recently added to the Learner Information Package Specification that provides additional support for accessibility. This new specification is referred to as the IMS Accessibility for LIP: Access for All (ACCLIP) specification. This specification will have an impact on the design and delivery of learning objects in that it will provide a framework to customize and personalize the learning environment for the specific characteristic of each learner.

ACCLIP Functionality: Access for All provides a means to describe how learners prefer to interact with an online learning environment. These preferences will likely have considerable impact on the user interface of learning delivery, tools, and managers and on how content is selected.

The <accessForAll> element completes an element that was left for future work in the IMS Learner Information Package (LIP) Specification v1.0. The accessibility data structure in LIP included the following elements: <language>, <preference>, <eligibility>, and <disability>. The ACCLIP specification fills in the <disability> element but does not change the other parts of the accessibility structure. Because ACCLIP addresses needs of learners, which go beyond disability, the name of the element has been changed from <disability> to <accessForAll>.

As the name implies, <accessForAll> is meant to serve the needs and preference of all users, not only those with a disability. In this model, accessibility extends beyond disability to benefit all users in a learning situation which requires alternative modes of use, such as an extremely noisy environment where captions are needed for a video. The user preferences that have been defined will aid the user in displaying learning materials in the style best suited to their particular needs and in specifying an interface that they can interact with effectively which allows the accessible display and control of learning materials. The purpose of Access for All is to allow information to be gathered from users regarding their needs and preferences so that the user interface and the content can be appropriately adapted.

The purpose of 'Access for All' is to allow information to be gathered from users regarding their needs and preferences so that the user interface and the content can be appropriately adapted.

The purpose of Access for All is to allow information to be gathered from users regarding their needs and preferences so that the user interface and the content can be appropriately adapted. Students with disabilities may have specific requirements for the format in which information is presented and the way in which they provide input to the system.

The information collected in <accessForAll> is associated with the learner's functional abilities and the assistive technology and other non-standard technology in use, as well as other user preferences. It is not a medical description of the disability. The reason for taking a functional approach is to provide the information needed for the learning system to adapt content and navigation to the needs of the learner.

Importance of this specification: The importance of the ACCLIP specification may not be immediately understood, but this specification provides enormous opportunities to customize and adapt the learning experience based on user preference. This powerful capability now can be used for anyone, not just those with disabilities. These preferences will be stored in the Learner Information Package and could travel with the learner from one on-line environment to another. Since these preferences are created and maintained by the learner, the individual has the control to change the environment as needed. This also allows one to consider the learning style of the learner as part of the environment. For example, visual learners will be better able to set preferences that are unique to the way they learn because the ACCLIP specification allows preferences to be translated into the type of learning objects that are selected and delivered in the learning environment.

Table 2: Broadening Access to Learning Objects

New specifications from IMS

IMS Content Packaging Best Practices and Implementation Guide, Information Model, and XML Binding Specification
http://www.imsproject.org/content/packaging/index.cfm

IMS Digital Repository Core Functions Best Practices and Implementation Guide, Information Model, and XML Binding Specification
http://www.imsproject.org/digitalrepositories/index.cfm

IMS Learning Design Best Practices Guide, Information Model, and Information Binding. http://www.imsproject.org/learningdesign/index.cfm

IMS Learner Information Package Accessibility for LIP: Best Practices Guide, Information Model, XML Binding and Uses Cases
http://www.imsproject.org/accessibility/index.cfm

Conclusion

Technical support for the online learning community has been advanced considerably in the past year with the introduction of these new specifications. The DRI specification creates an infrastructure for a whole new way of thinking about the federation of learning objects repositories supporting both the library and on-line learning communities. It invites the creation of learning object repository networks on an international scale and encourages the creation of niche repositories to support communities of practice. The LD specification provides tools for us to think about introducing a variety of pedagogical strategies to the learning experience while separating content from the design strategies. It supports a broader view of learning that includes collaboration, accessibility and adaptability. The ACCLIP specification adds new functionality that will allow the learner to control the look-and-feel of the learning environment. This control will allow the content to be delivered in ways that are customized to the learners needs.

In the future, as institutions and vendors embrace these technologies, the learner will find considerable new functionality in learning environments, tools, and on-line resources. These new features will inevitably lead to new requirements, new specifications and improved standards.

References

IMS (2001). IMS Learning Resource Meta-data: Best Practice and Implementation Guide, Information Model and Binding Specification. Retrieved August 31, 2003, from: http://www.imsproject.org/metadata/index.html.

IEEE (2002). IEEE P1484.12.1/D6.4 Draft Standard for Learning Object Metadata Document. Retrieved August 31, 2003, from: http://ltsc.ieee.org/doc/wg12/LOM_WD6_4.pdf

World Wide Web Consortium (W3C) (2000). Simple Object Access Protocols (SOAP) 1.1. Retrieved August 31, 2003, from: http://www.w3.org/TR/SOAP/

World Wide Web Consortium (W3C) (2003). XQuery 1.0: An XML Query Language. Retrieved August 31, 2003, from: http://www.w3.org/TR/xquery/

International Standard Maintenance Agency (2001). The Z39.50 Document. Retrieved August 31, 2003, from: http://lcweb.loc.gov/z3950/agency/document.html

Open Archives Initiative (2002). The Open Archives Initiative Protocol for Metadata Harvesting, Information. June 14, 2002. Retrieved August 31, 2003, from: http://www.openarchives.org/OAI/openarchivesprotocol.html

IMS (2003a). IMS Question and Test Interoperability: Overview, ASI Best Practices Guide, ASI Information Model, and ASI XML Binding. Retrieved August 31, 2003, from: http://www.imsproject.org/question/index.cfm

IMS (2003b). IMS Simple Sequencing Best Practices and Implementation Guide, Information and Behavior Model, and Information Binding. Retrieved August 31, 2003, from: http://www.imsproject.org/simplesequencing/index.cfm

Course Management Systems: Trapped Content Silos or Sharing Platforms?

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Introduction

The course management system (CMS), a software program that provides a set of integrated tools for assessment and evaluation, content management and delivery, communication and collaboration and course administration, has increased institutional capacity for delivering web-based learning. Course management systems have been recognized as the key technology for delivering courses and programs (Katz, 2003; Gallagher, 2003), have appeared on the 2003 list of top 10 issues that Chief Information Officers/IT executives have to resolve for a campus' strategic success (Crawford et al., 2002), and their use cited as an effective practice for redesigning courses for increased quality and cost savings (Twigg, 2003). Because tools are generic, use of a CMS cuts across disciplines and sectors.

The CMS represents an opportunity and a challenge. Large numbers of faculty are placing a variety of course assets such as lecture notes, presentations, publications, online textbooks, multimedia activities, sets of web links, assignments, and tests into CMS shells. Millions of students are participating in discussions, taking tests, turning in assignments, and developing portfolios. The amount of intellectual capital that is resident in CMS sites worldwide is staggering. Associated with this reservoir of content is an even deeper, more important, largely underappreciated, well of faculty pedagogical expertise. With their large user bases, there is tremendous potential for the CMS to form a basis for exchanging content and best practices. However, while more and more faculty and programs have come to rely upon course management systems over the past few years, rapid technology and business changes (mergers, elimination of products, etc.) have brought about a sense of discomfort in the community.

Questions arise:

- How invested is my institution in one platform?
- If I put my material in a CMS, can I get it out?
- What happens if my institution switches systems?
- How do I share materials between systems?
- If I have just arrived from an institution that uses a different CMS, how do I use what I have already created?
- How can my content development work be "future proofed" against CMS changes?

These types of questions speak to the role that the educational community is expecting the development of standards by inter-organizational consortia to address.

The January 2003 Ohio Learning Network Learning Communities Institute at The Ohio State University (http://telr-research.osu.edu/OLN-LearningInstitute/), provided an opportunity to investigate faculty needs related to reusability and sharing. Groups attending this conference used disparate course management systems, and there was a need to ensure that others could re-use any content developed. Our expectation was that the focus would be technical. However, we found that there was as much, or more, interest in understanding what is pedagogically possible with a CMS, understanding the link between learning objects and the CMS, or overcoming the functional limitations of their particular flavour of CMS, as there was a desire to have a deeper technical understanding. Cultural issues associated with sharing also emerged as important.

In this chapter, we will address content-related questions associated with course management systems, while putting forward some thoughts and observations about issues associated with sharing. We draw upon the experience of the authors at the January 2003 Institute, and at other workshops and collegial interactions, to explore issues related to sharing, including understanding the nature of course management systems, standards, general content development strategies, and cultural issues related to sharing. We review aspects and considerations related to reusability and course management systems at a high level. The features of course management systems and their compliance/conformance with technical standards are rapidly changing, so any comparison of products will be out of date shortly. The reader is encouraged to visit Edutools (http://www.edutools.info, hosted by WCET) for feature comparisons. Standards comparison web site resources are provided in the Technical Standards section of this chapter.

Building the Silo: The Rise of the CMS

In the mid 1990s, inspired by the release of the graphical browser, computer-savvy faculty learned how to develop web pages and put together extensive course web sites. The promise of this new medium was tantalizing - by making content and communication possible in new ways and at new times, students could be reached in different ways and could be provided the tools to take more control of their environment. However, to add interactive components like discussion boards or quizzes, a high technical skill level was required. Course Management Systems (CMS) emerged during this period in response to the need for a practical way for "normal" faculty members to use the web.

Bender (2003), in the ECAR Research Bulletin, "Student-Centered Learning: A Personal Journal," outlines how the emergence of the course management system affected his course environment:

> "... With a CMS, all of the "tools" of the classroom, from document archives to assignments and session notes to gradebooks and rosters, are integrated through a single platform. For the first time, students understand that the distinct elements of their coursework form a complete learning experience because they see the interrelationships through the window of the CMS"(Bender, 2003; p. 3).

Higher Education rightfully can lay claim to inspiring and indeed, creating this technology.

The table in the article, reproduced here as Table 1, illustrates how the introduction of the CMS facilitated the striking reduction in the need for maintaining and supporting multiple platforms to address specific pedagogical purposes. What is not shown, and is similarly important, is that with reduction came a new control. The faculty member no longer had to ask anyone to install or configure programs – the CMS took care of that. Within a few years, connections to other campus systems (for automated student registration, etc.) were made possible.

Higher Education rightfully can lay claim to inspiring and indeed, creating this technology. The earliest versions of course management systems – such as Web Course in a Box (Virginia Commonwealth University), WebCT (The University of British Columbia), and Blackboard Course Info (Cornell University) – emerged out of post-secondary educational settings, and in some cases from "innovate technology" funding efforts. Improvements to product features and functionality were prompted and guided by user feedback through listservs and user conferences, so early adopters gained a sense of ownership in the products. The place of origin, combined with the user involvement in the development process, may in part explain the strong emotions that are evoked

Table 1. Comparison of pedagogical tools used by Robert Bender for University of Missouri – Columbia writing courses as technology changed in the 1990s. From ECAR Research Bulletin, Volume 2003, Number 11 (2003). Used with permission.

Learner Tools	Technologies Used Prior to Launch of Course Web Site (Pre-1995)	Technologies Integrated in Course Web Site	Features Integrated in CMS
Communication Tools			
Discussion forums	LISTSERV/Usenet	Link to ListProc	√
File exchange	FTP	Eudora	√
Internal e-mail	Host-based system	Link from Web page	√
Online journal/notes	[Not used]	[Not used]	√
Real-time chat	"Tell" commands	Link to MOOs/MUDs	√
Video Services	[Not used]	[Not used]	√
Whiteboard	[Not used]	[Not used]	√
Productivity Tools			
Bookmarks	[Not used]	[Not used]	√
Calendar/progress review	Paper handout	Hyperlinked calendar	√
Orientation/help	[Not used]	Browser-specific	√
Searching within course	[Not used]	Dependent upon Web site navigation	√
Work offline/ synchronize	[Not used]	No posting capability for students	√
Student Involvement Tools			
Group work	Paper-based	E-mail exchange	√
Self-assessment	[Not used]	[Not used]	√
Community building	Online discussion	Link to discussion	√
Portfolios	Paper-based	Paper-based	√

by changes or perceived inefficiencies and shortcomings in the products and their vendors. This historical relationship, the frustrations experienced by the educational community as the products have matured, and the search for solutions to issues identified over time is explored further in Carmean and Haefner (2002, 2003) and Cambridge et al. (2003).

Delivering all or portions of courses online is now a core business of the Academy. Institutions have responded by becoming very systematic in their approaches to implementation (ongoing support, training and planning). A key indicator of this shift in focus is the very public and highly scrutinized selection process that some institutions and state systems are employing to choose or affirm their CMS choice (see links in Table 2). Overall, this shift is healthy for educators and vendors, and signifies the maturing of the technology.

Creating Openings in the Silos: Technical Standards

The distinct promise of the e-learning standards movement is that developing and adhering to a set of common technical specifications for educational software systems can lessen the negative impact of a technology change, as Lightle and Halm (this volume) explore. Standards community advocates (see for example Acker and Voltero, 2002) describe this promise as that of the "ilities": portability, reusability, interoperability, extensibility, accessibility, discoverability, etc.. For content, portability (easily moved) reusability (easily edited, changed or re-contextualized) and accessibility (easily read by those using assistive technologies) are particularly important. Interoperability and extensibility considerations control the connections between systems (e.g., a student information system and a CMS) for data exchange, or when adding to or strengthening system functionality by integrating external tools (new communication tools, specialized statistical packages, etc.). If a product adheres to the concepts embodied in the "ilities", those who use the product should have flexibility.

However, the technical educational standards movement is still quite young. It is important to be aware that adherence to a standard does not in and of itself guarantee educational or operational relevance. The ability to import a SCORM object does not automatically mean that the CMS has the ability for the object to interact with the internal tools that record student activity or provide interaction in a course management system. How many products have implemented particular standards? What level of effort does it take to comply with or conform to a standard? Does compliance or conformance actually mean anything to the educator? We would argue that the first consideration should be to achieve educational, as opposed to technical,

Table 2. Links to Recently Completed or Ongoing Course Management System Evaluation Processes

Institution	Web Resource
Deakin University	*Evaluation of Corporate Applications for Online Teaching and Learning* http://www.deakin.edu.au/lms_evaluation/old/
The Ohio State University	*Enterprise Level Course Management System Evaluation* http://telr.osu.edu/cms/index.html
University of Florida	*Course Management System Advisory Group* http://grove.ufl.edu/~cmsag/index.html
University of Illinois	*Enterprise Learning Management System Project* http://www.cites.uiuc.edu/edtech/projects/enterprise/index.html
University of Wisconsin System	*Preparing for Change: UW and the Quest for a New e-Learning System* http://www.uwsa.edu/ttt/articles/taskforce.htm
Wesleyan University, Brandeis University, and Williams College	*Project CMS@WBW.edu* http://web.brandeis.edu/pages/view/Instructional/ProjectSummary

objectives. The lack of conformance of a system to a particular standard should not be used as a sole criterion for deciding whether or not to use a particular product.

Standards work is ongoing and it influences course management system development. The largest North American based organization concerned with standards development is IMS Global (http://www.imsglobal.org). IMS brings together educational and industry representatives in a collegial setting to discuss, develop use cases, and develop technical specifications that allow testing and implementation. Table 3 lists and briefly describes current

Table 3: Current and emerging standardization efforts to monitor and consider. More information can be found at: http://www.imsglobal.org/develop.cfm

Current

- *Accessibility* – provides support for disabilities or challenging environments.
- *Competency Definitions* – defines competencies that appear as part of a learning or career plan, as learning pre-requisites, or as learning outcomes.
- *Content Packaging* – provides instructions for wrapping and exchanging learning content.*
- *Digital Repositories* – defines the technical architecture of storing, searching and retrieving digital objects, and interacting with other systems.
- *Enterprise* – specifies interoperability between systems within the same organization (e.g., data exchange between the CMS and a student information system).
- *Learner Information* – packages information about a learner or a producer of learning content so that the it is transferable.
- *Learning Design* – provides a generic and flexible language (Educational Modeling Language) to express different pedagogies and the resultant system interactions.
- *Meta Data* – codifies the description of a digital object used for learning.
- *Question & Test (QTI)* - provides formats for constructing and exchanging assessment information.
- *Sequencing* – provides a way of representing intended behaviour (order, dependencies, etc.) learning activities/content.

Emerging Areas of Interest

- *e-Portfolios*
- *Digital Libraries*
- *Mobile Computing*

** Related content specifications are described by the ADL with SCORM (Shareable Content Object Reference Model) and Microsoft with LRN (Learning Resource iNterchange)* specification development and emerging areas of interest. Halm (2003, and this volume) reviews the emerging efforts amongst standards organizations that are focused on more complex interoperability issues.

A good measure of the relative level of acceptance of certain specifications can be gleaned by perusing the list of companies that have implemented specifications (see: http://www.imsglobal.org/direct/directory.cfm). The UK-based CETIS organization maintains a listing with a bit more of an international flavour at http://www.cetis.ac.uk/directory. Edutools (http://www.edutools.info/index.jsp), a site that provides feature comparisons between different course management systems, also includes information related to standards compliance. The Advanced Distributed Learning Laboratory (ADL) maintains a list of Shareable Content Object Reference Model (SCORM) adopters and certified products on their site, http://www.adlnet.org/index.cfm?fuseaction=adopterslist. The latest generation of course management systems have made great strides to support emerging standards and modular content creation, and promise improvements that should make re-purposing even easier. However, possessing the tools to support an activity does not in itself guarantee success.

Removing Items from The Silo: Content in a CMS

How does a user – that is, how do faculty – maintain content flexibility while using a CMS? The key to determining the answer to that question depends on how the content is created, the complexity of the structure of the content, the reliance on built-in CMS tools, and the flexibility of the CMS. Early versions of course management systems were forms driven – much of the content was typed into text boxes and stored in a proprietary database, limiting its portability. This limitation is not as significant an issue now. The bulk of the common course content (lecture notes, presentations, multimedia elements) is created outside of a CMS as digital files (word processor, HTML files, PDF, multimedia, etc.) and uploaded into a course environment. As long as the file remains in its native format, not only does a copy exist on a local file system, the file (including any edits made since upload) can be downloaded from the CMS. Where CMS systems may and do differ, is where files are stored, and how easily files are to extract in bulk.

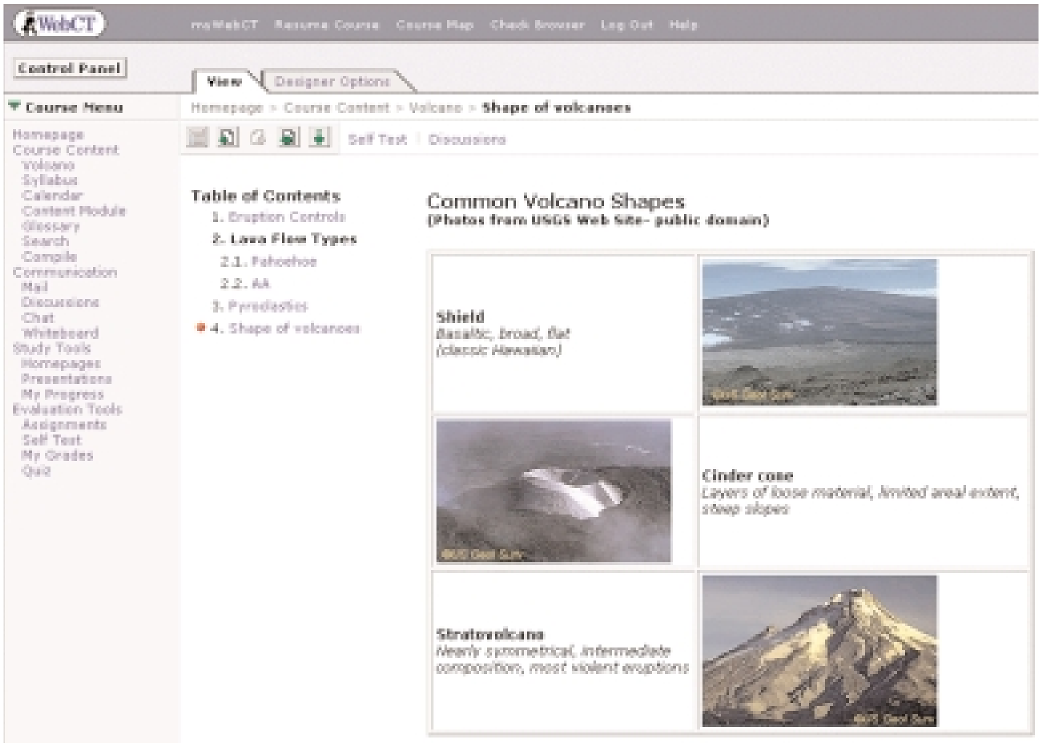
More complex, structured content, where the structure (navigation, sequencing, embedded tools) is generated by the CMS, can be more difficult to move intact. The major vendors claim that one can export an entire course in an open format defined for e-learning in XML. Does this mean that an entire course can be exported from one system and imported into another CMS without change? No. Standards are not yet sophisticated enough to address all

CMS tools and features. Vendors define custom elements for features that are not described by available specifications; these feature may not be accommodated in competitive products.

For example, an IMS Content Package or a Microsoft LRN (Learning Resource iNterchange) can describe a set of HTML files that are linked in a linear or hierarchical sequence. One can find this structure in a WebCT Campus Edition (CE) Content Module or a Blackboard Learning Unit. This structure is well defined by the IMS Content Packing Specification. However, features beyond the navigation may confound current specifications. A basic example of this is illustrated in Figure 1. Figure 1A shows a screenshot of a WebCT Content Module. There are four files, and associated with the last page of content are links to a Discussion and a Self Test. When this Content Module is exported as an IMS content package, and viewed in the Microsoft LRN Viewer (Figure 1B), the navigation and content listing are maintained, but the links to the interactive

Figure 1: Comparison of a WebCT Content Module and its exported equivalent as displayed in the Microsoft LRN viewer. Note that the navigation provided in the Action Menu, as well as the associated tools (Self Test and Discussions), are not recognized by the Microsoft Viewer.

A. WebCT Content Module



Common Volcano Shapes

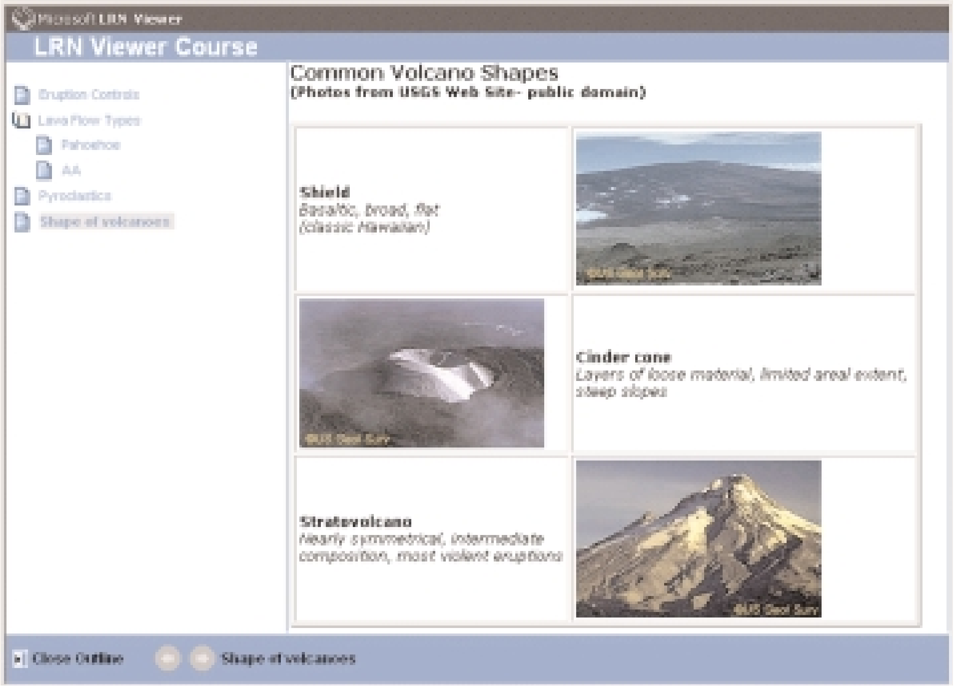
(Photos from USGS Web Site- public domain)

Shield
Basaltic, broad, flat (classic Hawaiian)

Cinder cone
Layers of loose material, limited areal extent, steep slopes

Stratovolcano
Nearly symmetrical, intermediate composition, most violent eruptions

B. Exported WebCT Content Module, as displayed in Microsoft LRN Viewer



Common Volcano Shapes
(Photos from USGS Web Site- public domain)

Shield
Basaltic, broad, flat (classic Hawaiian)

Cinder cone
Layers of loose material, limited areal extent, steep slopes

Stratovolcano
Nearly symmetrical, intermediate composition, most violent eruptions

tools (Discussion, Self Test) are lost. Other unique features, such as selective release of content based on performance or date, also may not be retained upon export of content from one CMS and import into another. The Learning Design Specification and Simple Sequencing do address more complex structures and content relationships, but these specifications have not yet been implemented in major CMS products.

Data that are entered into a form, and associated with a tool (e.g., calendar, quiz, assignments) can also be a challenge to re-use. CMS programs provide text-based batch uploads for some tools, such as calendar and quizzes, but the text formats differ from program to program. More work is needed in this area to improve portability and reusability. For quizzes, specifications like the IMS QTI show promise, not only for standardizing formats, but also for allowing unique question formats (beyond multiple choice, matching, etc.) to be readable by systems. Products such as Respondus, a quiz and test editor, effectively serve as neutral middleware by creating files that can be imported into competitive products (in this case, WebCT and Blackboard). Until the standards programs mature, and conformance programs are in place to prevent vendors from interpreting specifications differently, using 3rd party "middleware: products are an effective strategy for future proofing content development.

In order to understand how easily elements of a CMS course can be re-used, the questions to consider asking include:

- Are files stored as discrete files in the system or generated on the fly from databases)?
- Are there utilities for zipping files and folders together for downloading?
- Does the product support Web DAV as a file transfer protocol?
- Can quiz questions or whole quizzes be exported in a standards compliant fashion?
- Can students and faculty selectively compile and download discussions in text format?
- Does the product support export of discrete packages of content (versus a whole course) in a standards compliant fashion?
- Are file transfer and modular export capabilities provided at the instructor (content creator), as opposed to administrator level?

Portability is enhanced when tools are made available to the end users, files are stored discretely, and exported objects are either standards compliant or in a common format (e.g., text).

Decisions to use particular course management systems are largely based on the integrated set of tools that allow users to build pedagogically effective environments. At the same time, there are expectations that existing standards should allow a complete course built on one system to have the same character and value when exported and imported into another system. This expectation is premature, and it might force the vendor and the educator to adhere to vanilla standards.

Nevertheless, the problem is multi-faceted. As we use the unique tools that our systems provide, we need to have some assurances – from vendors, from our institutions, from our systems administrators -- that our pedagogical choices will be supported by the technology today and tomorrow. Technical differences exist and technical accommodations can and should be made for sound pedagogical reasons. To this end, educators should become more involved in the standards movements, through organizations like IMS, or the Canadian organization EduSource (http://www.edusource.ca), so the voice of the educator is strong in the ongoing development of standards.

The Foundation of the Sharing Platform: Content Development Strategies

A significant effort has been focused on content standards. Until recently, content import and export capability was available only at the full course level, limiting its usefulness. Since the January 2003 Institute, there has been significant movement in this space. With its Campus Edition 4.0 and Vista 2.0 releases, for example, WebCT provides support for modular import and export of IMS (for content and assessments) and import of Microsoft LRN packages. Desire2Learn and Blackboard offer Learning Object import for various versions of the IMS content packaging specification, SCORM and LRN. Up-to-date information on the standards support is available at each vendors web site, and documented on the Edutools, ADL, and IMS sites mentioned earlier.

While the import capability lays the foundation for sharing, it also calls for a more rigid content development strategy. If it is important to be able to share a learning module (as defined by a content package of some type) between courses or platforms, then one should consider developing new content with standards-compliant tools outside of the CMS, and importing them with the tools made available by the CMS. From that start, the instructor can modify and enhance the content with the specialized tools that are uniquely available within a CMS that serve teaching and learning needs. To accommodate this capacity, the major CMS vendors are partnering with content creation tool providers (e.g., Macromedia) and Learning Content Management System (LCMS, e.g., Harvest Road) vendors.

What is truly exciting here is not the import capability, but rather the combination of the import and export of small "chunks", ***using tools made available to the instructor***. The export capability allows instructors and communities to leverage the content that has already been created (perhaps especially important in light of the heavy institutional and personal investment in existing platforms). Modular import and export allows for differentiated development and reuse. For example, many Librarians and Student Services personnel have developed modules related to common topics like information literacy or online learning preparedness. The export capability allows us to extract a module from one course, then modify it to be generic (less discipline specific) with a standards based editor. The "generic" module could then be repackaged, imported into a course, and edited for context. Similarly, in a more advanced course, an instructor may notice that some of the students are struggling with a concept taught in a prerequisite course. Rather than re-building a remedial module, the instructor could obtain a module from a lower level course. It is easy to imagine Learning Object Repositories, academic and commercial, that specialize in modular content for CMSs.

Being able to export and share modular pieces of a course may also address an important cultural issue within the Academy. We cannot take for granted that faculty are keen to share their materials. At two workshops[1] held at The University of British Columbia held in May and June 2003, participants cited a number of objections to sharing: that work might be used or misused without proper attribution; that the considerable efforts required to make materials available would not be rewarded or reciprocated; and that shared materials might support competitors (this was especially a concern with regard to specialized courses or programs). These and other issues are explored more in Greg Webb's (2000) paper, "Why Teachers Don't Share Resources, And What We Can Do About It." Sharing a piece of a course (a chapter or a quiz for example) via modular import and export addresses the concerns found in the existing culture and as such seems more palatable than sharing an entire course.

Content Silo or Shared Platform: The CMS Can be Either

Current e-learning specifications address packaging of content where content is defined as a file, a structured set of files (modules), and a quiz or set of quiz questions. CMS vendors provide, or are close to providing, the capacity for portability and reusability, including the issue of transferability between systems through import and, in some, export tools. To varying degrees, at this time, major course management systems (e.g., WebCT, Desire2Learn, Blackboard) are capable of providing a platform for the sharing of:

- Full Courses (import or export entire course as package)
- Course templates (shells that capture course structure, including tools)
- Structured content sequences (sets of files)
- Quiz questions
- Assessments

For all practical purposes, content is not trapped if it is housed in any major CMS. Differences in interpretation of standards, and feature sets will determine how much work will be required during any migration process. Content is not the only item, however, that must be addressed before educators can begin to harness the promise of learning objects (reusable media) to develop their courses.

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[1] The workshops were for Distance Education and Technology, May 15, 2003; and the 23rd Annual Conference of the Society for Teaching and Learning in Higher Education, June 10, 2003.

What does content have to do with it?

Until this point in the chapter, the underlying assumption is that content is something is generated by the instructor or some expert group of content developers associated with a course. One of the key moments of the January 2003 Institute for both of the authors of this paper occurred during David Wiley's talk, when he asked the audience: "What were the most valuable aspects of your own university experience?"

The replies were telling:

- "exposure to faculty and talented students"
- "chance for professional networking"
- "opportunity to collaborate on funded projects"
- "hanging out, arguing with other students"
- "recommender system" -- good/bad courses, books
- "enculturation into a professional community"
- "time for self-examination and chance to experiment"

What is notably missing from this list is "exposure to excellent educational content." As noted in Carmean and Haefner (2002), deeper learning is social, active, contextual, engaging and student-owned. The barriers to achieving transformative change through online learning are not those imposed by technical barriers related to content, but are those caused by limiting the frame of reference for what we expect to achieve – what we consider to be content. Given that interactions are vital to the educational experience, it is striking how difficult it is to capture interactions simply because they are not considered content.

Current technical definitions of content are conventional. When a CMS exports a course, no student data are preserved in a readily extractible form, if at all. There is no technical need; current content packaging specifications neither require retention of learner data nor provide a consistent format for their retention. Major CMS vendors support text export of discussions, but this functionality is rudimentary. Discussion export should allow a student to retain the context and depth of a discussion by supporting retention of ownership and re-threading. In the Faculty of Arts at UBC (Warren Scott, personal communication, 2003), educational technologists are developing an XML standards-based tool (the WebCT Discussion Object Exporter) for extracting, saving and re-threading compiled WebCT discussions as reusable learning objects. Future development of this and other student-centric tools would be enhanced if the viewpoint of the student were more strongly reflected in content standards. We need to value the learner's viewpoint more, and support their ability to document their own learning. There should be straightforward, standards-based ways to address the following questions:

- How do students obtain a long-term record of their assessments?
- How can a student extract an assignment (complete with instructor comments and grade), add a reflection, and post it to their e-Portfolio?
- How can a student extract a group project, and be given the facility to demonstrate their contribution?
- How do we provide a student with a personalized, with a personalized, portable record of their course contributions (assignments, discussion posts, projects, etc.).

The standards work related to Learning Design and the Learner Information Profile hold strong potential for moving us ahead in this effort. The Special Interest Group related to e-Portfolios (see http://www.imsglobal.org/workinprogress.cfm, for more information) will most likely play a significant role in this process.

A related concern expressed at the January 2003 Institute and the UBC workshops was that approaches to using learning objects in education were prone to the dread condition of "contentitis", a malady that renders victims incapable of recognizing pedagogy as more than the deployment of resources. As a result, many of the recommendations that emerged from discussions stressed the importance of sharing strategies and techniques in addition to content. While few argue with the need to effectively catalogue and store costly multimedia instruction, the utility of more ethereal and personal-scale resources such as lesson plans and design rubrics should not be ignored (though they may not justify a rigorous metadata regime). It must not be forgotten that benefits may be realized beyond the simple sharing of a resource, that the most interesting part of the process might be the resulting interaction between instructors who share a common interest.

Summary: Is the CMS a Silo or a Platform?

While technical barriers exist with respect to using a CMS to promote content sharing, the technical barriers are being addressed through implementation of e-learning specifications or standards. The biggest, most pressing challenge on the reusability front, and one that needs to be accelerated, is placing the tools for transferring files, learning objects, and learning records closer to the end user (faculty and students). However, there are issues that the educational community needs to tackle if we expect to take advantage of future technical flexibility in course management products.

Perhaps the most striking characteristic of the issues raised by January 2003 Institute participants and our subsequent collegial interactions, is how few challenges have to do with technical considerations related to the course management systems or content creation methodologies, but are linked to the culture of sharing, including motivations for sharing. Steve Acker and his colleagues explore similar cultural issues in their article, "Is the Academy Ready for Learning Objects?" (Acker et al. reprinted in this volume). It is important, we believe, to avoid trapping our own discussions about technology in to content-driven silos, and to challenge the concept of content: Is discipline content the most valuable resource we have? Is the technology really holding us back? What is going to make a difference in terms of helping us transform our practice? At the end of the day, we need to consider our primary motivation – learning.

References

Acker, S., Pearl, D. and Rissing, S. 2003. Is the Academy Ready for Learning Objects? Syllabus, July 2003. Retrieved August 30, 2003, from: http://www.syllabus.com/article.asp?id=7886

Acker, S. and Voltero, K., 2002. E-Learning Standards: Harbingers of Faculty, Student, and Organizational Change. Presentation at the 2002 AAHE National Conference on Higher Education, Chicago, Illinois. Archived at: http://www.webct.com/service/ViewContent?contentID=9793069.

Bender, B., 2003. Student-Centered Learning: A Personal Journal. ECAR Research Bulletin. Vol. 2003, Issue 11, May 27, 2003, 12 pp.

Cambridge, D., McGee, P., and Suter, V., 2003. NLII Next Generation Course Management System Focus Session, March 7, 2003, Tucson, Arizona, Meeting Notes Final Draft (4/24/2003). Available online: http://www.educause.edu/asp/doclib/abstract.asp?ID=NLI0343.

Carmean, C., and Haefner, J., 2002. Mind over Matter: Transforming Course Management Systems into Effective Learning Environments. Educause Review, Vol. 37, No. 6, p. 26-34.

Carmean, C., and Haefner, J., 2003. Next-Generation Course Management Systems. Educause Quarterly, Vol. 26, No 1 (2003), p. 10-13. Available online: http://www.educause.edu/ir/library/pdf/eqm0311.pdf.

Crawford, G., Rudy, J. A. and the EDUCAUSE Current Issues Committee, 2003. Fourth Annual EDUCAUSE Survey Identifies Current IT Issues. Educause Quarterly, Vol. 26, No. 2., p. 12-26. Available online: http://www.educause.edu/ir/library/pdf/eqm0322.pdf

Gallagher, S., 2003. The New Landscape for Course Management Systems. ECAR Research Bulletin. Vol. 2003, Issue 11, May 13, 2003, 10 pp.

Katz, R., 2003, Balancing Technology and Tradition: The Example of Course Management Systems. Educause Review, Vol. 38, No. 4, p. 48-59. Available online: http://www.educause.edu/ir/library/pdf/erm0343.pdf.

Twigg, C., 2003. Improving Learning and Reducing Costs: Lessons Learned from Round I of the Pew Grant Program in Course Redesign. Online. Retrieved from http://www.center.rpi.edu/PewGrant/Rd1intro.html, Aug 2, 2003.

Webb, G., 2000. Why Teachers Don't Share Resources, And What We Can Do About It. Retrieved from http://ps.pageseeder.com/ps/jg/papers/teachers/teachers.pshtml
July 31, 2003

Acknowledgements

The authors are grateful to Bob Bender (University of Missouri – Columbia), Scott Leslie (EduTools), and Kimberly Voltero (WebCT), for providing excellent feedback on draft versions of this chapter. Permission to use the table from Bob Bender's article was provided by Richard Katz of ECAR (http://www.educause.edu/ecar/).

Project Management of Your Learning Community

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From the first ideas to the final evaluation, undertaking an innovative project is a complex, challenging business. Initial chaos somehow has to develop into a defined project, and the project has to produce results that answer a given need in a way that others can adapt and emulate.

Initial chaos somehow has to develop into a defined project, and the project has to produce results that answer a given need in a way that others can adapt and emulate.

At the January Learning Institute, Learning Community project teams shared their projects with each other. To document the development of the Learning Communities, to prepare for the Institute, and to help move us all from chaos to replicable ideas, an abbreviated project management framework was provided.

Part One: Creating a Project Charter

Overview

The purpose of a Charter is to define at a high level what the Project Team will deliver, what resources are needed, and why it is justified. The Charter also represents a commitment to dedicate the necessary time and resources to the project. For this reason, the Charter should be shared with all major stakeholders, securing sign-off when appropriate. The document should be brief (up to three pages maximum). It should contain the following sections, some of which will come from your initial grant proposal:

I.The Purpose, Success Factors, and Benefits of the (NAME OF THE) Learning Community *This section describes why your learning community is being initiated, and what you expect the benefits of the outcome to be*

A. Learning Community Purpose

What is the justification for initiating the project (e.g., increase quality, decrease costs, improve access)?

B. Critical Success Factors

How will you know that the learning community is a success?

C. Expected Benefits

Quantify whenever possible, including any return on investment calculations, but also speak to "return on value" in terms of other benefits.

II.The Objectives, Primary Deliverables and Management of the (NAME OF THE) Learning Community

This section clarifies what is expected, what will be delivered during the project, who has control over these outcomes, and who is interested in these outcomes. In determining the scope of your Learning Community (below), identifying what will be specifically "excluded" from the deliverables will help keep the team focused.

A. Primary Objectives

B. Primary Deliverables

D. Management of the Learning Community

E. Stakeholders for the Learning Community

F. Grantor Expectations (in this case, the Ohio Learning Network)

III. Resource and Cost Estimation of the (NAME OF THE) Learning Community

This section should include people, equipment and funding. All of these can be further refined during the project planning process (below).

IV. Stakeholders

Identifies anyone who has a vested interest in the success of the project, so that their expectations can be better understood throughout the project lifecycle.

Project Charter Timeline

Complete the Project Charter prior to beginning work on the project plan.

Project Charter Checklist

☐ Purpose
☐ Assessment Criteria
☐ Benefits
☐ Objectives
☐ Resources
☐ Stakeholders

Part Two: Creating a Project Plan

A project plan should answer the key journalistic questions of "who, what, where, when, how, and how much." This covers the resources (people, facilities, equipment, and materials) that will be needed, and identifies project activities with a schedule that includes an estimate of when each activity will take place, and what resources are required to finish the tasks.

The project plan document is expected to change over time as more information about the project becomes available. Let this help guide your team to accomplish its tasks, but not constrain anyone from making necessary changes. The key is identifying what is necessary and what is beyond the scope of the project. To this end, the plan should document the scope of the project; clearly define the deliverables the project will produce; what resources are needed; the tasks involved and who will accomplish each task; assessment criteria for success; and evaluation of the project.

I. Scope Statement

The scope statement defines the initial range of the project. It will inform future decisions about changes to project activities and deliverables.

A. Scope Description

Describe the project's academic and administrative objectives (with an emphasis on assessment of these objectives) along with the final deliverables of the project, using terms that are easily understood. Include specific target dates when the project will begin (the acceptance of the grant) and formally end (for example, the point at which the Learning Community delivers usable assessment data or the point at which the data will be evaluated).

B. Scope Boundaries

What is included in the Learning Community scope, and specifically what is not included (to avoid later confusion). Identify any known overlap with other projects.

C. Contingency planning (managing risks)

Contingency planning discusses what steps will need to be undertaken if the Learning Community criteria for the final deliverable are not met. This step in the plan encourages the project team to anticipate countermeasures to overcome obstacles and proceed with the project. To write this part of the statement, brainstorm possible problems and possible solutions to those problems. Also describe major risks or constraints associated with the alternate activities, and who on the project team will lead each countermeasure. Addressing the possibilities builds in needed flexibility to your project plan.

D. Project Deliverables Acceptance Criteria

The project deliverables are described in the Project Charter. In this section, the project team should develop acceptance criteria for the final project deliverable, and create a schedule of major interim deliverables with their acceptance criteria. A "review and approve" table with review dates and people conducting the reviews for deliverables will be helpful in tracking the interim deliverables.

II. Work Breakdown Structure

This section shows how the project will be broken down into sub-projects, the deliverables that will be produced for each sub-project, and who is accountable for each sub-project. A good work breakdown schedule will help keep the team clear on the status of each deliverable and articulates the measures used to judge completion. It will have starting and ending dates of activities clearly stated, along with the deliverable of each sub-project.

A. Describe the work breakdown in sufficient detail to manage the small pieces of each activity. Keep focused on the deliverable that the activity is meant to produce.

B. Identify the interdependencies among the work deliverables (the critical path elements that affect other portions of the project, establishing predecessor/successor relationships).

III. Resources

A. Project Team Members.

List the names of individuals (or categories of required staffing) for the project team along with their status as regular or ad hoc members.

B. Project Stakeholders.

List each project stakeholder and their status, including who on the project team will be the primary liaison for each stakeholder.

IV. Schedule and Budget

A. Schedule.

Based on information collected thus far, create a schedule for project staffing effort (based on estimates and/or forecasts) needed to achieve project milestones and deliverables.

B. Budget.

Create a project budget based on the Schedule information and other cost assumptions.

V. Communication Plan

Establish how the Project Team will inform all involved parties on project information, timely updates, and performance reporting. Also, outline how the Project Team will ensure an open, two-way exchange of information, ideas, recommendations and concerns regardless of physical location. Include training for team members as needed.

VI. Change Management

Decide how the project team is going to handle changes to the project. Good project management includes procedures that can be used to approve review and approve any significant changes to the original scope, budget and schedule. This documentation becomes part of the Project Plan for future reference.

Conclusion: Benefits of Project Planning

Definition of the objectives of the project team, and a high-level commitment to these objectives by the team and its stakeholders, help assure successful completion. Additionally, the project plan allows multiple members of the group, as well as those outside the group, to understand what is going on at any given point. It is serves an archival function in helping others duplicate the project.

Make sure there is room for the intuitive aspects of what the learning community is attempting to accomplish. The process is meant to help organize people and things in both informal and formal ways so that the work can get done. Don't let the form get in the way of the substance, but don't let the substance escape without leaving its imprint for others to see.

Adapted in part and with permission from information provided by P-Cubed. See their website at http://www.pcubed.com

Is the Academy Ready for Learning Objects?

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A revised version of this article appeared in the July 2003 Issue of Syllabus magazine (www.syllabus.com).

Introduction

Are the instructional infrastructure and academic culture of higher education ready to deliver and embrace learning objects? The answer is "yes," but not at a level that suggests massive institutional transformation-- yet. The promise remains too tenuous, the risk-reward ratio too high, and the sense of urgency too low for the majority of faculty to change their current practices. Nonetheless, learning objects-- right-sized content that may be re-used, re-contextualized, and re-purposed—bring with them small seeds of change that likely will grow vigorously in the future.

The learning object landscape is more encompassing than the topics highlighted in this brief article-- disciplinary context for knowledge, publisher practices, re-constituted faculty roles, and learner-customized content. The speed and direction of learning objects deployment will be driven by the more inclusive set of players, policies, and protocols discussed at our website (Figure 1).

Disciplinary Context: Learning objects as TRUTH

At the January 2003 Ohio Learning Network conference held at Ohio State University (http://morty.uts.ohio-state.edu/OLN-LearningInstitute/), faculty and staff from six campuses gathered to determine whether they could design learning objects that met their multiple needs. Attendees fell into two camps: enthusiasts or skeptics. Enthusiasts were prepared to de-contextualize learning objects and trade them freely across disciplinary boundaries. Their metaphor for a learning object repository was the dictionary- an organized set of words easily combined and re-combined into multiple, meaningful sentences. Skeptics held that knowledge exists primarily in context and if learning objects are words, they lose meaning when extracted from the cover of the book, the typeface that nuances their presentation, and the community for which the words were intended. Speaking as a skeptic, James Anderson argued that knowledge communities operate from incommensurable assumptions, different political economies, and seek different learning goals (Anderson, 2003). Interdisciplinary enthusiasts countered that knowledge grows as outsiders re-view what has become invisible within a traditional discipline.

The context for learning objects is their juxtaposition with other learning objects. They may well be used within a discipline, but their generative power is in novel combinations rather than disciplinary lineage.

The skeptics defined learning objects as TRUTH, but with this ironic twist- Teaching Resources Used in The Humanities. They posited that "learning objects" was simply a trendy term for reference materials, "repository" a library, "metadata" a catalog record, and "structured sequence" a course syllabus. They concluded that knowledge is the subjective experience of a community of learners, not an object that can be transported from its disciplinary setting.

The enthusiasts used an analogy to George Gilder's (http://www.seas.upenn.edu/~gaj1/wireless.html) account of the rise of cellular telephony- a history he subtitled: When short and weak conquered long and strong. In the late 1940s, AT&T positioned a powerful radio antenna atop the Empire State Building; its 360-degree omni-directional pattern divided into 30-degree sectors. Each "radio channel" carried a single voice and New York City was able to support 12 simultaneous mobile conversations within its population. Today, roughly seven million distinct voices travel over New York's cellular infrastructure. This remarkable increase in efficient and effective "telecosm" use parallels its division into smaller and smaller communication "cells." By connecting small cells along multiple paths, many more conversations are supported.

If we take the "long and strong" parentage of disciplines and organize their structure as learning objects, within lessons, within courses, we are not engaged in reductionism. Rather, we encourage diversity, knowledge organized in multiple ways as the dendrites shorten and synapses increase in number.

Learning objects invite new contexts, extended meaning, discovery, conversations across chasms. The "knowledgecosm" and Gilder's telecosm are of similar character. The context for learning objects is their juxtaposition with other learning objects. They may well be used within a discipline, but their generative power is in novel combinations rather than disciplinary lineage.

Content in context: Publishers fear of starlings

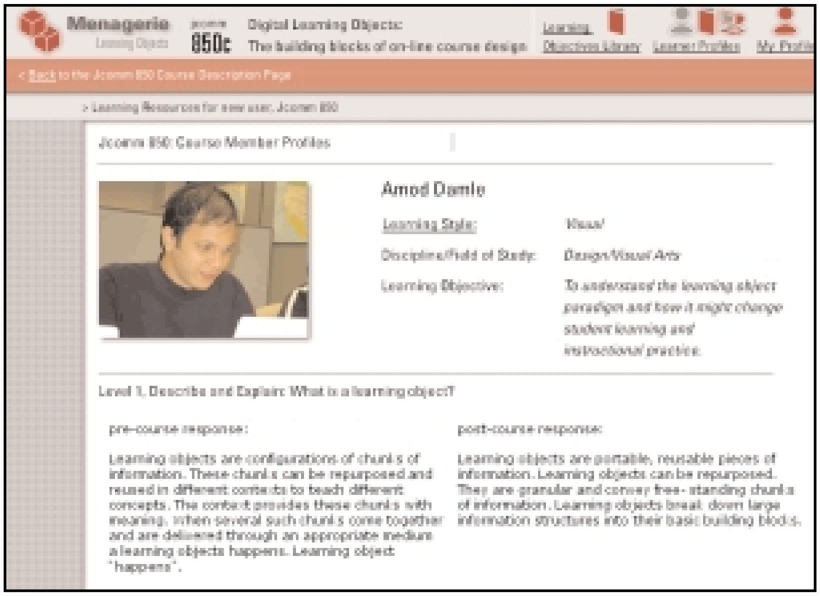
The publishing world also is conflicted about the proper level of aggregation (context) for its intellectual property. A textbook is a self-contained content collection with a privileged sequence of presentation- a classic case of long-and-strong voice. Yet, a textbook is really a portable library of "learning objects," chapter sections, illustrations, and charts described individually and stored digitally. Only later does SGML (standard graphical markup language) pull them into sequence and freeze them in ink on paper. Tradition and lack of economic incentive prevent publishers from unbundling this content for dynamic re-organization by faculty and students.

Publishers see learning objects in both roles- fearing potential disruption of their profit base, and at the same time meta-tagging ever-smaller units of content in their digital repositories for eventual self-displacement.

Rissing, an evolutionary biologist (also responsible for the curriculum presented to 8,500 OSU students per year) recounts this curiously related story: In isolated places like Hawaii, small populations of birds were shaped over evolutionary time to occupy various bird niches. In modern times, exotic species like European Starlings can float in on a boat and more successfully occupy those niches. It's unlikely that the small, indigenous Hawaiian families of birds ever could have evolved to a starling-equivalent; they did not have the genetic variance to exploit optimally the environment's resources. This is an example of the evolutionary biology concept of "multiple adaptive peaks." A globally dominant species, able to adapt better to a new environment, displaces a once dominant local species.

This concept of multiple adaptive peaks applies to publishers. Today's learning content environment organized as 1,000-page, $120 textbooks sustains the publisher, supports the faculty member, and engorges the student. Although the faculty selects the text, students are required to purchase the equivalent of discipline-specific hard copies of The Encyclopedia Britannica, and then only consume a small part of the resource. Rissing estimates that only 27% of his introductory biology text is covered in any one quarter. The many learning objects that make up the text could be combined in multiple subsets, introducing pedagogical variation to flourish in niche course environments.

As a harbinger of starlings on the horizon, a 2002 summer offering of one of Rissing's courses replaced a $105 textbook with "learning objects" selected from XanEdu, Inc.'s digital content library. For $28, each student received a code that unlocked a digital reading pack in three sections- universal course readings, readings specific to students in different groups, and access to a search engine to target course content to individual research topics. The model equates course content with the economic notion of "utils." Each student draws equal utility ($28 worth), but from different subsets of the library. Although each sale returns less revenue, the lower price and greater value encourage more sales of the publisher’s content. One year later, use of digital course packs on the OSU campus has increased by 300%.



Jcomm 850: Course Member Profiles

Amod Damle

Learning Style: Visual

Discipline/Field of Study: Design/Visual Arts

Learning Objective: To understand the learning object paradigm and how it might change student learning and instructional practice.

Level 1, Describe and Explain: What is a learning object?

pre-course response:	post-course response:
Learning objects are configurations of chunks of information. These chunks can be repurposed and reused in different contexts to teach different concepts. The context provides these chunks with meaning. When several such chunks come together and are delivered through an appropriate medium a learning objects happens. Learning object "happens".	Learning objects are portable, reusable pieces of information. Learning objects can be repurposed. They are granular and convey free- standing chunks of information. Learning objects break down large information structures into their basic building blocks.

Figure 1: Amod's learner profile from a graduate course taught by Acker and Bracken (2002).

Many faculty today fear the de-construction of their teaching role into components: knowledge creation, knowledge packaging, knowledge delivery, and student assessment.

Some bird lovers see the starling as a big, black invasive bird; others as a sublime example of the history of natural selection. Publishers see learning objects in both roles- fearing potential disruption of their profit base, and at the same time meta-tagging ever-smaller units of content in their digital repositories for eventual self-displacement. Just as Apple Computer’s TM micro-pricing of songs in its iTunes Music Library™ intermediates a more user-centric value proposition than pre-packaged compact discs, learning objects are better adapted to serve individualized delivery preferences of faculty, focus the attention and fiscal resource of students more successfully than the textbook, and offer rich new ecologies of learning for both. When publishers decipher util-based economics and derive proper pricing formulae, they will sell their content from learning object repositories that maximize value to both the intermediary (faculty) and the end-user (student). The resource-wasteful world of the textbook is subject to predation, or more likely cannibalism.

Re-constituting the faculty role

Webster and Robins (1986) Information Technology: A Luddite Analysis offered this contrarian thesis: Ned Ludd, a weaver who destroyed technology and by so doing became a symbol and namesake of irrational impediment to progress, simply was acting in his self-interest. Looms introduced into the English textile industry of the early 1800s wove more cloth by breaking the holistic efforts of the weaver into mechanically-assisted, smaller, repetitive tasks, gaining efficiency, but to the detriment of the weaver’s work satisfaction.

Many faculty today fear the de-construction of their teaching role into components: knowledge creation, knowledge packaging, knowledge delivery, and student assessment. Stephen Downes (2000) observes: "There is very much a tension between those who create the knowledge and who jealously guard their monopoly over its propagation and distribution, and those who must consume that knowledge to get a job, to build a life, to partake fully in society."

Like Ned Ludd’s reaction, faculty resistance to de-constructing their role into component parts is perfectly rational behavior. The emergence of a "learning objects economy" will change the life of faculty and not favorably for those insisting on a bundled existence. In spite of the social cost, and arguably to the detriment of the individual learner the faculty’s role is more secure with their expertise internalized as subjective wisdom, rather than externalized as "objects of learning."

While most faculty members are comfortable as creators, packagers, and deliverers of their subject matter expertise, some have grown dissatisfied facing diverse learners with a single long and strong "voice," regardless of its eloquence.

Learner-centered content

While most faculty members are comfortable as creators, packagers, and deliverers of their subject matter expertise, some have grown dissatisfied facing diverse learners with a single long and strong "voice," regardless of its eloquence. The notion of teaching and learning connected within a repository of learning objects, with content in multiple modalities, appeals to these faculty. Their new subjective wisdom and source of job security is packaged as skills in finding relevant materials, sequencing them for students, and inventing more targeted assessment strategies that are as much diagnostic as they are evaluative.

Pearl, an Ohio State University Professor of Statistics, leads the Statistical Buffet, an instructional research project supported by the PEW Foundation and the Center for Academic Transformation. The concept is deceptively simple- students consume learning but all have specialized tastes. The role of the curriculum is to provide a wide variety of nutritious choices, and allow the student to put together a palatable meal of concepts and application skills. Pearl’s neo-Luddism philosophy: "The loom is precisely the technology that takes those shiny pieces of yarn and integrates them into a fabric. The Luddites fought against looms that were controlled solely by the mill owner who used them to mass-produce the same sterile fabric over and over. The ‘looms’ of today need to be designed to produce a quality ‘fabric’ under the control of the individual [faculty and student] seeking to achieve their own sense of style."

The Statistical Buffet categorizes students using Felder and Solomon’s (1999) learning styles inventory (active-reflective, visual-verbal, sensing-intuitive, global-sequential) and context preferences (large group lecture, small group problem-solving, on-line individual work) and packages modular course content into equally rigorous, student-selected tracks. The project builds on Norris’ (1995) notion of mass customization- create a prodigious amount of different content/context relationships and allow individuals to maximize their learning by finding the best fit. Learning is not a "main effect" of delivered content, but an interaction effect between different learners and different representations of concepts.

The Autumn 2002 Statistical Buffet delivered the course as three customized tracks and showed an aggregate increase of 3% (.5 letter grade) in student performance on a common midterm and final. Further, more than 90% of the students were enthusiastic about selecting their preferred learning environment. The course re-design also will save approximately $200,000 per year in delivering the course to 3,250 students (Pearl, 2002).

Achieving these results requires tools for identifying student needs and competencies, and faculty willing to mix and match small units of learning content to capitalize on these differences. The Statistical Buffet demonstrates that "one size does not fit all," and that learning efficiency and effectiveness can be achieved with curricula targeted to different student profiles through technology.

One size does not fit all...learning efficiency and effectiveness can be achieved with curricula targeted to different student profiles through technology.

Next steps

This closing screenshot of a graduate course taught by Acker and Bracken (2002) invites the reader to consider additional educational implications of learning objects. Amod’s learner profile indicates a visual learner in the field of design working toward meeting a course objective of understanding learning objects. His profile searches content metatagged by learning objective, learning style, and critical thinking level modified from Bloom (1956): Level 1- describe and explain, Level 2- apply and analyze, and Level 3- evaluate and synthesize. The course goal is for students to achieve critical thinking skills on individually-constructed scaffolds. Several next-generation learning management systems are working to accommodate competency-based and customized learning style content delivery requirements (http://telr-research.osu.edu/learning_objects/LMS).

Norris, Mason, and Lefrere (2003) describe one of many transformations in the learning environment as a move from content silos to interpenetrating content, context, and community. We remain in the early stages of this transformation, but models are emerging to assist faculty wishing to adapt their practices to new learner expectations and technology-supported opportunities.

References

Acker, S. & Bracken, J. (2002). Digital learning objects: The building blocks of online course design (Journalism and Communication 850C, a graduate course offered Autumn quarter, 2002). An archival copy of the course available for public review is available at http://telr-research.osu.edu/learning_objects.

Anderson, J. (Jan. 23, 2003). "The Challenges of Collaborative Knowledge: Character, Communication, Community." Presentation to the Building and sharing assessable content Ohio Learning Network conference.

Bloom, B. (1956). Taxonomy of Educational Objectives, (Ed.). New York: David McKay Company Inc.

Downes, S. (May 23, 2000). Learning objects. Retrieved May 13, 2003, from www.atl.ualberta.ca/downes/naweb/Learning_Objects.htm.

Felder, R. & Soloman, B. (1999). Learning styles and strategies. Retrieved May 13, 2003, from www.ncsu.edu/felder-public/ILSdir/styles.htm.

Gilder, G. (March 29, 1993). The New Rule of the Wireless. Forbes ASAP, March 29, 1993. Retrieved May 13, 2003, from www.seas.upenn.edu/~gaj1/wireless.html.

Norris, D. (1995). Transforming Higher Education: A Vision for Learning in the 21st Century. Ann Arbor, Mich.: Society for College and University Planning.

Norris, D., Mason, J., & Lefrere, P. (2003). Transforming e-Knowledge. Ann Arbor, Mich.: Society for College and University Planning.

Pearl, D. (2002). Center for Academic Transformation Pew Project Interim Report. Retrieved May 17, 2003, from www.center.rpi.edu/PewGrant/RD3%20Award/Ohio.html.

Webster, F., & Robins, K. (1986). Information Technology: A Luddite Analysis. Norwood, N.J.: Ablex Publishing.

XML and XSLT Approaches to Integrating Learning Objects from Multiple Sources

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XML (extensible markup language) offers a flexible, standard syntax and set of descriptive terms to represent characteristics of digital text, sounds, images, and movies. These descriptive “tags” can drive production, archival, and search strategies for libraries, museums, and other repositories. XML Stylesheet Language Transformations (XSLT) interpret underlying core content and present it in different ways to serve different user requirements. Thoughtful pairings of XML-described content and XSLT provide major benefits for production, management, and personalization of large, inter-related educational content collections such as course instructional modules, learning objects, and library resources. Here are our experiments in this arena: http://telr-research.osu.edu/learning_objects/LO_XSLT.htm

In figure 1 we have taken the introduction to the Syllabus article authored by Steve Acker (communication and learning technologies), Dennis Pearl (statistician) and Steve Rissing (biologist). We demonstrate how the same underlying text marked up in XML can be represented to reflect different visual and text treatments. This illustrates how a repository of learning objects could be filtered through different XSLT to better integrate them into courses with different shells, making the multiple searching of the content less jarring for student users. For a more detailed look see the web site address mentioned above.

Figure 1: XSLT Filters Examples: XSLT Stylesheets of the abstract for the Syllabus article for people of different three different academic disciplines(2003).

In the illustrations above (figure 1) notice how the one xml-based content file can change font, color scheme and supporting images based on XSLT Style sheets. The look and feel of each style sheet is customized for each person based on their academic discipline. Each person has a different XSLT filter for their individual discipline. For the biologist there is a green layout with an Ohio State Biology logo, for the statistician there is a gold layout with a department of Statistics logo, and the communications professor uses a purple layout with a TELR learning technologies title. In future development we hope to bring mass customization and personalization to users of learning objects by using XSLT style sheets. More of our XML/XSLT experiments can be found here: http://telr-research.osu.edu/Template/XSLT-tests/XSLT-Templates-Demo.htm

References

Acker, S., Beeth, M., Cantor, S., Curtis, C., Green, C., Hadad, C., Kantor, B., Leach, B., Mauger, Mungell, D., O'Hanlon, N., Pearl, D., Rissing, S., & Santner, T. (2001). Scientific and Information Literacy: A K-20 curriculum. Proposal funded by the Ohio Board of Regents.

Bosak, J. (March 10,1997). XML, Java, and the future of the Web. Retrieved April 29, 2000, from: http://www.ibiblio.org/pub/sun-info/standards/xml/why/xmlapps.html.

Bosak, J. (October, 1998). Media-independent publishing: Four myths about XML. IEEE Computerworld 31, 10, 120-122. Retrieved April 29, 2003, from: http://www.ibiblio.org/pub/sun-info/standards/xml/why/4myths.htm.

Center for Adaptive Technologies (CAST) (2003). Universal design for learning. Retrieved April 29, 2003, from: http://www.cast.org/udl/.

Cover Pages (2003). Online resource for markup language technologies. Retrieved April 29, 2003, from: http://xml.coverpages.org.

Fleming, N. (2001). VARK: A guide to learning styles. Retrieved April 30, 2003, from: http://www.vark-learn.com/english/index.asp.

Goldfarb, C. (October 15, 2002). The SGML History Niche. Retrieved April 29, 2003, from: http://www.sgmlsource.com/history/index.htm.

Greenspan, J. (February 18, 2000). Understanding XSLT. Retrieved April 29, 2003, from: http://hotwired.lycos.com/webmonkey/98/43/index2a.html.

Greenspan, J. (October 13, 1998). Introduction to XML. Retrieved April 29, 2003, from: http://hotwired.lycos.com/webmonkey/98/41/index1a.html?tw=authoring.

IMS Global Learning (2003). Public preview of accessibility specification. Retrieved April 30, 2003, from: http://www.imsglobal.org/accessibility/.

Izzo, M., Murray, A., & Acker, S. (2002). Improving the Quality of Education for Students with Disabilities: A Multi-State Collaborative Network of Colleges and Universities. Sponsor: Office of Postsecondary Education, U.S. Department of Education.

Rose & Meyer, A. (2002). Teaching Every Student in the Digital Age: Universal Design for Learning. Association of Supervision and Curriculum Development.

The Ohio State University's Knowledge Bank Project (2003). Retrieved April 29, 2003, from: http://www.lib.ohio-state.edu/KBinfo/.

W3C, (2001). W3C Architecture domain Extensible Markup Language (XML). Retrieved April 29, 2003, from: http://www.w3.org/XML/.

W3C, (January 16, 2003). W3C Extensible Stylesheet Language (XSL) Version 1.0 (October 15, 2001). Retrieved April 29, 2003, from: http://www.w3.org/TR/xsl/.

Learning Styles and Learning Objects

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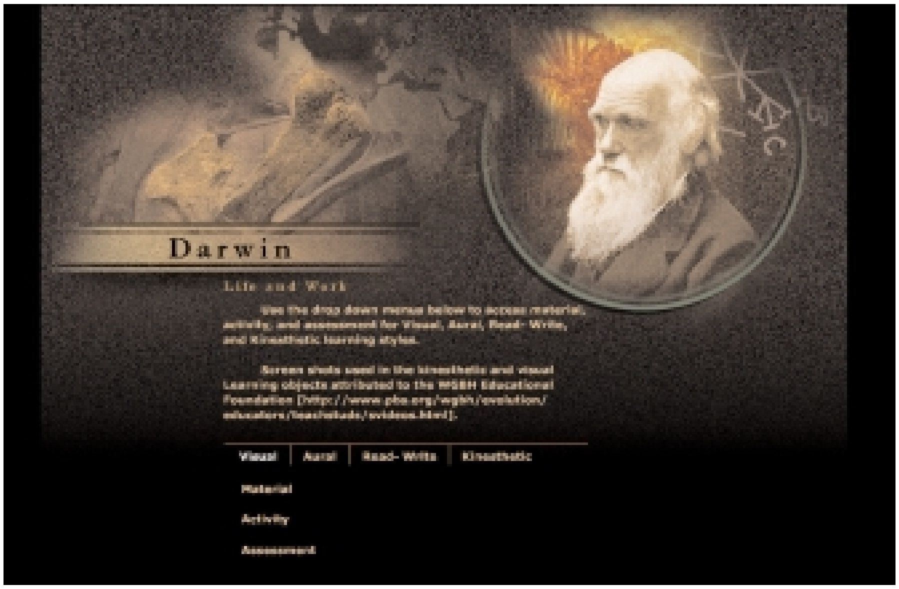
Learning styles have received a good deal of attention recently. Learning styles represent tendencies and general preferences, and different contexts often invoke different preferences. Nonetheless, learning styles offer a useful heuristic and suggest to content designers that presenting ideas, concepts, and information in a variety of modalities will likely benefit more learners than relying on a single presentation form. Visit our work on learning styles here: http://telr-research.osu.edu/learning_objects/LearningStyles.htm



Use the drop down menus below to access material, activity, and assessment for Visual, Aural, Read- Write, and Kinesthetic learning styles.

Screen shots used in the kinesthetic and visual Learning objects attributed to the WGBH Educational Foundation [http://www.pbs.org/wgbh/evolution/educators/teachstuds/svideos.html].

A graduate course in learning objects: A project of iterative design

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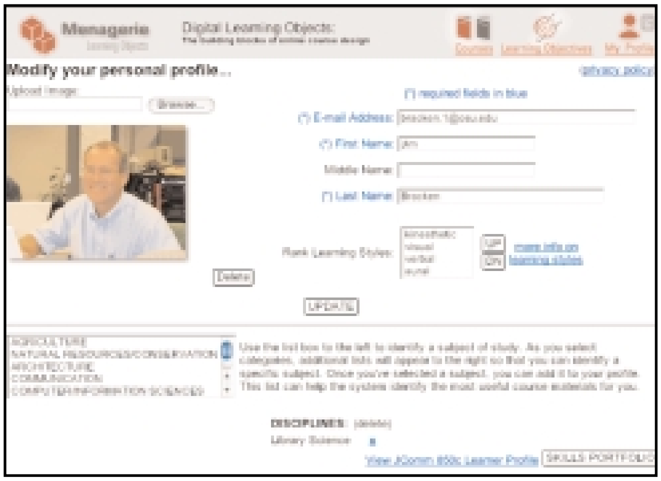
In the autumn of 2002, Jim Bracken and Steve Acker offered a graduate course on learning objects. The premise of the course was that students would build learning objects emulating a model provided by the instructors. Each student group created content within a format developed in the class. The learning outcomes from the course were significant, but like many first attempts created controversy. "Content as king," project management in the face of ambiguity, and the best ways for faculty and instructional designers to work together were paramount in the discussions. Visit this URL to review the course: http://telr-research.osu.edu/Template/jcomm850c-info/jcomm850c-info4.htm.



Modify your personal profile...

(*) required fields in blue

(*) E-mail Address: bracken.1@osu.edu

(*) First Name: Jim

Middle Name:

(*) Last Name: Bracken

Rank Learning Styles:

DISCIPLINES: (delete)

Library Science

Figure 1: Jim Bracken's learner profile from a graduate course taught by Acker and Bracken (2002)

A graduate course in learning objects: Visualizing knowledge in new educational environments

Susan Metros
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In Spring 2003, Susan Metros, Deputy CIO and Professor of Design Technology offered a follow-up course on learning objects. The objective of the course was to immerse visual design students and education students in a new model for active learning that uses the inherent capabilities of technology to support the design, development, and delivery of learning objects. The students worked on a client-initiated project for the Nisonger Center at Ohio State. The Center had received a two-year grant to develop digital learning objects for high school students with disabilities. The students in the learning objects course worked in teams, serving as consultants to each other, to design prototype solutions using universal design guidelines for learning. The course was a blended course meeting face-to-face once a week in a wireless classroom and online, using the university's course management system.

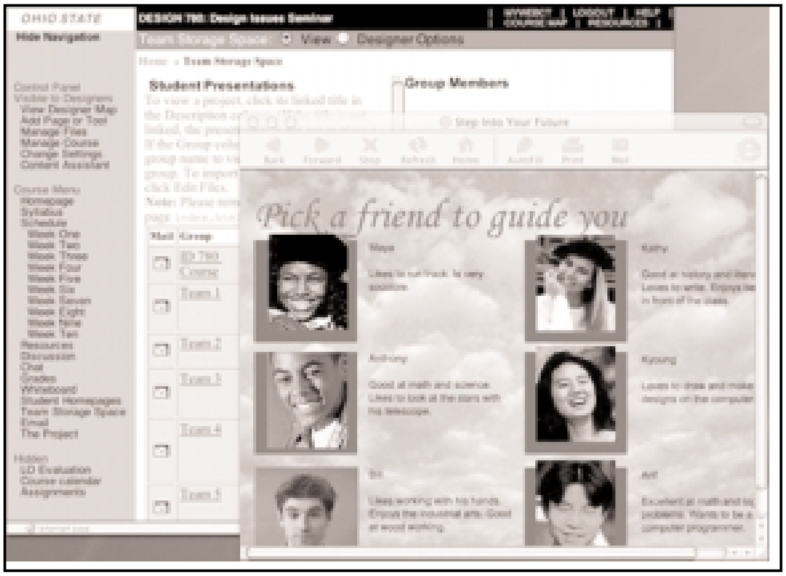

Figure 1: Students' learning object prototype solution accessed from the student presentation section of the course site.

Additional Reading on Learning Objects

Academic Advanced Distributed Learning Co-Laboratory. Retrieved August 20, 2003, from: http://www.wiadlcolab.org/resources/learning_objects.html

American Association for the Advancement of Science. (2001). Atlas for Science Literacy. New York: Oxford University Press. [on-line] Retrieved August 20, 2003, from: http://www.project2061.org/tools/atlas/default.htm

American Association for the Advancement of Science. (1993). Benchmarks for science literacy. New York: Oxford University Press. [on-line] Retrieved August 20, 2003, from: http://www.project2061.org/tools/benchol/bolframe.htm

Association of College and Research Libraries Information Literacy Competency Standards for Higher Education Retrieved August 20, 2003, from: http://www.ala.org/acrl/ilcomstan.html.

Barron, T. (2000). Standards: The vision and the hype. ASTD Learning Circuits, November 2000. Retrieved August 20, 2003, from: http://www.learningcircuits.org/nov2000/standards.html

Bloom, B.S., M.D. Englehart, E.J. Furst, W.H. Hill, and R. Kathwohl. (1956). Taxonomy of Education Objectives Book 1: Cognitive Domain. New York: David McKay Company, Inc.

Computer Education Management Association (2001). Learning Architecture Learning Objects Overview. Retrieved August 20, 2003, from: http://learnativity.com/lalo.html

Downes, S. (2000). Learning objects. Retrieved August 20, 2003, from: http://www.atl.ualberta.ca/downes/naweb/Learning_Objects.htm

Eisenhower National Clearinghouse. Retrieved August 20, 2003, from: http://www.enc.org/

Fletcher, J. D., & Dodds, P. (May, 2000). All about ADL. ASTD Learning Circuits. Retrieved August 20, 2003, from: http://www.learningcircuits.org/may2000/fletcher.html

IMS Meta-Data Best Practice and Implementation Guide, Final Specification, Version 1.1. (June, 2000). IMS Global Learning Consortium, Inc. Retrieved August 21, 2000, from: http://www.imsproject.org/metadata/index.html

Mealy, M., & Reeser, S. (2000). <XML> Your Course Here</XML>: The implications of extensible markup language for course development and design. In Proceedings of the 16th Annual Conference on Distance Teaching and Learning, August 2-4, 2000. Madison, WI: University of Wisconsin System, 277-282.

Merlot Project. Retrieved August 20, 2003, from: http://www.merlot.org/Home.po

Muzio, J.; Heins, T.; & Mundell, R. Experiences with reusable E-learning objects: From theory to practice. The Internet and Higher Education Volume: 5, Issue: 1, 1st quarter, 2002 (pp. 21-34). Retrieved August 20, 2003, from: http://journals.ohiolink.edu/cgi-bin/sciserv.pl?collection=journals&journal=10967516&issue=v05i0001

National Research Council. (1996). National Science Education Standards. Washington, DC: National Academy Press. [on-line] Retrieved August 20, 2003, from: http://books.nap.edu/books/0309053269/html/R1.html#pagetop

Nielsen, J. (2000). Designing Web Usability: The Practice of Simplicity. Indianapolis: New Riders Publishing.

O'Hanlon, N. NetTUTOR: Your personal guide to understanding the Net. Retrieved August 20, 2003, from: http://gateway.lib.ohio-state.edu/tutor/.

Pearl, D., Acker, S., Escovitz, A., Kalish, A, Rumsey, D., Woodward, R. (2001). The Statistical Concepts Buffet: A Proposal from The Ohio State University to the Pew Grant Program In Course Re-design (funded 6/15/01).

Pew Grant Program in Course Re-design Project Planning Tool. Retrieved August 20, 2003, from: http://www.center.rpi.edu/PewGrant/Tool.html.

Quinn, C. & Hobbs, S. (2000). Learning objects and instructional components. Educational Technology and Society, 3(2). Retrieved September 10, 2001, from: http://ifets.ieee.org/periodical/vol_2_2000/discuss_summary_0200.html

Robson, R. (May 1, 2002). Metadata, Schmetadata: Why do I have to know about this? eLearning Magazine. Retrieved August 20, 2003, from: http://www.ltimagazine.com/ltimagazine/article/articleDetail.jsp?id=18574

Schatz, S. (2000). Paradigm shifts and challenges for instructional designers: An introduction to meta tags and knowledge bits. Retrieved August 20, 2003, from: http://www.usq.edu.au/electpub/e-jist/docs/old/vol4no1/2001docs/pdf/mcpherson.pdf

SMETE Digital Library. Retrieved August 20, 2003, from: http://smete.org/

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