Infusing Curricula with Adaptable Learning Objects
To Improve Student Engagement and Learning

Abstract

In this project, we will build on and extend the concept successfully demonstrated in the MELO (Michigan Education through Learning Objects) project, which was funded by LSA-ITC under the title "Enhancing Undergraduate Education Through the Deployment of Good Learning Objects". MELO is a cross-disciplinary project that worked over the past two years to facilitate the integration of curriculum-based sequences of online learning objects (LOs) that complement classroom pedagogy in large enrollment gateway courses to enhance student learning, engagement, and persistence in college. The project took a unique approach to overcoming barriers to technology-enriched instruction by involving students (undergraduate and graduate) in addition to select faculty and staff from across different disciplines as the key collaborators. By training select students and faculty to find, evaluate, adapt, create, and integrate LOs, the project facilitated the incorporation of high quality interdisciplinary and discipline-specific LOs into the curricula.

With funding of the proposed new project we will:

1) Scale the project training process to identify, adapt, and incorporate LOs into course sequences to additional instructors and curricula at UM.
2) Address the issue of sustainability of LO integration in the MELO gateway courses where LOs have already been incorporated.
3) Develop robust learner analytics to assess the effectiveness of LO integration in promoting deeper learning, engagement, and achievement of course goals and objectives.

What is a Learning Object (LO)?

LOs are interactive web resources designed to support a learning objective and include such things as animations, simulations, tutorials, case studies and games. In this project, we work primarily with openly licensed and adaptable LOs, including those created by graduate students and instructors at UM as well as those freely available on the web and through MERLOT (Multimedia Educational Resource for Learning and Online Teaching, www.merlot.org). A distinctive aspect of MERLOT is that their LOs have been triaged and peer reviewed by a nationwide community of scholars committed to enhancing education through this method of curricula resource development.

Research into the efficacy of online learning objects has demonstrated that, by offering students a sense of control and ownership of the learning process, students' educational achievement improves, compared to a control group (Windle, McCormick, Dandrea, & Wharrad, 2010). Other research suggests that educational strategies that improve understanding and provide learning feedback have a positive impact on student retention (Hershock & O'Neal, 2008; O'Neal et al., 2007; Seymour & Hewitt, 1997).

LOs can be used to enhance student engagement and understanding by offering interactive instruction and peer-to-peer learning that extends beyond the classroom. LOs can develop or reinforce important relationships and/or concepts, model dynamic relations in a way that print or other static demonstrations cannot. LOs can provide students with immediate feedback, and encourage them to apply their understanding to

new situations. The application of LOs to deepen learning and engagement depends upon their thoughtful integration into curricula and on the technological awareness and pedagogical skills of faculty. The efforts of our project are therefore targeted at helping instructors identify, adapt, and integrate quality LOs into their own curricula to impact student engagement, retention, and persistence.

Lessons Learned From the MELO Project

The MELO project officially spanned two years, although work on some of the projects has continued beyond the grant period. The first year of MELO involved 3 faculty and 8 Graduate Student Instructors (GSIs) connected with courses in Chemistry, Psychology, and Statistics, where over 8000 undergraduates benefited from the inclusion of LOs. In the 2nd year, we included 4 more disciplines: Math, Physics, Spanish and Writing. Four new faculty mentors and an additional 17 GSIs were trained, with a minimum of 150 GSIs being impacted directly and indirectly. With chain-reaction adoption in untargeted courses, an estimated 14,000 students were impacted. An "Innovative Use of MERLOT Award" and a "MERLOT Institutional Stewardship Award" honored our work in identifying, adapting, and incorporating LOs.

Many useful resources exist, but all must be adapted in some way to become a strong match to UM curricula.

> Many LOs are well constructed but may not be appropriate to be integrated into curricula, for example, because of differences between LO and course terminology, lack of clear directives or lack of an assignment. The latter problems often are a major reason why potential users of LOs choose not to integrate them into curricula. Thus, potential users may simply reject the notion of incorporating LOs into curricula because nothing available online appears suitable for course integration.
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> We determined that many such "imperfect" LOs were excellent candidates for curricula integration when properly adapted to the curriculum needs by means of a "pedagogical wrapper" that provides directives for the use of the LO or an assignment or other adaptation. The wrapper might take the form of a guided "Jing" movie, for example, to provide directives for the use of the LO, an assignment or some other adaptation. We therefore conclude that if the new proposal is funded we must include training in adapting LOs by means of a wrapper. The reference in our proposal title to "Adaptable Learning Objects" refers to this idea of wrapping the LO to make it suitable for course inclusion.

It is important to select OER (Open Educational Resources) for adaption and to acquaint project participants on the desirability of working with openly licensed learning materials.

> The MELO project training process did not include discussion of OERs. The subsequent adaptation of LOs and unexpected authoring of new LOs by project students clarified the need to address the subject of OERs. We might point out that one of the graduate student participants from chemistry was nominated for a classic award for her creation of physical chemistry LOs using Wolfram

Mathematica and thus the project is not only a great training foundation for future faculty but was the source of newly authored LOs. The creation of openly licensed supplementary curricula support materials using LOs for common key concepts benefits UM students and the study of the discipline by students elsewhere.

Familiarity with the MERLOT criteria and training in the LO process requires time, and needs to occur during the Spring/Summer semester rather than Fall and Winter terms which are better suited for integration and evaluation.

During the initial year, integration of LOs into curricula did not start for most disciplines until winter (rather than fall) semester because participants did not have sufficient time for training in the process prior to Fall semester to formulate LO integration plans. Students and instructors from disciplines associated with the project for two years were able to create LO collections and integrate and adapt LOs for use within the curricula. Disciplines associated with the project for only one year had limited accomplishments compared to those associated with the project for two years.

MELO participants agree that the interdisciplinary nature of the project was one of its most valuable and exciting aspects.

Working in a cross-disciplinary setting of students, staff, and faculty allowed for a rich-learning environment due to the exchange of different knowledge and ideas. Evidence of the positive nature of interdisciplinary collaboration is the creation of a Calculus LO, “How to Write Up Math Homework,” that combined the disciplines of writing and math. It also included the design and creation of a writing LO that used concept mapping as a vehicle for analyzing writing.

The potential for interdisciplinary collaboration was shown in the creation of a preliminary cross-disciplinary collection of LOs that addressed the common cross-discipline needs of students entering gateway courses. The preliminary collection was created by the three disciplines involved in the project for two years to address students’ common needs and skills and included resources such as “Writing a Research Paper” and “The Equation of a Straight Line”. Unfortunately, for those disciplines involved in the project for only one year there was insufficient time to contribute to this facet of the project.

During initial project planning we addressed scalability and adoption to new curricula, but found it is also necessary to address the sustainability of existing projects.

Projects from the initial grant are in a different time frame of development, including growth and revision. We continue to work on projects remaining from the initial grant: Psychology was in the process of creating a collection of video case studies for course inclusion when graduate students working on the project completed their degrees. Statistics is in the process of creating scenarios and “tweaking” LO wrapped pre-labs. Chemistry has a collection of over 100 LOs identified by students that are appropriate for course infusion that need to be categorized. The maturity of these projects offers a greater potential for

completing the new project goals including the collection of learning impact data and the provision of pedagogical models for knowledge transfer.

A variety of evidence supports our contention that the integration of LOs into curricula has the potential to improve student learning and engagement.

In Introductory Physics, for example, instructors using LOs reported, "more enthusiasm, better learning, and better understanding" for their students. Deeper engagement in learning is evidenced by students in Chemistry 125/126, who submitted over 100 LOs with reviews and recommendations for course implementation. In addition, the overwhelming response of the students to the challenge to conduct a "Scavenger Hunt for LOs" highlighted the student excitement associated with LOs. It also illustrates the potential for using students to facilitate the shaping of the curriculum via their suggestions with regard to integration of technology and LOs into the course.

In Statistics 350, not only did average grades increase after the implementation of LOs in the Fall 2008, but also students commented that, of the pre-labs they did, "the applet-based ones were the most useful." Indeed, 90% of students in the course agreed that SPSS pre-labs provided enough detail to complete assignments and 65% agreed that they liked the opportunity LOs provided to learn SPSS at their own pace.

With LSA/ITC funding of our new proposal, we would focus on the collection of more rigorous data that shows the efficacy of LOs in enhancing deeper learning and engagement, retention, and persistence for targeted students. This goal is reflected in the reference in our title to "Improve Student Engagement and Learning".

Strong evidence supports our contention that travel support to the MERLOT International Conference for project participants facilitates the accomplishment of project goals and project visibility.

Participants' enthusiasm and willingness to invest in the MELO project related directly to the experiences, knowledge, and bonding that resulted from attendance at the MERLOT/Sloan C International Conference. It was during the 2008 MIC that participants learned about the tools that were used to adapt learning objects to meet specific curricula needs. New technology tools are shared at every conference that allowed us to more quickly move forward with our goal of integrating LOs into curricula. Our 2008 MELO presentations would lead to the UM receiving a MERLOT Institutional Stewardship Award. During the 2009 MIC one graduate student presented her created LOs. That presentation specifically led to her offer of a position with Wolfram Mathematica. All of our different presentations over the two years of the MELO project led to the honor of receiving the "Innovative Use of MERLOT" award.

Proposed Project

With the proof of concept in hand, we plan now to scale our model to using students, both graduate and undergraduate, to help integrate LOs into additional curricula at UM. The goal will be to infuse LOs into several new curricula over a two-year period to

ensure sufficient time for training, LO adaptation and integration, input to the inter-disciplinary collection, and collection of student engagement and learning impact data.

New potential curricula being explored for project inclusion include organic chemistry, education, biology, languages, and economics. In addition to scaling our model for adoption to new curricula, we propose to explore models of sustainable LO integration. In the MELO project we showed that we could integrate LOs into courses to good effect. In the new project we will explore how to make infusion of LOs into curricula a self-sustaining process. We would begin the exploration of question of sustainability with the MELO core projects (psychology, statistics, general chemistry, and writing). At the same time, the MELO participants would serve as a source of models and ideas for the new project participants.

During the MELO project, impact was primarily observational and qualitative. In a gatekeeper statistics course, where video- wrapped LOs were first used for pre-labs in Fall 2008, the average course grade increased by 10%. Course GSIs reported that students who had done the pre-labs were "curious why they observed the results they did and wanted to ask questions and better understand." With more sophisticated learner analytics, we could demonstrate further efficacy.

In the new project we propose to develop robust learner analytics to assess the effectiveness of LO integration in promoting deeper learning and engagement and achievement of course goals and objectives. These analytic models will utilize numerous data sources including CTools, student performance records, admissions databases, and student and instructor surveys. Overall, these learner analytic models will help us evaluate the effectiveness of LO integration as well as assess their impact on student retention and persistence metrics that, over time, can be developed into predictive models of behavior and related success (Campbell, DeBlois, & Oblinger, 2007). The USE Lab and CRLT will assist us in achieving such goals.

Project Details

Below is a Table showing the general training activities for new graduate students. It is expected that participants from MELO core project disciplines (psychology, statistics, general chemistry, and writing) would include primarily new graduate students since many of the MELO graduate students have graduated.

Table: New Graduate Student Training Workshops and Development Activities

Activity	Hours	Academic Schedule
Edit workshop content for graduate students		Spring
Discipline-specific training workshops	10	Spring
Discipline-specific reviews of MERLOT LOs	20	Spring
Cross-disciplinary training workshops	10	Spring
General Principles of Adapting LOs and OER	20	Spring /Summer
Creation of discipline and cross-discipline collections	40	Spring /Summer
Monthly cross-discipline meetings and follow up	10	Fall /Winter
LO adaptation and integration		Fall/Winter
Total hours per new graduate-student participant	**150**	

During training we will continue to feature MERLOT (Multimedia Educational Resource for Learning and Online Teaching) (http://www.merlot.org). The MERLOT resources including Grape Camp proved especially useful. Participants especially enjoyed the

participation in nationwide teleconferences with “reviewers-in-training” from across multi-disciplines. Grape Camp trains participants how to find and evaluate and review LOs for effectiveness as learning and teaching resource. In addition, a MERLOT editorial board member with expertise in the evaluation and use of LOs within curricula will be available to our training participants.

Face-to-face LO training seminars for new participants would be based on some materials already created by the MELO team during the MELO project. New materials developed to emulate lessons learned from the MELO project, will enable scaling to additional instructors and curricula at UM. Training in the past included finding and choosing exemplary LOs but now will also include training on adapting learning objects and OER. Emily Puckett Rodgers will serve as the OER training resource. The creation of openly licensed supplementary curricula support materials using LOs for common key concepts will allow students needing extra help to benefit from LOs.

Proposed Project faculty and staff co-PIs for the new proposal were associated with the MELO project and have expertise in finding, evaluating, and adapting LOs for course integration. Trainees will attend a workshop during Enriching Scholarship offered by Lynne Crandall, Nancy Kerner, and Brenda Gunderson:

> **Integration (and Creation) of Online Learning Resources: Why and How?**
> There is a great deal of useful content available online, but how does one select, augment and integrate these resources for use in a course? This session is a combination demonstration and hands-on workshop and will feature examples of how online resources were integrated effectively into courses at UM. We will use the MERLOT framework to introduce participants to creating collections of learning objects, making collections student accessible, creating assignments, and customizing resources using "wrappers" created with Jing. The new MERLOT sponsored authoring tool "content builder" will also be included.

We will explore various ideas related to project sustainability. MELO core disciplines will explore the inclusion of LO integration training into regular GSI training. Writing will consider distributing LOs on the Sweetland resources webpage. In addition, Writing would like to form a research group of instructors to evaluate what kind of LOs make a difference in student writing. The undergraduates in a science teaching methods course will examine and evaluate LOs as an assignment for determining learning effectiveness. Creation of enhanced data regarding LO impact on student engagement and learning should increase the likelihood of project sustainability.

The new project will address the ways to make project outcomes more visible and available to students and instructors across gateway courses. This dissemination focus will enhance the scalability of the project and adoption by new disciplines and instructors. For example, if many potential LO users understood that imperfect LOs can easily be adapted, we would likely observe more LO enhanced curricula. Steven Lonn will assist the project by enhancing the visibility, accessibility, and adoption of project findings and results. Facilitated by Emily Puckett Rodgers, the OER project will create a page on the open.umich.edu site that links to all openly licensed U-M LOs. OER support staff will provide training, audit, and publication support for LOs produced in partnership with them.

Appendix

Select diverse faculty and staff from the MELO project who also are members of the UM-MERLOT Community of Practice will serve as project leads and coordinate the project activities:

Brenda Gunderson is a Senior Lecturer in the Department of Statistics. She teaches and coordinates the largest undergraduate statistics course: Statistics 350, serving approximately 2600 undergraduate students each year, as well as oversees mentorship activities for all Statistics GSIs. bkg@umich.edu

Nancy Konigsberg Kerner is a Lecturer IV in the Department of Chemistry. She teaches and coordinates the introductory chemistry course: chemistry 125/126, serving approximately 2100 undergraduate students each year, as well as serves as faculty mentor for the training of the GSIs in Chemistry nkerner@umich.edu

Other Personnel

Brian Malley is a Lecturer III in the Department of Psychology. He primarily teaches Introductory Psychology 111, serving approximately 1000 students each year. Brian will be a faculty participant in the project. bmalley@umich.edu

Instructional Consultant with the LSA Instructional Support Services to be determined.

Victor Wong is Senior Strategist, Office of the Vice-Provost for Strategy, will serve as an advisor to the project. vkw@umich.edu

Steve Lonn is a Research Fellow in the USE Lab in the Digital Media Commons and a member of the UM-MERLOT community. Steven's current research examines how learning management systems are used within higher education and will serve as a resource for developing learning analytics models utilizing information from CTools and the student records and admissions databases. slonn@umich.edu

Charles Dershimer is a Clinical Professor of Educational Studies in the School of Education. Undergraduate students from his science teaching methods course will be involved in the project as well as masters levels students in the Woodrow Wilson Teaching Fellows Program. dersh@umich.edu

Emily Puckett Rodgers is a member of the UM-MERLOT Community with expertise in OER and will serve as a training resource and general resource for participants relative to understanding and integrating practices of OER into this project, epuckett@umich.edu

Christine Ann Modey is a Lecturer II in English, Sweetland Writing Center and will be a faculty participant in the project. cmodey@umich.edu

Associated Activities

General Principles of Adapting LOs and OER

These workshops will address learning content production, helping participants acquire new pedagogical and ICT skills in order to use, create, adapt, and share openly licensed LOs.

Primary facilitator: Emily Puckett Rodgers, 4-8 hours for preparation and implementation.

Audit of LOs to ensure adherence to open licensing standards

Audits can be conducted by trained participants or by Open.Michigan Publishing Assistants, hired for this specific project. Audit training (based on the dScribe model, http://open.umich.edu/dScribe) can be incorporated into this training session or a separate session.

Primary facilitator: Emily Puckett Rodgers, 2-4 hours for preparation and implementation.

Open.Michigan staff investment

Open Education Coordinator (Emily Puckett Rodgers) = 28-30 hours, ~$26 per hour
Auditing by Open Education Specialist or Publishing Assistant = (2 hours / file*)
at (~$15 / hr)

*Open.Michigan unit of comparison: presentation slide decks (containing ~15 slide decks or files with 20-75 slides per lecture).

BUDGET 2011-2013

PROJECT TITLE: Infusing Curricula with Adaptable Learning Objects To Improve Student Engagement and Learning

	Year One	Year Two
Project Leadership		
Stipend for Spring/Summer Workshop Training, Development and Project Coordination @20 hours each Gunderson and Kerner	4000	
Stipend for Project Coordination @10 hours each Gunderson and Kerner		2000
Fringe Benefit @35%	1400	700
Faculty Developers		
7 Disciplinary Faculty Developers @ $2500 each	17500	17500
Fringe Benefit for 7 faculty at 35%	6125	6125
14 Graduate Student Developers (2@per faculty project)		
14 graduate student developers @ $17/hour @ 60 hours	14280	0
$17/hour @ 100 hours/project	11900	11900
Fringe Benefit for 14 graduate students @ 8%	2094.4	952
Total Stipend, Salary and Fringe	*$53299.4*	*$39177*
OER Coordination and Training		
Emily Puckett Rodgers (OER Coordinator effort) 30 hours @ $26/hour	780	
Fringe benefit 35%	273	
OER Specialist for auditing 1 reviewed LO per discipline @ 7 disciples, 10 hours each @ $15.hour	1050	
Fringe benefit 35%	367.5	
Total OER participation cost	*$2470.5*	*0*
Evaluation Assistance		
CRLT evaluation instrument development	*$1500*	*$1500*
Supplies		
Poster Materials: 14 posters @ $50 each	*$700*	*0*
Travel		
Conference attendance at MERLOT Sloan C for 3 graduate students each year at $1500 each	$4,500	$4,500
Subtotal	**$62,470**	**$45,177**
Funds remaining from MELO grant	-21,000	
Total Requested	**$41,470**	**$45,177**