

Mathematics Teaching-Research Journal On-Line

A peer-reviewed scholarly journal

Editors: Bronislaw Czarnocha (Hostos Community College)

Vrunda Prabhu (Bronx Community College)

Anne Rothstein (Lehman College)

City University of New York

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IPARK: Integrating Practice-based and Research-based Knowledge into Learning Resource Repositories

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Learning resource repositories are of growing importance in linking together the stages of knowledge production and improvement of practice in undergraduate STEM education. New educational materials are now frequently made available through repositories for reuse and adaptation by faculty, with networks of repositories of varying scopes appearing at the national, regional, state, and discipline levels. However, learning resources can only be effective when faculty have the motivation, time and expertise to incorporate them into effective learning designs that meet the needs of their students.

Recent studies of use and users of digital resource repositories have identified several clear needs including the following:

- *Reusing resources in new contexts*: “Faculty, including those active and enthusiastic in their use of digital resources, identified many obstacles to using these resources for teaching, including how to...reuse them in new contexts”¹. For example, a recent NSF-funded project in Physics demonstrated the need to rethink instructional designs when resources from a research-intensive institution are reused in the differing context of a four year institution².
- *Time and expertise to adapt teaching practices*: for example, a study of Geoscience faculty noted that “While many faculty have a general knowledge of teaching methods, they are most interested in the application of these methods to the specific topics they teach, and they prefer to learn about teaching methods within such a context... This required a design...that would capitalize on faculty use of the web to find materials for class as a mechanism for bringing them into contact with materials that could be used later to support their redesign of a course³.”

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The concept of “learning object” repositories reflects the view that resources targeting a single learning activity will be easier to reuse in multiple contexts than resources bundled together into a course level package. However, successful reuse still requires that faculty design appropriate learning activities for student learning, including effective tasks, roles, feedback, etc.

Of course, a deeper understanding of student learning is a key element in adapting learning resources and teaching practices. While much of the pedagogical content knowledge incorporated in repositories reflects the practical know-how of exemplary teachers, there are few links to the growing body of research knowledge about learning and teaching. Our new approaches will integrate research-based knowledge with the exemplary practice of teachers.

Teaching strategies for the effective use of the resources are currently being shared and extended through evolving repository elements for pedagogical content knowledge. MERLOT has been a leader in integrating teaching expertise and exemplary resources in its repository⁴, including the following formats for contributions of knowledge and experiences on teaching and learning:

- *Authors' Snapshots* to document teaching strategies from the resource originator⁵;
- *Peer Reviews* for expert assessments of the effectiveness and roles of the resource⁶;
- *Assignments* for contributions of teaching expertise from faculty⁷;
- *Comments* for contributions of experiences from teachers and students.

Other repositories are also extending their formats for pedagogical knowledge, including representations for generic learning designs via *Activity Sheets* in the Teach the Earth portal⁸, community expertise through *Expert Voices* in next generation prototypes of the National Science Digital Library⁹, and student *Skills, Misconceptions* and *Assessments* in pilot studies for extensions of the Digital Library of Earth Science Education¹⁰. The impact of the pedagogical knowledge represented to date has been promising, e.g., the *Activity Sheets* facility is being reused across multiple repositories, including MERLOT, in a current NSF-funded project *Pedagogical Services for Digital Libraries*.

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These existing initiatives do not directly address the need to tailor learning designs to suit specific learning contexts, nor do they provide a link to research results and community scholarship. As outlined in the previous section, these are key elements in developing faculty expertise for more effective learning designs. In the IPARK project, we plan to address these needs by developing, evaluating, refining and disseminating the following innovations for pedagogical content knowledge associated with exemplary learning resources in our repositories:

In our planned work in the IPARK project, we will develop several kinds of resources to accelerate the dissemination and implementation of important new faculty-developed teaching strategies and learning resources, including the following:

1. *Analytic Reviews*: an extension to existing Peer Reviews of learning resources, to provide a digest of research on learning issues associated with the resource and related teaching strategies [e.g., challenges students encounter with the topic, misconceptions that have been shown to impede their learning, etc.]
2. *Community Teaching Portfolios*: An evolving collection of faculty experience reports about how they adapted that resource for use in a variety of specific settings (different courses, different types of students, different faculty teaching strategies);
3. *Guides to Best Evidence*: A summary, written for faculty, of evidence relevant to the use of the learning resources and appropriate teaching strategies; the summary will be designed to help faculty decide how to adapt their teaching strategies to engage students with the subject matter content through the resource, and highlight particular experience reports from other teachers which demonstrate effective approaches for their context;

You can see prototypes of each innovation at the project wiki, <http://castl.merlot.org>. The IPARK project is an outgrowth of a collaboration amongst MERLOT institutions within the *Institutional Leadership Program* for the Carnegie Foundation's Academy for the Scholarship of Teaching and Learning¹¹. The IPARK group is leading the program's *Online Teaching Commons* initiative, and the 96 campuses and systems participating in this program provide an additional audience for the results of the IPARK project.

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The structure and processes for creating and refining these resources will support the engagement of *Communities of Inquiry* for ongoing development, management and dissemination of these resources. Our intent is to create a cycle of resource creation and upgrade that can be sustained within the normal reward systems of academic institutions, and the normal work processes and institutional support for MERLOT.

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<http://cshe.berkeley.edu/research/digitalresourcestudy/report/>

² Loverude, Michael, Measuring the effectiveness of research-based curriculum at a university serving a diverse student population Physics Education Research Conference - AIP Conference Proceedings 9/9/2004, 2003 Volume: 720 pp. 7-10

³ Manduca, C. Iverson, E., Fox, S. & McMartin, F. (May 2005). Influencing User Behavior Through Digital Library Design". *D-Lib Magazine*.

<http://www.dlib.org/dlib/may05/fox/05fox.html>

⁴ Hanley, G., Enabling Open Education with MERLOT, Proceedings of OpenEd2005, September 2005, <http://www.archive.org/details/OpenEd2005EnablingOpenEducationwithMERLOT>.

⁵ E.g., <http://www.cfkeep.org/html/snapshot.php?id=19195704>

⁶ E.g., <http://www.merlot.org/merlot/viewMaterial.htm?id=80336>

⁷ E.g., <http://www.merlot.org/merlot/assignments.htm?material=91221>

⁸ Manduca, Cathy A., Ellen R. Iverson, Sean Fox, Flora P. McMartin: Motivating and supporting faculty use of educational digital libraries: an example from the geosciences. Joint Conference on Digital Libraries ([JCDL 2005](#)) pp. 389

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⁹ Lagoze, C., D. Krafft, T. Cornwell, D. Eckstrom, S. Jesuroga, C. Wilper, Representing Contextualized Information in the NSDL, 10th European Conference on Research and Advanced Technology for Digital Libraries ([ECDL 2006](#)) pp. 329-340

¹⁰ Also Holzman, N., K. A. Kastens, and R. A. Arko, Adding Value to NSDL Resources through Pedagogical Content Knowledge Annotations, poster presented at the Annual Meeting of the National Science Digital Library, Washington, D.C., Oct. 2006. Accessible at http://www.ldgo.columbia.edu/edu/eesj/directors/kastens/talks_posters/posters/NSDL06.pdf

¹¹ <http://www.carnegiefoundation.org/programs/sub.asp?key=21&subkey=2025&topkey=21>

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