

Integrating Evaluation into a Technology Education Program

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Most, if not all, states in this country have school districts and boards of education interested in the uses of technologies for education at the K-12 and higher education levels. Technologies in use and under consideration range from CD-ROMs and digital cameras to desktop networked computers with access to the resources of the Internet and the World Wide Web (NCREL, 1995). Well-planned technology programs in schools have the obvious benefit of teaching young people in a technological age to be comfortable and proficient with technologies. Being connected to the Internet also offers students a window to real-world, up-to-the-minute information, which can improve learning. But how do we determine the success of such programs?

This paper presents a case study in evaluating a technology project involving partnerships between museums and formal education. The focus is on the multiple-method design, which was required in order to work with all participants, from funders to educators, to teachers and students. A set of tools, from traditional surveys through teacher-led performance assessments, was used to measure student learning, teacher satisfaction, and effective implementation of technology and museum content into quality Web pages. We hope our experiences help others who plan to join forces with schools using technologies to optimize the resulting projects through well-planned evaluation.

What is Engaged Learning?

Technology in schools is being introduced to support an *engaged learning environment* (NCREL, 1994). Engaged learning is effective, almost self-perpetuating (or “intrinsically motivating”) learning. Engaged learners -- be they school children, teachers, or our colleagues at meetings -- are responsible for their own learning. They are energized by learning; they are strategic and collaborative (NCREL, 1994).

Teaching for engaged learning can be done with a variety of pedagogies in both formal and informal settings. It is strengthened by technologies that allow students to seek information from a world of resources, create authentic products, and share their work with a worldwide audience. Designing tools to determine the effectiveness of the Internet and other technologies for creating engaged learning was one of the challenges we faced in evaluating the "Museums in the Classroom" project.

"Museums in the Classroom"

To most strategically move forward in providing technology learning in Illinois schools, the Illinois State Board of Education, in the past year, has begun to implement seven Learning Technology Initiatives. One of them is "Museums in the Classroom (MIC)."

Four museums and 100 schools were involved in MIC during the pioneering 1995-1996 academic year. Brookfield Zoo, in a partnership with the Illinois State Museum, was teamed with 25 schools across the State, with students of grades K-12. This group is the focus of this paper. Brookfield Zoo's evaluators developed an evaluation plan for these 25 schools to deal with both their "product" World Wide Web pages, and the "process" of team learning by these virtual visitors as they became familiar with the collections and human resources at the zoo and museum, and with the powerful networking tools provided to them.

These projects were envisioned as a way to "seed" some classrooms in a diverse group of schools with high-end technology, with the hope that, eventually, school districts would develop other classrooms similarly. The projects were intended to replace, rather than add onto, current curriculum; teachers were encouraged to allow the technology to *transform* their teaching. Along with the project's effects on students, evaluators had to consider its effects on teachers and their teaching. Had the State's goals for creating more of a teacher-as-mentor classroom atmosphere been internalized by teachers?

The Project Format

The MIC project allowed the Zoo to install a direct Internet connection, a high-end desktop computer matching the one given to each of our 25 partner schools, and a larger server on which to keep Web pages

resulting from the project. Each school was given one computer to be shared by two classrooms (but not placed away in a media lab).

These computers each came with two types of digital cameras and a bundle of software that allowed teachers and students to create "QuickTime Virtual Reality™" images and panoramic scenes for use on their Web sites. Once the schools, through matching funds, had robust Internet connections installed, students could also videoconference, seeing each others' pictures in real-time over the Internet. Each school received funding to bring two teachers and six students on one image-gathering field trip to the Zoo or to the Museum.

After some initial technology training offered by the State to teacher and student representatives from each school, the 25 school mini-projects were coordinated by the Museum "MIC" staff. Two full-time staff were hired to oversee the MIC project: one technology-focused person and one educator, both housed at the State Museum. An evaluator played the third role most visible with teachers. The project's coordinating curators devised a list of program goals specific to our MIC group (Table 1), which needed to be communicated to teachers and students and evaluated throughout the project.

To do this, project coordinators and evaluators made extensive use of any and all forms of communication, keeping in touch with teachers and, in some cases, individual students. We maintained an e-mail discussion list for teachers who had e-mail access. We also mailed, faxed, phoned, and visited schools.

During the Summer of 1996, our museum MIC staff hosted two four-day professional development workshops for teachers. We met again with individual schools to help them further develop the content and logistics of their projects. On the technology end, we provided training from back-to-the-basics computer use and the use of the digital cameras through design tips for Web sites. On the content end, we invited speakers to discuss engaged learning, biodiversity and cultural diversity, and uses of Internet communications in the classroom. Teachers received many resources to take back to their schools in preparation for Year 2 of the project. With a project as complex as MIC, it was imperative that evaluators be involved face-to-face with teachers from the start. This strong relationship helped evaluators and teachers work as a team to define goals and objectives for each class, and to design each teacher's in-class performance assessments.

Our 25 MIC schools chose topics with ecosystem foci, such as "Horseshoe Lake Wetlands and the Cache River of Southern Illinois," and with cultural adaptation foci which are the strength of the Illinois State Museum, such as "Changes in Projectile Points Found in Central Illinois." Many projects combined these foci. All schools were asked to address the broad themes of bio- and cultural diversity with all of their involved students, in a grade-appropriate way.

In addition to content learning, students developed procedural knowledge skills during visits to the Museum and Zoo, and in class while using the computer. They benefited from special access to our collections for imaging use. Students were shown technology and photography procedures, as well as some research methods such as quadrant analysis or botanical identification by our professional researchers, as appropriate for their topic.

Evaluation Design

An evaluation challenge was to seek information on the success of the project (in terms of student factual and procedural learning, teacher comfort and procedural learning, and successful implementation) while considering all of its audience members, many of whom will need to be supportive of the project if it is to succeed in the coming years. Also, evaluation was conducted over a range of grade levels, content, and technology topics, and took into account previous school exposures to technology, and teachers' areas of expertise.

Evaluation was organized at three simultaneously occurring "levels," characterized by the individuals most directly responsible for completing each "level". At one level, state evaluation consultants were engaged in an overview of MIC for this first year. During site visits to several focal schools, they were primarily concerned with four research questions: What happened during implementation with respect to the project goals and the several audiences they address? What changed, in terms of learning, expectations, and communications? What role did technology play in these changes? And, what are the plans and expectations for the future? They asked these questions in four areas: teacher practice, student engagement and learning, technology integration, and school environment.

At the second level of MIC evaluation, museum evaluators measured the project's success in creating an engaged learning environment and at

teaching students about the broad themes of biodiversity and cultural diversity. We developed measures to document shifts in attitudes, knowledge, and abilities with the technology and with our content themes. We were responsible to our consortium for assessing our progress toward our Program Goals (Table 1). Since an evaluation perspective was integrated into the projects from the beginning, during their development we were able to suggest to educators a "Big Picture" document resource to help teachers discuss the overarching content themes of the projects with students and hence be better able to demonstrate awareness of our themes. We also worked with educators to develop pre-visit agendas for orienting students to the logistics of their visit to optimize their attention to the content learning, as suggested by Falk and Dierking (1992).

The classroom teachers, at the third level of MIC evaluation, were responsible (with our guidance) for performing in-class authentic assessments embedded into the daily MIC work. Expanding the traditional evaluator role, we trained and encouraged teachers to develop their own assessments of engaged learning, furthering the project's instructional goals.

Measuring our Success

Various assessment instruments and techniques were developed to evaluate and document progress against program goals (Table 1). Although our initial plans called for more on-line methods of evaluation, many schools could not be reached on-line due to delays in installation of their Internet access lines.

Content

In 1996, for our two content goals, we looked for increased awareness of the interactions between humans and their environments by student pre-study questionnaires for grade levels 4-7 and 8-12. (We determined it best to measure K-3 using primarily teacher-led in-class assessments of students' work.) In designing the questionnaires, we looked to the World Wildlife Fund (1994) and others who had previously attempted to measure levels of sophistication in students' understanding of these concepts. Students' responses helped our staff judge beginning levels of classroom sophistication with the content and the technology.

Process

We tracked teachers' skills and comfort with the technology through use of pre, mid-, and post-program teacher questionnaires. At the end of the school year, we also asked teacher teams to meet and complete a "Teacher Input" sheet. This gave us a unified view of teachers' feelings about the project and encouraged each school's team of teachers to meet and reflect before moving into the project's second year.

To evaluate the summer teacher workshops, we distributed a simple, standard feedback form to teachers on each workshop day, on which they had a chance to comment on the positive and negative aspects of the program and to ask questions. By using these evaluations at the end of each day, we were able to improve the workshops instantly, and we were sure to address all questions or uncertainties about the content we had covered. At the end of the week, after having met with our staff team one-on-one, teacher teams were asked to prepare a document titled simply "What's Next?" These sheets are being used to keep track of how much Year 2 support each school will require from our museum staff.

We also worked with teachers to build their understanding of what assessment should look like in an engaged learning situation. There are 26 indicators of engaged learning developed by NCREL, of which four refer to assessment. Assessment in an engaged learning situation is *performance-based*, with students involved in creating authentic products as they will in the workplace. It is *generative*, in that it has meaning for the learner and may produce a product or service. Assessment is *seamless and ongoing* since assessment is part of the instruction, and it is *equitable* or culture-fair (NCREL, 1994). We endeavored to use these assessment-related indicators to design the evaluation plan as an integral part of the learning environments we were assessing. We used the other 22 indicators of engaged learning as a framework, along with our own program goals, against which to analyze the classrooms situations which developed during the project.

More difficult to assess than students' knowledge and attitudes were skill development and increases in students' responsibility for learning. For these, we relied heavily on our e-mail records of correspondence with teachers and students, and on in-class assessments, which we asked teachers to develop and complete by June. Table 2 lists the types of assessments that we described to teachers, partially based upon the work

of Braus and Wood (1993). During the first year, we gave teachers descriptions of only the top six methods here, and asked them to complete an example of at least one with the students. For the project's second year (1997), we will ask teachers to use at least two performance-based assessments. Over time, with a program of assessment tools such as this, we were able to get several views of the classroom situation from several perspectives.

We found that getting teachers to think about non-test and non-written evaluation, even observations of students, in a systematic, formative way, was necessary to getting them to use any in-class performance-based assessments. By introducing teachers to these types of assessments, we are hoping to get the MIC project "into the gradebook" and thus to make it a legitimate part of the curriculum. This will, in the coming year, require more work with some teachers to develop their own rubrics or criteria to gauge how well students perform these various activities.

Products

Our final Project Goals this year referred to the product Web pages that schools are publishing on our servers as they are completed. Some schools have developed impressive sets of pages; others are completing their pages this fall through an extension granted to all schools by the State Board of Education. This rate of progress is comparable to that of similar projects throughout the United States (Jan Hawkins, Center for Children and Technology, personal communication). Meanwhile, to support the state's consultant evaluators who intend to have product pages rated by an independent panel sometime next year, we have collected some intermediary pages as part of the in-class assessments for last year, and we have solicited feedback from teachers about what criteria they feel will be most important to consider when critiquing students' Web pages.

The Future of, and Implications for, On-Line Museums

Next year we will continue to build and expand the teachers' role as evaluators in this project by working directly with each teacher to develop valid, reliable in-class assessments. Again, this overlap with the

roles of educators is intentional and necessary: new learning will require assessment to become more embedded and useful to students.

This project has many implications for the future development of virtual visitors and school projects at our institutions, and Web-based assessment of their learning. We have proposed establishing public workstations at the Zoo and Museum to allow all visitors to access and explore the MIC project pages. This fall, we will focus on finding ways to assess the success and quality of these product pages. Once all schools are on-line, we also hope to explore more on-line, interactive methods of assessment such as videoconference interviews and on-line journals. Finally, we will develop ways to measure the usefulness of these project pages to the worldwide audience who will access them.

According to NCREL, many regional, state and local organizations, including museums and zoos, are developing into "new educational service providers." These providers, together with federal agencies and others, "will replace conventional textbook publishers as the next generation of content providers for schools" (NCREL, 1995). Our on-line resources will make possible the collaborative, real-life activities of students involved in contacting museums and other organizations for specific information or input they need. If these predictions become reality, it will place our organizations in a good position to expand our impact on our local and national or even international school audience, through the effective use of Web sites and Web-based school projects.

Currently there are problems with these programs: the computers and the fastest connections to the Internet are expensive, and most teachers do not have sufficient training to feel comfortable guiding students who are using computers and multimedia equipment in the classroom. However, implementation can be greatly fostered through program-integrated evaluation such as that in which we are involved at the moment.

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Table 1
Illinois State Museum/Brookfield Zoo “Museums in the Classroom” Project Goals

Content

1. Students will recognize the importance of biodiversity and ecosystem conservation.
2. Students’ understanding of different cultures/ramifications of human interactions within ecosystems will increase.

Process

1. Students will develop and use a variety of skills (including verbal and non-verbal communications, problem-solving, decision-making, analysis, strategic planning, working collaboratively, reasoning and inquiry skills) to develop an interdisciplinary project . . . linked to the above content themes.
2. Students will engage in authentic, hands-on learning experiences.
3. Students and teachers will increase proficiency and positive attitudes about using technology (i.e. computers, software, telecommunications tools) to conduct research, plan strategically, work cooperatively and gain other critical life and occupation skills.
4. Students’ responsibility for their own learning will increase.
5. BZ and ISM will serve as a hub for other schools as they research and develop Internet resources on cultural and natural diversity.

Products

1. BZ, ISM and ISBE will provide teachers with the resources necessary to develop interdisciplinary classroom activities featuring their on-line projects.
 2. BZ and ISM will maintain the on-line, student-created modules for general access on the WWW.
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Table 2
In-Class Assessment Options

1. Portfolios	10. Research and reports
2. Student and teacher assessments of students' roles	11. Meetings with students, parents, and other teachers
3. Web pages with commentary/reflection	12. Peer- and self-evaluation by students
4. Videotaped student presentations	13. Public displays or posters
5. Student journals and teacher log	14. Questionnaires
6. Persuasive or other-creative writing	15. Paper-and-pencil testing
7. Teacher systematic observation	16. Computer lab practical
8. Homework	17. Peer teaching
9. Discussions, debates, panels, simulations, and mock trials or talk shows	18. Other ideas?