A CASE STUDY OF AN ONLINE SCIENCE FAIR – THE INTERNATIONAL CYBERSCIENCE EXPO 2000 (ICE2000)

B. MURFIN
New York University, New York, NY 10003
beml@acf2.nyu.edu

The International CyberScience Expo 2000 is a project that promotes project-based, science learning by secondary students. The event was organized and held entirely online in a collaborative virtual learning environment called ScienceMOO. It was found that ScienceMOO had great advantages and disadvantages as a tool for organizing and staging synchronous online events involving large numbers of people. Scheduling of online, synchronous meetings between the students and judges was very challenging. However, when judges did manage to meet with students, many beneficial interactions resulted.

Introduction

Technology is a tool that allows one to create learning environments that are very different but in some ways quite similar to traditional learning environments. The initial idea for an online science expo arose during a conference that was sponsored by the New York Collaborative for Excellence in Teacher Preparation (NYCETP) that was held in spring 1996 at New York University. The plan was to have NYCETP Master Teachers help their students develop science research projects that would then be exhibited in the online science expo. NYCETP Teaching Scholars would work closely with the NYCETP Master Teachers to provide individual assistance to the students in getting their projects completed and on the web. The Teaching Scholars gained valuable experience in educational technology through their work facilitating individual web-based projects, and also by helping out in the administration of the online event.

The International CyberScience Expo 2000 (ICE2000) used a technology tool called a Multi User Dimension Object Oriented (MOO) to begin to examine learning that takes place during large, online, educational events, such as science fairs. The following research question was investigated: What are the advantages and disadvantages of the use of collaborative virtual learning environments for holding large online events, such as science fairs?

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Procedure

Over a period of two weeks in June 1999, over two hundred secondary students met with judges to discuss the students' science research projects. The students, from both middle schools and high schools, worked on their science projects in groups or individually and then placed posters explaining their projects in an assigned room. At the scheduled time and date, the judges met the students in their rooms and judged the projects. The scores were submitted, totaled, sorted, calculations made, and prizes awarded. However, there was one way in which this science fair was very different from any other science fair that occurred before it.

Everything took place in cyberspace!

The main goal of The International CyberScience Expo 2000 (ICE2000) was to promote project-based, science learning. Project-based learning was chosen as a pedagogical technique in order to foster the acquisition of higher order thinking skills. Modeling [1] and interaction in a multiple electronic zone of proximal development [2] were the main mechanisms by which the students would acquire higher order thinking skills and learn science. Further particulars may be found on the ICE2000 web site at http://www.cat.nyu.edu/ice2000.

Secondary students and teachers from all over the world were recruited through the use of email announcements; flyers were sent to New York City public schools. These participants were physically located in many different places, including Harlem, Chinatown, Brooklyn, and even Toronto. Allowed to work in groups or individually, students' science projects can be viewed at the following web site: http://www.cat.nyu.edu/murfin/ice2000/projecturls.html. ICE2000 differed from other large science competitions, such as the Intel Talent Search, in that it was open to all students, not just to the top students in a school. Students who traditionally do not take part in science competitions had a chance to present their work to their peers and to scientists, and all students who completed a science research project and placed it on a web page were eligible to take part. Since there was no preliminary screening of projects, this led to a wide variety in the quality. This was a way to encourage participation by all students, regardless of ability. In the future, the standards will be raised for project entry as schools, teachers, and students gain confidence and skill at conducting web-based science research. Feedback from the judges on projects was emailed to all participating teachers after the projects were scored and the prizes awarded.

The ICE2000 judges were recruited through the use of email invitations to major organizations for scientists such as AAAS, the New York Academy of Science, and to the email lists associated with organizations for scientists. Webmasters of sites frequented by scientists were asked to include our invitation and establish links with the ICE2000 web site. Using online forms, potential judges were asked to provide information on their areas of science expertise, previous experience in judging science fairs, and any other relevant qualifications. The criteria for selection were a strong science background and a desire to get involved in secondary science education, and those chosen were found at the Shedd Aquarium in Chicago, MIT, Brookhaven National Lab, and in Italy, Botswana, even Iceland. The majority of the judges were science professors, science graduate students, or research scientists in government or industry. Approximately 25% of the judges were science educators, science education graduate students, or science teachers whose students were not participating in the competition. Some of the judges interacted with the students from home, some from their laboratories; some had to connect after midnight local time while others did their judging early in the morning; and some were logged on for many hours, interacting with the students. All of the judges felt that they had experienced something very different and many stated that the experience was very educational, both for themselves and the students. Of course, not everything worked perfectly and it soon became apparent that while technology did some things very well, other things might be better accomplished in a traditional face-to-face setting.

What is a Collaborative Virtual Learning Environment (CVLE)?

A collaborative virtual learning environment (CVLE) is a shared space available online where learners can interact, communicate, and build knowledge [2]. In other words, a CVLE is a subset of cyberspace where learning takes place.

What is a MOO?

A MOO is a Multi-User Dimension Object Oriented. A MOO consists of two main parts, a MOO server and a database. When a participant connects to a MOO, they can either create a new character or connect to one that already exists. In a MOO, everything is an object. A character is an object, and even rooms and *their exits* are objects [3]. All of the MOOs that exist today are descendants of the original

LambdaMOO written by Pavel Curtis [4]. A webbed MOO allows a user to access the MOO using a web browser. A very good introduction to educational uses of MOOs can be found in the collection of articles edited by Cynthia Haynes and Jan Rune Holmevik [5]. MOOs have been used for a great variety of purposes and at nearly all school levels, from elementary school students who built virtual worlds, to college students and doctoral candidates during their dissertation defenses. In this project, a webbed MOO was chosen for the following reasons:

1) It is freeware for educational purposes.
2) It functions well over relatively low bandwidth connections and on typical desktop computers, both Mac and Windows.
3) It allows multiple modes of communication, both asynchronous and synchronous.
4) It allows users to build and construct objects and virtual worlds.
5) It allows the use of many types of media, including sound, graphics, VRML, and Shockwave, video and audio conferencing.
6) It is relatively easy to install and can function on multiple platforms.
7) MOOs have been used to create large communities of people successfully.

This last reason is probably the most important. The ability of users to build in the MOO makes it a very flexible tool. ScienceMOO was structured and utilized in a "divide and conquer" strategy; it was obvious that utter chaos would result if more than 200 students and 64 judges were in one room chatting about their projects. Instead, each project was given its own room and access to the room could be easily controlled using simple MOO objects and commands, such as locking, closing doors, etc. A private room was also provided for the judges. One can connect to ScienceMOO using any Java-enabled Web browser, e.g., Netscape or Microsoft Internet Explorer to connect to the following URL: http://www.nyu.edu/education/scied/moosnyu.html. Once someone connects to ScienceMOO, he or she can move through the rooms of ScienceMOO by clicking on links or typing in commands. Users communicate by typing in a manner similar to that used for chat rooms.

Results

The activity in ScienceMOO varied tremendously during the first year of the project. During off-peak periods, one might find a few students puttering around in their rooms, trying out commands, chatting with other students, or visiting other rooms to check out the competition. A few judges might be found in rooms diligently reading web pages or in the judges' room chatting with their fellow judges. About three weeks before the competition, the level of activity in ScienceMOO increased sharply and during the two weeks of judging, the MOO became a literal hive of activity.

The judging of projects was originally scheduled for the first week of June, but it was extended for an additional week. Feedback was obtained from the students, teachers, and judges using online forms, and this data, together with the project scores, are still being analyzed. The judging process can be illustrated using one of the winning senior projects entitled, "How Do Homogeneous and Heterogeneous Groups Affect Test Taking?" This student's topic was one of very practical concern to both teachers and students: do students work better on problem-solving tasks in groups that are homogeneous or heterogeneous when these groups are based on ability level? The judges who met with this student commented on how valuable and interesting the interaction was, even though at first glance the presentation on the web site definitely needed improvement. For example, a physics professor who judged this project spent more than an hour in discussion with the student. Since the judges were from very different areas of science and not experts in the social sciences, the student was required to give a detailed explanation of the topic of his research and in effect, teach each judge. In return, the judge was able to critique the design of the experiment and give valuable insights to the student. This was an example of an interaction where the judges and the student both gained substantial knowledge. The rigorous questioning and interaction with the judges helped the student arrive at a much more realistic assessment of the results of his experiment. In the case of this student, the online interaction with the judges definitely helped the student improve his critical thinking skills and understand the limitations and strengths of experimental research.

Preliminary results from the online science expo showed that, among other things, the majority of participants had a very positive experience. Both students and judges enjoyed the convenience of being able to connect via the web. The main complaint of the students was that they wished there could have been more judges. Lack of judges was caused by judges spending far more time interacting online with each group of students than originally anticipated. Another problem that emerged was that the students tended to come online to be judged "en masse" and these times were usually during mid-morning or early afternoon. Many scientists just were not available at these times. As a result, three judges visited most students, but not all.

It quickly became apparent that the structure of ScienceMOO would have to be very adaptable and capable of change at a moment's notice. URL links to student projects changed from moment to moment, schedules changed, and projects were added and dropped. A less flexible tool than a MOO would have failed miserably to react quickly enough when necessary. The key to this success was determined by two important properties of the technology tool chosen:

1. The administrators in charge of the MOO, traditionally called "wizards," were able to change virtually any feature of the MOO almost instantly.
2. The students and judges could make changes themselves in their rooms if they knew the proper MOO commands.

Conclusions

Technology made many things possible that could never have been accomplished in a face-to-face science fair. In spite of the problems, technology did automate and improve many of the time-consuming tasks needed to organize and carry out a science fair. This enabled the judges to spend more time interacting with the students and evaluating the project web pages. The other great benefit of online science fairs is that it changes national and international science fairs from an elitist event to one that is more egalitarian. An extremely wide variety of students, of varying ability levels, participated in ICE2000. Students from different grade levels and with differing ability, including both English speakers and English as a Second Language (ESL) students, rubbed virtual shoulders with each other; all were able to interact with each other and with scientist judges. An online community that cut across socioeconomic backgrounds, ethnic lines, and grade levels was established. Online judging also allowed scientists whose busy schedules might have precluded time-consuming, face-to-face judging, to take part.

Paradoxically, scaling up the event to involve much larger numbers might enable the most serious problems to be solved. If a large number of international judges from various time zones can be enlisted, and a team of science graduate students is hired to be on call during peak judging times, the judge availability problem could be solved. The use of technology can allow the benefits of sustained authentic science research to be made available to larger numbers of students. A prescribed, pre-built, and unchangeable collaborative virtual learning environment would fail miserably in accommodating a dynamic online event involving large numbers of individuals.

However, MOOs are only a stepping-stone in the quest for the perfect collaborative virtual learning environment. MOOs are still at a clumsy and awkward stage; they don't always function well. In addition to technical difficulties, they do take some getting used to, and can be very disconcerting for first-time users. MOOs or their analogs, and their successors will need to develop much more user-friendly interfaces that enable higher-bandwidth communication and seamless updating of the database before they become truly useful educational tools. In the meantime, however, they can bring about collaboration and create communities that would not be possible otherwise. The progeny of MOOs could very well be the "constructivist learning environments" that so many educational technology researchers are seeking [6]. ■

Bio

Brian Murfin completed his Ph.D. in Science Education at Ohio State University. He is presently Assistant Professor of Science Education in the Department of Teaching & Learning, School of Education, New York University. His research interests are in the uses of technology in science education.

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