Crossing Boundaries with Web-Based Tools for Learning Object Evaluation

Jerry Zhigang Li[1], John C. Nesbit[1], and Griff Richards[2]

[1] School of Interactive Arts & Technology, Simon Fraser University
2400 Central City, Surrey, BC, Canada V3T 2W1
{jerryli,nesbit}@sfu.ca
[2] British Columbia Institute of Technology
Burnaby, British Columbia, Canada, V5G 3H2
griff@sfu.ca

Abstract. Learning object repositories and evaluation tools have the potential to serve as sites for interaction among different cultures and communities of practice. This paper outlines the web-based learning object evaluation tools we have developed, describes our current efforts to extend those tools to a wider range of user communities, and considers methods for fostering interaction among user communities. The approaches considered include establishing shared but differentiated learning object evaluation standards, mapping between local languages, ontologies and practices, and recommending objects across community boundaries.

Keywords: e-learning, reviews, quality, repositories, communities, eLera, LORI, convergent participation, collaboration, professional development

1 The Need for Learning Object Evaluation Across Communities

Learning objects are distinguished from other educational resources by their immediate availability through web-based repositories that are searchable with standardized metadata. Specialized repositories serving different user communities are emerging that are interlinked by metadata and interoperability standards. Within the next five years, the U.S. National Science Digital Library (NSDL) is predicted to grow to include as many as 100,000 specialized collections representing over a million learning objects [1]. As we have claimed previously [2], the effectiveness of most online learning resources is severely limited because they do not follow design principles established by educational research, and have not been subjected to formative user testing. Thus, there is a pressing need for methods and tools to facilitate the development, evaluation and dissemination of high quality resources.

The strategy of specializing learning object evaluation tools for specific user communities clearly offers benefits through more focused support for community needs. However, here we also consider complementary strategies for fostering communication and interaction among these communities. Such strategies are important to avoid the establishment of 'multiple solitudes' in which innovations, solutions and beliefs are not readily disseminated across community boundaries. This paper introduces resource evaluation tools we have developed and describes how we are extending these tools to diverse communities of practice, language and culture.

W. Liu et al. (Eds.): ICWL 2004, LNCS 3143, pp. 286–292, 2004.
© Springer-Verlag Berlin Heidelberg 2004

2 Current Approaches to Evaluation

Current learning object evaluation sites can be viewed as variations on a common model [3,4,5]. Each is formed from a searchable database of resource metadata conforming to the IEEE LOM standard, evaluation criteria in the form of guidelines or an instrument, a process for conducting reviews including restrictions on who can review, and a structured form in which all reviews are published.

In the common model there are often two tiers of evaluation – reviews by individual users and reviews by selected experts or "peers." These mirror the two different types of consumer product evaluation systems found on the Web. For example, at one video game review site (www.pcgamereview.com), any user can register to rate and comment on three quality dimensions of a video game. Similarly, at a general consumer product review site (www.reviewcentre.com), any user can rate products on the two dimensions of "quality" and "value for money", as well as record comments. In contrast to these open evaluation systems, other product evaluation sites present only expert reviews. As with most of the product review sites, the evaluation processes of learning object repositories provide few opportunities for interaction among expert reviewers (e.g. content experts and instructional designers), and even fewer between expert and consumer reviewers (e.g., learners and teachers). Such interactions are potentially important because reviewers have been consistently observed to modify their evaluation of a learning object after being presented with reviews that differ from their own [6, 7].

3 eLera

eLera is a website designed to support a distributed community of teachers, instructors, researchers, instructional designers, and media developers. The initial version of eLera was publicly released in November 2003 at www.elera.net. eLera is a member of eduSource Canada, a network of interoperable Canadian repositories.

Developed in Zope, eLera maintains a searchable database of learning objects and reviews, and provides tools for learning object evaluation. eLera complies with the IEEE learning object metadata standards as interpreted by the CanCore guide [8]. It uses a modified version of the Dewey Classification System as a subject taxonomy. eLera includes evaluation forms and reports, statistical aggregation of ratings, and a "my collection" feature allowing members to assemble frequently used objects. Basic features include a home page listing recently registered members and reviews, and the ability to search other repositories using the eduSource Communication Language [9].

4 Learning Object Review Instrument (LORI)

The eLera website allows users to evaluate resources with the Learning Object Review Instrument [10]. LORI has been iteratively developed through testing with instructional developers and teachers [6]. Version 1.5 of LORI includes nine items shown in Table 1. For each of the nine items, reviewers can enter comments and ratings on a 5-point scale. Reviews are published in eLera as web pages.

Table 1. Dimensions of learning object quality in LORI 1.5

Content Quality	Veracity, accuracy, balanced presentation of ideas, and appropriate level of detail
Learning Goal Alignment	Alignment among learning goals, activities, assessments, and learner characteristics
Feedback and Adaptation	Adaptive content or feedback driven by differential learner input or learner modeling
Motivation	Ability to motivate and interest an identified population of learners
Presentation Design	Design of visual and auditory information for enhanced learning and efficient mental processing
Interaction Usability	Ease of navigation, predictability of the user interface, and quality of the interface help features
Accessibility	Design of controls and presentation formats to accommodate disabled and mobile learners
Reusability	Ability to use in varying learning contexts and with learners from differing backgrounds
Standards Compliance	Adherence to international standards and specifications

5 Tools for Collaborative Evaluation

eLera's tools for collaborative evaluation are designed to support the convergent participation model developed in previous research [6, 7, 11, 12]. In this model, small evaluation panels are formed from participants representing relevant knowledge sets and interests (e.g., subject matter expert, learner, instructional designer). A panel moderator chooses objects for review, schedules the review activity, and invites panel members. Moderators can use eLera's request feature to invite panel members to review an object. Members may choose to accept or reject participation. After the panel members have completed individual reviews, they meet in an online, real-time conference to discuss their evaluations. In this model, reviewers first discuss the items showing the greatest inter-rater variability. The moderator can use statistics calculated by eLera to order items for discussion. Panel members can edit their ratings and comments during the session. The moderator can publish a panel review by automatically aggregating individual reviews authored by panel members.

Two studies [6, 7] have shown that the collaborative review process causes participants' ratings of learning object quality to converge. This research also found that participants believe collaborative evaluation is an effective activity for teaching and learning about learning object quality.

6 Localization and Trans-Localization of eLera

The term *localization* is often used to connote the adaptation of a website to the language and culture of specific linguistically, geographically or ethnically defined groups. Here we also use the term when adapting to communities of practice, such as high school teachers or e-learning professionals. In this section we provide examples of both types of localization of the eLera website. We use the term *trans-localization* to connote methods or practices that promote communication and interaction among communities and cultures.

Internationalization, by which we mean adherence to international standards and avoidance of content or symbols that are heavily laden with idiosyncratic cultural knowledge, is a pre-requisite for both localization and trans-localization. The eLera website was designed to comply with the IEEE standard for learning object metadata. It also avoids reference to local or national institutions, and other knowledge not likely to be meaningful to an international audience.

Table 2. Ratio of web pages to users for different language groups in 2002. Data for pages [16] and users [14] from referenced sources

Language	Web Pages (Millions)	Web Users (Millions)	Pages per User
English	11425	234	48.87
German	156	43	3.63
French	113	23	4.92
Japanese	98	61	1.61
Spanish	60	50	1.20
Chinese	**48**	**78**	**0.62**
Italian	41	24	1.71
Dutch	39	13	2.98
Korean	31	28	1.10
Portuguese	29	19	1.55
Other	168	64	-----

6.1 Localizing Language

Over the last decade, the demographics of the web have seen a dramatic shift toward a more culturally diversified, multilingual user base. The proportion of users accessing the web in English dropped from 49.6% in 2000 [13] to 35.6% in 2003 [14]. The proportion accessing the web in Asian languages (mainly Chinese, Japanese and Korean) increased from 20.6% in 2000 [13] to 29.4% in 2003 [14]. Chinese-speaking web users, the second largest language group after English, increased from 1 million in 1997 to 160 million in 2004, and are expected to number 220 million by 2005 [14].

eLera has been localized to French and Chinese using the Zope localizer tool [15]. Most eLera pages are composed of several elements from different sources, such as navigation menus, page body, and images with text. For every element of the web page, eLera determines in which language it will be shown. The determination is based on an ordered set of languages preferred by the user. If a user prefers French, but also knows some English, then the user can set his or her preference to {French, English}. eLera will show French by default, but if the element is not available in French then it will display in English.

Chinese was selected not only because Chinese speaking users are the second largest language group on the web, but also because they are relatively underserved by available content. Table 2 shows that the ratio of web pages per user is far lower for Chinese than other major language groups on the web.

With learning object metadata and reviews represented in multiple languages in the eLera database, how can users in one language community use the information generated by another language community? Standardized metadata present a lesser problem because standard translations can be developed for all field names and fixed vocabulary values. We used the Canadian CanCore guidelines [8] for mapping such metadata between English and French. We then extended this mapping to the Chinese E-Learning Technology Standard (CELTS) 3.1 [17].

Although numerical ratings require no translation, the evaluative comments entered by users do present a challenge. We are exploring a method in which reviewers are able, for each item of LORI, to select comments from a closed menu in addition to entering free text. Comments selected from menus would be automatically mapped to all supported languages.

6.2 Localizing Ontologies

Leacock, Nesbit and Richards [18] found that teachers working with eLera in professional development workshops expected the subject taxonomy to follow the provincial curriculum structure they work with daily. They found eLera's modified Dewey system somewhat confusing and not availing of the specific needs of their community. For example, instead of the searching for objects with the Dewey subject "genetics and evolution," they would have preferred to use "grade 9 biology." Later versions of eLera will allow localization of subject taxonomies so that members can opt for a taxonomy already established in their community.

With subject terms entered in a local ontology, how can users in one community (e.g., Ontario high school teachers) use the metadata generated by users in another community (e.g., French university professors)? We are planning to use a modified version of the Dewey classification system as a universal subject taxonomy into which a large number of local subject taxonomies can be mapped. Hatala and Richards [19] proposed that, instead of enforcing a full metadata standard, repositories provide a narrow subset of the standard and allow extensions generated by community needs. We intend to follow this principle in localizing subject ontologies.

6.3 Localizing Evaluation Tools

E-learning design communities, unlike consumer communities, require methods for formative evaluation. We are now planning versions of eLera to facilitate workflow within teams that develop learning objects. For example, we may create a review instrument in which items become activated or deactivated as the object passes through defined stages. At the end of the development cycle, when the object is published, the incrementally assembled review can be published as a summative warrant of quality. This enterprise leads immediately to an examination of critical factors influencing learning object quality in design and development: What work is completed in each stage of the development process? Who should monitor quality at each stage? What information must be communicated to assure quality?

7 Recommendation across Boundaries

Through eLera we are researching models for supporting e-learning communities of practice. This research asks how online communities should be structured to foster norms of reciprocity, collective action, identity, and information flow. Key questions at this stage are: How can community members recommend resources and reviews to others? How can they find, and be introduced to, other members with similar or complementary interests? How can they build the identity, interpersonal trust and reputation that are prerequisite to effective collective activity?

At present, eLera provides only rudimentary facilities for recommendation and trust. By default, search results are ordered by average rating so that the most highly rated objects are presented at the top of the list. Users can also choose to order objects by *popularity*, a metric that is incremented whenever an object is placed in a personal collection. To support trust and alliance building, eLera members can create personal profiles detailing their interests and areas of expertise. Thus, decisions about whether to trust and collaborate with a reviewer can be based on the combined knowledge of his or her profile and previous reviews.

As we build on these features we are researching more advanced models of trust and recommendation that will contribute to the nascent research base in this area [20, 21, 22]. For example, we are implementing a "web of trust" – a social network in which members can create a list of highly trusted others. eLera will be able to recommend new members for one's trust list, and objects and reviews associated with those members, by chaining forward through the network of trust lists.

We expect to find relatively dense patterns of trust relationships within communities and sparse connections between communities. This being so, how can relevant objects and reviews be recommended across community boundaries? Recent work on the "six degrees of separation" phenomenon [23] has demonstrated that only sparse connections between node clusters are sufficient to ensure that the distance between any two nodes in a large network is fairly short. This suggests that as long as a few members of a community are connected to other communities, a strategy of recommending objects and reviews associated with near neighbors on the web of trust may ensure sufficient circulation of relevant objects across community boundaries.

8 Conclusion

Although the languages, tools and practices used in evaluating learning objects may need to be specialized for different communities, these communities need not operate as multiple solitudes. On the contrary, methods for recommending objects, and mapping metadata and reviews across languages and ontologies, can sustain substantial communication and interaction among learning object communities.

References

1. Saylor, J.M.: Why Every Digital Science Collection Builder Should Contribute Catalog Information to the National Science Digital Library. Retrieved December 28, 2003 from http://collections.comm.nsdlib.org/cgi-bin/wiki.pl?WhyJoin

2. Nesbit, J.C., Li, J.: Web-Based Tools for Learning Object Evaluation. *International Conference on Education and Information Systems: Technologies and Applications*. Orlando, Florida (2004)
3. Clarke, M.: CLOE Peer Review. Retrieved January 30, 2003, from Co-operative Learning Object Exchange: http://cloe.on.ca/documents.html
4. Merlot Peer Review. Retrieved March 31, 2004 from www.merlot.org
5. Digital Library Network for Engineering and Technology. Retrieved March 31, 2004 from www.dlnet.vt.edu
6. Vargo, J., Nesbit, J.C., Belfer, K., Archambault, A.: Learning Object Evaluation: Computer Mediated Collaboration and Inter-rater Reliability. *International Journal of Computers and Applications* **25** (2003) 198-205
7. Nesbit, J.C, Leacock, T., Xin, C., Richards, G.: Learning Object Evaluation and Convergent Participation: Tools for Professional Development in E-Learning. *7th IASTED International Conference on Computers and Advanced Technology in Education* (2004)
8. Friesen, N., Fisher, S., Tozer, L., Roberts, A., Hesemeier, S., Habkirk, S.: *CanCore Guide for LOM Implementation*. CanCore Initiative. Retrieved January 7, 2004 from www.cancore.ca
9. Hatala, M., Richards, G., Eap, T., Willms, J.: *The EduSource Communication Language: Implementing Open Network for Learning Repositories and Services*. Retrieved January 7, 2004 from www.sfu.ca/~mhatala/pubs/sap04-edusource-submit.pdf
10. Nesbit, J.C., Belfer, K. Leacock, T.: *Learning Object Review Instrument (LORI).* E-Learning Research and Assessment Network. Retrieved January 7, 2004 from www.elera.net
11. Nesbit, J.C., Belfer, K.: Collaborative Evaluation of Learning Objects. In: McGreal, R. (ed.): *Online Education Using Learning Objects*. London: Routledge/Falmer (2004)
12. Nesbit, J.C., Belfer, K., Vargo, J.: A Convergent Participation Model for Evaluation of Learning Objects. *Canadian Journal of Learning and Technology* **28** (2002) 105-120
13. Haynes, J.D.: Internet Management Issues: A Global Perspective *Chapter 5 - International User Interfaces.* Idea Group Publishing (2002)
14. Global Reach: Global Internet Statistics. Retrieved March 28, 2004 from http://www.global-reach.biz/globstats/index.php3
15. David, J.: Localizer. Retrieved March 28, 2004 from http://www.j-david.net/
16. Retrieved March 31, 2004 from http://www.netz-tipp.de/languages.html
17. Xiang, X., Shen, Z., Guo, L., Shi, Y.: Introduction of the Core Elements Set in Localized LOM Model. *Learning Technology*, 5, IEEE Computer Society (2003)
18. Leacock, T., Richards, G., Nesbit, J.C.: Teachers need simple effective tools to evaluate learning objects: Enter eLera.net. *7th IASTED International Conference on Computers and Advanced Technology in Education* (2004)
19. Hatala, M., Richards, G.: Global vs. Community Metadata Standards: Empowering Users for Knowledge Exchange. *International Semantic Web Conference*, Sardinia, Italy (2002)
20. Wiley, D.A., Edwards, E.K.: Online Self-Organizing Social Systems: The Decentralized Future of Online Learning. Retrieved January 4, 2004, from http://wiley.ed.usu.edu/docs/ososs.pdf
21. Recker, M., Walker, A.: Supporting 'Word-of-Mouth' Social Networks via Collaborative Information Filtering. *Journal of Interactive Learning Research,* **14**, (2003) 79-98
22. Recker, M., Walker, A., Lawless, K.: What Do You Recommend? Implementation and Analyses of Collaborative Filtering of Web resources for Education. *Instructional Science* **31** (2003) 229-316
23. Buchanan, M.: Nexus: Small Worlds and the Groundbreaking Theory of Networks. Norton, New York (2002)