

**Front-end Evaluation of the
On-line Teacher Resources Project:
Final Report**

John G. Shedd Aquarium

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EXECUTIVE SUMMARY

Introduction. John G. Shedd Aquarium (Shedd) is working with a group of K-12 teachers from the Chicago area and Central and Southern Illinois to develop multimedia-enhanced lesson plans, a framework for adding lesson plans in the future, and support materials to facilitate teachers' use of multimedia. This report describes what Selinda Research Associates (SRA) learned from a series of focus groups and depth interviews with teachers associated with the *On-line Teacher Resources* project. It then synthesizes these results with findings from an earlier literature review to propose best practices for developing on-line resources for K-12 teachers. [Read more.](#)

Methodology and methods. Selinda Research Associates used its expertise in informal learning and naturalistic methodology to perform this evaluation. The goal of naturalistic methodology is to provide a holistic understanding of a program from a variety of perspectives. To help ensure variety among respondents for focus groups and depth interviews, we used purposive sampling methods to select 20 project teachers from a range of grades who had used computers and likely had in-school technical support. For the focus groups, we supplemented these project teachers with teachers who had less experience and support with in-school computer use. [Read more.](#)

Access to computers and the Internet. All project teachers had some in-school access to computers, and almost all had computers and the Internet in their classrooms. A few had multiple computers with Internet access in their classrooms, but more typically they used computer labs to get the whole class on-line at the same time. Some teachers said their schools had begun to cut back on computer acquisitions and support because of financial challenges at the district level. Almost all the project teachers had one or more computers at home, and all but a few had home Internet access. [Read more.](#)

Access to multimedia. Most of the project teachers had used a variety of computer-based multimedia applications. In some schools, only tech support could install multimedia plug-ins. Many OLTR teachers used CD-ROM-based multimedia programs more frequently than Web-based multimedia, especially in the elementary grades; they were easier to access with classroom computers and more reliable than school networks. [Read more.](#)

Access to on-line communications and printers. Most OLTR teachers had a school-based e-mail address and access to e-mail at home; many preferred to be e-mailed at home rather than at their school-based address. All had access to printers in their schools; about half had printers in their classrooms. Most also had printers at home. [Read more.](#)

Comfort with and knowledge about information technology. Most of the OLTR teachers said they were moderately to extremely comfortable with computers. Descriptions of relationships with computers included "cautious," "occasionally annoyed," "frustrated at times," "forced to become friends with computers," but also "appreciative...my job would be more difficult without the computer." Most said they had learned about computers through informal means (e.g., "self-taught" by "trial and error" at home and on the job). About half had participated in formal in-service training sessions through their school or

district, and a fifth had taken undergraduate or graduate-level technology courses. [Read more.](#)

Uses of the Internet. Almost all OLTR teachers had used some plug-ins for on-line multimedia (e.g., Adobe Acrobat or Shockwave). E-mail was by far the most frequently used form of on-line communication, both at school and at home. Teachers who used listservs often did so professionally, but instant messaging and on-line chat were almost always used at home, for personal reasons. Many teachers were unfamiliar with “bulletin boards,” and only a few had engaged in on-line video conferencing. [Read more.](#)

Uses of computers with their students. During our discussions, some teachers listed the many ways they were able to use computers with their students; however, these discussions helped reveal inequities in the distribution of hardware, software, and expertise among schools. Most OLTR teachers said their students were not given free e-mail access at school, although some speculated that in some situations, students could communicate with each other using computers. [Read more.](#)

Support for teachers’ use of computers and the Internet. The level and quality of technical support seemed extremely variable among OLTR teachers’ schools. Most high schools and some middle schools had adequate on-site technical support, but elementary schools often received their technical support from the district level rather than in-house. [Read more.](#)

Barriers to teachers’ use of computers and the Internet. Unlike teachers in national surveys, OLTR teachers complained little about their lack of time to learn about or use computers with their students. However, some did note the lack of computers in their classrooms or the difficulty with scheduling time in the computer lab. Poor technical support and unreliable in-school networks were also cited as barriers to computer and Internet use. [Read more.](#)

Preferences for on-line resources. When they turned to the Web for lesson planning, OLTR teachers tried to fill specific needs related to their curricula. Almost all OLTR teachers currently used on-line lesson planning resources, but some had difficulty giving students access to materials on the Web. The teachers said they needed to quickly identify the topics and concepts covered by on-line lessons and activities. Teachers said they liked to teach with activities, but stressed the need for background information for both students’ and their own use. There is a need for two material formats: One easily read on-screen and the other a printer-friendly format. [Read more.](#)

OLTR teachers and learning standards. The OLTR teachers told us that, in general, they were much more concerned about state standards than national ones, and their local districts had various ways to ensure that they appropriately met state standards. Most OLTR teachers didn’t show concern about meeting state standards at the level of individual lesson plans, yet they still recommended that on-line lesson plans include references to state and national standards. It also seems important that on-line resources address and support literacy and technology standards. [Read more.](#)

Finding and using on-line resources. OLTR teachers followed four major strategies for finding on-line resources for lesson planning: Using search engines, consulting knowledgeable people, using trusted Web sites, and consulting printed sources of Web addresses. Many seemed naïve in judging the credibility of Web materials, and few seemed to systematically apply accepted guidelines for evaluating educational sites. It seems likely that Shedd will start out with a great deal of subject-matter and educational credibility among teachers. Overwhelmingly, OLTR teachers told us that they adopt only parts of lesson plans found on the Web. This pick-and-choose behavior seemed to reflect practical realities (e.g., time and budget constraints), the need to adapt materials to the abilities and interests of their students, and professional pride. [Read more.](#)

Recommended best practices: Goals and objectives. The goal for the OLTR project should be to help teachers write great lesson plans by providing them with convenient and accessible resources. More specific objectives should be to help teachers find the *On-line Teacher Resources* Web site, given the various ways they locate on-line resources; to help teachers easily find exactly the resources they need, once they reach the OLTR site; and to create credible, easy-to-use teacher resources that will produce outcomes closely related to teachers' own goals. [Read more.](#)

Recommended best practices: Design of the OLTR Web site. This report concludes with a range of specific best practices identified by synthesizing the results of this study with a review of the literature on teachers' use of computers and the Internet. [Read more.](#)

INTRODUCTION

Background

John G. Shedd Aquarium (Shedd) is working with a group of K-12 teachers from the Chicago area and Central and Southern Illinois to develop multimedia-enhanced lesson plans, a framework for Shedd to use when adding lesson plans in the future, and support materials for the technology components to facilitate teachers' use of multimedia. As part of this development process, Selinda Research Associates (SRA) worked with Shedd to plan and oversee a front-end evaluation of the *On-line Teacher Resources* project. This report describes what we learned from a series of focus groups and depth interviews with teachers associated with the *On-line Teacher Resources* project. It then synthesizes these results with findings from an earlier literature review (Gyllenhaal, 2002) to propose a set of best practices for developing on-line resources for K-12 teachers.

The primary purpose of this front-end evaluation was to inform and shape the development of *On-line Teacher Resources*. The overall research questions, as originally defined in the evaluation plan, included the following:

- *What are the Web-based technologies that teachers find comfortable and also have access to?*
- *What kind of support will teachers need?*
- *How can on-line lesson plans supplement teachers' curricula?*
- *How do Shedd's activity guides fit into the teachers' curricula?*

As part of this process, we developed a topical framework in collaboration with Shedd team that outlines the specific issues that we explored. The Topical Framework is included as [Appendix A](#).

Methodology

Selinda Research Associates used its expertise in informal learning and naturalistic methodology to perform this evaluation. The goal of naturalistic methodology is to provide a holistic understanding of a program from a variety of perspectives. Naturalistic inquiry is a rigorous approach to understanding experiences in the natural context in which they occur. It usually includes collecting data from a variety of sources and triangulating that data to develop a thorough understanding of the subject of investigation (Miles & Huberman, 1994).

This approach to user research is particularly useful in a setting such as Shedd's Web site because teachers will be coming to it with varied experiences, interests, and levels of knowledge. Rather than looking for an "average" experience, naturalistic inquiry aims to describe the range of experiences and understandings. As such, it is a powerful tool for program planners, who are concerned with reaching complex audiences.

Naturalistic inquiry relies to a large extent on qualitative data. One of the strengths of naturalistic evaluation is that unanticipated findings often emerge from the data, often in

respondents' own words. This type of inquiry allows for the researcher to follow up on threads and themes that characterize how visitors think about their experiences. This approach also allows the program planning team to develop a rich understanding of the ways in which users may react to and use the planned resource.

Methods

Data was collected and analyzed throughout the study, and the analyses continually informed the data collection process. A number of qualitative methods were used to answer the “how” and “why” questions underlying respondents' beliefs, experiences, and behavior. Each data collection method is explained below.

Respondents

To help ensure variety among respondents, we used purposive sampling methods in selecting respondents for this study (Lincoln & Guba, 1985). In purposive sampling, each respondent is handpicked for certain characteristics. The goal is to talk with respondents who are as different from each other as possible in order to elicit the widest range of possible responses. Because purposive sampling deliberately selects respondents (i.e. the sample is not randomly generated), any percentages we report are solely to characterize this particular sample of teachers, and should not be generalized to any larger population.

SRA and Shedd staff collaboratively determined criteria for selecting teachers who would serve as respondents for this study, including:

- Teachers within pre-selected grade ranges
- Teachers who had already used computers in their classrooms (though the degree of use and comfort may vary)
- Teachers who would likely have some technology support in their schools

Twenty of the teachers were designated as project teachers, who will continue to work with Shedd through the duration of the *On-line Teacher Resources* project. Because the list of *On-line Teacher Resources* (OLTR) teachers was generated partially through Shedd's internal Education Department records, many of the teachers were very familiar with Shedd and had used Shedd resources in the past. For the focus groups, we supplemented these project teachers with additional Chicago-area teachers, some of whom had less experience and support with computer use in schools.

Information about the respondents is included in [Appendix B](#). This information is limited by our promise to preserve the anonymity of the respondents.

Literature Review

Selinda Research Associates staff completed a review of literature to inform the development of the *On-line Teacher Resources* project (Gyllenhaal, 2002). It explored what researchers from a variety of disciplines had already learned about teachers' use of technology in the classroom and how they used on-line resources. In addition, the literature review examined projects that created on-line resources for teachers to identify “lessons learned,” which may help inform the development of this project. Much of the literature

review data was on a national level, but in many cases we were able to supplement this with data on Illinois teachers.

We cite sources from the literature review in many places within this report as we try to understand how OLTR teachers compare with other teachers both statewide and nationally. In addition, we include findings from *River Link*, a joint venture of Shedd and the Illinois State Board of Education, and *MuseumLink-Illinois*, a joint venture of the Illinois State Museum and Illinois State Board of Education. Selinda Research Associates served as evaluator on both projects. *River Link* was part of the larger *Museums in the Classroom* program, a pioneering program that involved Illinois teachers and their students in the development of multimedia Web sites. The two evaluation reports from *River Link* (Beaumont *et al.* 1999; Beaumont & Perry, 2000) include some “lessons learned” that contributed to the best practices section of this report. The *MuseumLink-Illinois* project developed five Web-based modules of information and activities for use by K-12 teachers in Illinois. This report’s best practices section also makes use of some of the “lessons learned” during evaluation of the *MuseumLink-Illinois* Web modules (Gyllenhaal & Garibay, 2001).

Focus Groups

Much of the data for this report came from a series of focus groups that Selinda Research Associates staff conducted with OLTR teachers and their colleagues. The goal of this method was to gain a deeper understanding of the teachers’ attitudes and opinions regarding technology and lesson plans. In particular, we assessed their knowledge, interests, expectations, and needs in terms of: 1) the intended content, 2) use of the on-line modules, and 3) technology issues. In the focus groups, we were able to observe peer interactions and the ways in which the teachers discussed the subject matter with the group leader and among themselves.

The focus groups took place at Shedd, and Shedd staff recruited the respondents based on criteria outlined above. At least one Shedd staff member was available to coordinate activities on the nights of the focus groups. SRA and Shedd staff worked together to develop the discussion guide and protocol for the focus groups, which is attached as [Appendix C](#).

The focus group participants included six of the eight project teachers from the Chicago area as well as 13 additional Chicago-area teachers recruited just for the focus groups in order to obtain information from teachers with wide range of experiences with technology (see [Appendix B](#)). The following four focus groups, that included teachers from a restricted range of grades, were held:

- Kindergarten through third-grade teachers
- Third- through fifth-grade teachers (with a first-through-eighth-grade computer teacher included)
- Middle-school teachers
- High-school teachers

Staff members from Shedd observed each focus group, but did not participate in the discussions. The focus group leader wrote up a debrief after each group. Each focus group also was recorded, and the tapes were transcribed for later analysis.

The four focus groups included four to six participants each for a total of 19 respondents.

Depth Interviews by Phone

In order to ensure input from OLTR teachers in the central and southern regions of the state, Selinda Research Associates conducted in-depth telephone interviews with the project teachers from these areas. We also conducted phone interviews with two Chicago-area project teachers who had been unable to attend the focus groups. The depth interviews, which were unstructured and open-ended, yielded rich descriptive data in respondents' own words and allowed us to explore questions in a depth not usually possible with quantitative research. In these interviews we addressed many of the same issues as the focus groups, assessing teachers' knowledge, interests, expectations, and needs in terms of: 1) the intended content, 2) use of the on-line modules, and 3) technology issues. The interview protocol is attached as [Appendix D](#).

We conducted a total of 13 interviews with 14 project teachers lasting 45 to 70 minutes each. The interviewer wrote up a debrief after each interview, and interviews also were recorded and transcribed for later analysis.

Teacher Questionnaire

Selinda Research Associates staff developed a short questionnaire to collect data about computer availability and use from the OLTR project teachers and other focus group participants. The questionnaire included multiple choice and short open-ended questions, and is included as [Appendix E](#).

Focus group participants filled out their questionnaires in writing before group discussions began. Teachers who were interviewed by phone were read the questionnaire near the conclusion of the interview and responded orally. The results were tabulated and the ranges and other basic statistics calculated. The resulting statistics provide interesting insights into the OLTR teachers as a group; however, because participants were chosen using purposive sampling, one should not use the statistics to extrapolate toward any larger population of teachers.

We obtained questionnaire data from a total of 33 teachers.

Data Analysis

Interview and focus group data were analyzed using inductive constant comparison (Lincoln & Guba, 1985), whereby each unit of data is systematically compared with each previous unit of data. In constant comparison, concepts emerged from data units and then were elaborated or modified by the researcher as incoming data were meticulously compared to previous data units. This allowed us to continually identify, develop, and refine categories of data and interesting themes as they emerged.

Limitations of the Study

Due to limited resources, this study was necessarily limited in scope. For instance, when conducting an evaluation study using naturalistic methodologies, it is standard practice to

continue collecting data until a *state of redundancy* is reached. Redundancy is the point at which no new information is gleaned despite repeated attempts to elicit additional findings. We seem to have achieved redundancy on most of the issues we listed in the topical framework.

However, due to the limited number of teachers we have talked with, we were not able to reach a state of redundancy with *all* aspects of this study. We also recognize that the range of teachers who will be interested in the OLTR project's offerings will be extremely broad, and our limited sampling has not done justice to its diversity. In some cases this does not appear to be a major limitation, because we still have broad range of responses. However, we received a more limited range of responses in some areas of the study. Also, some new issues came up during our investigation, and we were unable to explore them in depth. Where appropriate, we identify issues that warrant further exploration, should funds be available at a later time.

Here are a few other points to keep in mind when reading this report:

- **Use caution when comparing statistical data.** Questions about access to computers, the Internet, and various types of software and applications were asked in a variety of ways: Multiple choice and open-ended response; in focus groups and phone interviews; in paper-and-pencil surveys; and over the phone. Therefore, statistical comparisons either within the OLTR population or with other surveys of teachers are difficult, except in the broadest sense. We often resort to describing the OLTR teachers using words like “almost all” or “only a few” rather than giving precise numbers.
- **Preserving confidentiality.** We offered our respondents confidentiality during the focus groups and interviews. Therefore, we do not use individuals' names in this report, and we avoid linking possible identifying information with individual quotations included in the report.

TEACHERS' ACCESS TO INFORMATION TECHNOLOGY

Access to Computers and the Internet

In Schools and Classrooms

All of the OLTR teachers had access to computers somewhere in their schools, and almost all of the OLTR teachers had access in their classrooms. Most also had access to the Internet in their classrooms. A few had multiple computers with Internet access in their classrooms, but more typically, the OLTR teachers used computer labs when they wanted to get the whole class on-line at the same time.

However, we should note that the levels of access among the focus group teachers varied broadly. At one extreme, some schools had both wired and wireless access at the classroom level.

At our school, we're completely wired. Every classroom has at least two computers [with] Internet access. We have a server and the students have [networked] folders, and the staff always has to have [networked] folders. So nobody saves to a [floppy] disk in our building. Anytime that they do anything on the computer, it's [on the] server....We have a great, big computer lab, and then, a reference area. And then, we have two sets of laptops....In one part of the building, they're mainly used just for word processing. In the other part of the building, they have AirPort connections. So you can get a laptop and go on the Internet without having to plug in anywhere.

We have a lab with well over 40 computers. We just got, like, six new computers. We have six going. Our technology base is growing extensively. We have a printer on each floor. We don't each have one in our classrooms, but one is housed on each floor.

At the other extreme, a few OLTR teachers said their schools had computers in labs and other centralized places, but not yet in individual classrooms.

Many classrooms [in our school] don't have a computer, or they have a computer that's broken. And it's hard. There's one computer, 28 kids or more, and no assistant or aide or anything so the kids can circulate through it. They really don't find time for it.

Funding was a major issue at many of the less computerized schools. However, some teachers gave other reasons why their schools had been slow to adopt computer technology at the classroom level.

Usually, they have a phobia about stealing computers and computer parts, but that [fear] seems to be lax over the last couple of years. They're not as paranoid about it.

We should note that a number of OLTR teachers said their schools were cutting back on technology acquisition because of financial challenges at the district level.

Our school district is kind of financially strapped. Maybe like the other ones as well. Several years ago, they had wonderful intentions of wiring up everybody, and it just hasn't [happened]. We have

computer labs, and you have to sign up and reserve them to bring your classes there. And I actually have computer tables in my classroom, but no computers. So, hopefully, it will all turn around.

For comparison, nationwide surveys indicate that almost all American schools had at least some access to computers and the Internet (Rowand, 2000). In 1999, 84 percent of public school teachers reported having at least one computer available in their classrooms—36 percent reported having one computer, 38 percent had two to five computers, and 10 percent had more than five computers in their classroom (Smerdon *et al.*, 2000). Illinois schools seemed to fall only slightly below national averages for school connectivity and close to the national averages for classroom availability of the Internet. In an analysis of 2001 survey data from Illinois schools, 82 percent of Illinois classrooms had access to the Internet (*Education Week*, 2002). Therefore, the sample of OLTR teachers seemed to include a fairly representative range in terms of access to computers.

In Homes

Almost all of the OLTR teachers had one or more computers at home, and all but a few had home Internet access. The teachers varied greatly in how much they use their home computers. Some said they use their home computer rarely, if at all.

I have a computer at home and Internet access. But I also have three teenagers. So I don't get on that computer.

Others said they made frequent use of their home computers both for school-related work and personal uses.

I'm at school quite late, so I probably use the same amount of time at home and school. At home, we have cable, so it's fast. I use search engines and e-mail. I don't do on-line chat. If I'm going to talk to someone, I'm on the phone. I use word processing. Things for school. Lesson plans, and when I'm taking classes. That kind of thing.

I'm doing my Master's program on-line, so I'm on it all the time.

It's real easy for me to be at home to look up Web sites and things that I want to try to bring into the classroom. Because I can do it at home, and then, I can just write down the URLs. And the next day at school, say this is what I want to do. And on-line lesson plans, I'll look for all kinds of stuff at home.

I'm always on my computer at home. And I admit it. I'm a cyber-junkie. I use it to wind down when I'm at home and when I just need a break. I'm on the Internet at home a lot more than when I'm at school.

For comparison, in a 1999 nationwide survey, Smerdon *et al.* (2000) reported that 82 percent of public school teachers had a computer at home, and 63 percent had the Internet available at home.

Access to Multimedia

Most of the OLTR teachers had used a variety of computer-based multimedia applications. Many of them said they access on-line applications more at home than at work, and relatively few used on-line multimedia on a regular basis with their students. Some of the exceptions worked at schools that subscribed to services such as *biology.com*, or were themselves working with groups developing on-line multimedia for classroom use.

The OLTR teachers seemed to have had a range of experiences with installing plug-ins for on-line multimedia. Some teachers said that only tech support staff were allowed to install plug-ins in the school.

The reason why so many things run smoothly is that all the computers are under foolproof control. We can't add or remove hardware. We can't add software. We can't do anything. I mean, we can't change the settings on the Web browser. Or we can't put a picture of our dog as a desktop. We can't do anything. Sometimes, it's frustrating when we're trying to do things that require plug-ins, because you can't get the plug-ins. But it cuts down on a lot of problems, because students that are, as you say, savvy, if they sit down at a computer and they have free rein of it, they can have it do whatever they wanted to do. And then that causes problems for other people.

As far as installing things, you really need to know in advance. You know, depending on when it is. If it's the beginning of the year, OK, then, it will take three weeks. If it's a slow time, OK, by the end of this week, we can have it done. So, it kind of varies.

Some teachers told us that their ability to add plug-ins to computers in labs was limited, but they could install almost anything on computers they used in their classrooms.

In our lab, it's the same thing. The labs are very strictly monitored. But, [with] individual computers in the classrooms, I think that we have pretty much free rein.

We have a laptop program. Yes, I've installed stuff on there. They do what they call ghosting on our laptops, though, every year when the school year begins. They wipe everything that's on it off, except for what's supposed to be on the networks. Then, you have to reinstall things that you use that aren't tied in to the network.

Many OLTR teachers seemed to use CD-ROM-based multimedia programs more frequently than Web-based multimedia, especially in the elementary grades. Several teachers told us they preferred CD-ROM games to Web-based games, since they were easier to access with their classroom computers, and CD-ROMS seemed more reliable than their school networks.

There's no wait time on it. I mean, there's no downloading time. And a kid can turn it on.

Sometimes, if you can't get online, you're having problems, I know that can be really common. Sometimes, you get on and your network just isn't working. And so, you leave.

I had a class last year. We were doing wireless laptop. I had a whole activity planned on the Internet and everything. In fact, we had another school coming in to see our laptops and our wireless, because they were thinking about purchasing them. The kids got in, went to log on, and the whole network crashed and they couldn't get on. It was kind of humorous, you know. But at the same time, the whole lesson was over. And then, I had 15 minutes to try and figure something out with all the kids sitting there, looking at me.

We also found that many of the more experienced OLTR teachers relied on older forms of media in their classrooms.

Videotapes. I bring them in and show them....Audio CDs. Actually, I have a number of slides from classes I take into the zoo....So, I guess I do use a little bit of everything. We have all the old stuff, [even a] filmstrip projector.

Younger teachers in our sample did not seem to use the older media as much.

I don't really use them. Occasionally, a video. That's about it. I mean, this is my personal preference, I guess. I'm not sure if we even have those kinds of things.

Some more experienced teachers said they found the older forms of media less frustrating than computers, and more comforting, as well.

It's something I've used a lot longer than I have the computer. I actually had to take a class, an audio-visual class, on how to run all these projectors and all that other stuff. So with the computer, I kind of [learned] a little bit at a time.

I'm really more comfortable with slides and videos, and I'm getting a little bit better at the computers.

Some of OLTR teachers said they valued exposing their students to a range of media besides what was accessible by computer.

What makes them intriguing [to the students] is, it's not a video and it's different from what they're used to. They're kind of like, "This is interesting." Usually, it's something that I've experienced, and I take in slides, and I share it with them. So, it's very personal, too. They really like it. So, I love slides.

My gut reaction is I like the sort of technology [we've been talking about]. I liked the idea of bringing the slides and the kids going, "Slides?" You know? Or those stories that you can read and have them "beep, beep."...So, I like it. I like that different forms are different forms, that they're not all one place.

Based on the limited nationwide survey data about multimedia, it seems that access to multimedia, and especially cutting-edge, on-line multimedia, may be a problem for some teachers. For instance, Anderson & Ronnkvist (1999) found that most of the computers in schools in 1999 were not able to run a large variety of multimedia software and were limited in their abilities to access graphical information on the Internet.

Access to On-line Communications

Almost all of the OLTR teachers said they had a school-based e-mail address, and most also had access to e-mail at home. Many OLTR teachers preferred to be e-mailed at home rather than at their school-based address. An earlier study of Illinois teachers found problems with the reliability of e-mail hosted by K-12 school and district servers (Gyllenhaal & Garibay, 2001).

For comparison, in a 1998 nationwide survey Ronnkvist *et al.* (2000) found that 52 percent of teachers said they had access to electronic mail at school. In an analysis of 2001 data, 80 percent of Illinois schools reported that at least half of their teachers had a school-based e-mail address (*Education Week*, 2002).

Access to Printers

All of the OLTR teachers said they had access to printers somewhere in their schools, and about half had a printer in their classroom. Most OLTR teachers also had printers at home.

Based on a 1998 nationwide survey, Ronnkvist *et al.* (2000) found that 78 percent of teachers said they had access to a printer in their room or nearby.

TEACHERS' COMFORT WITH AND KNOWLEDGE ABOUT INFORMATION TECHNOLOGY

Comfort with Computers and the Internet

On the questionnaire, we asked OLTR teachers to rate their own comfort with Internet technology on a scale of 1 to 4, where 1 is "not comfortable" and 4 is "extremely comfortable." Table 1 shows the preliminary results.

TABLE 1: PERCENTAGE OF OLTR TEACHERS INDICATING VARIOUS LEVELS OF COMFORT WITH INTERNET TECHNOLOGY

	<u>Frequency</u>
1 (not comfortable)	0%
2	12%
3	45%
4 (extremely comfortable)	39%

In focus groups and interviews, we probed a bit more deeply about the range of ways in which teachers had developed their current levels of comfort.

You know, I've had computers growing up, so, it hasn't been like something intimidating for me.

My first experience with computers was back with a keypunch card. So, obviously, I'm a little older, and that's why it seems like, this is so much easier. But again, I'm using just the word processing. And now, I'm trying to overcome the fear that I find myself caught up in somewhere, I'm lost somewhere [on the computer], that I can get back out easily, because I'm not really sure what I'm doing.

Then we asked the teachers if “comfort” was the best word to describe their relationship with computers. The answers varied.

Exactly. I'm very comfortable.

Cautious. Cautious and comfortable, maybe. Or if something goes wrong, like, how am I going to find my way out of here to get that? You know, we're going to lose something. Where did it go?

Occasionally annoyed.

Frustrated at times.

Appreciative. I know my job would be more difficult without the computer.

Finally, we asked the OLTR teachers how comfortable their colleagues felt using computers and the Internet. They said most of them seemed fairly comfortable, although there were exceptions.

Everybody's pretty comfortable with it. But I've heard stories about people [who are less comfortable].

You know what? We do our report cards. We do a lot on the computer, so we're on it all the time. They provide us with some classes within our building, too. And a lot of them take outside classes as well. So we were forced to like the computer. Some people feel that way, as if they were forced to become friends.

We heard a number of stories about how the schools were trying to help less comfortable teachers. One teacher was a technology trainer in her school, so we asked her if she had good attendance at the teacher in-serve classes at her school.

Not at first. But I think a lot of people are kind of scared....They thought, oh, I'm going to come to this and I'm not going to know anything. So, I wheeled my computer into another technology coordinator's room, where she has two computers in there. So, we're pretty much giving them more than enough comfort, anything that they need. Tuesday, I showed one teacher how to do PowerPoint. She was all excited the next day, because she [made a] PowerPoint presentation and showed it to me. She was all excited about it. Whereas, the tech coordinator was working with another woman who was just trying to use the mouse and open up programs and course programs. So, you know, we do pretty much whatever people need. Just the concepts, and it starts getting comfortable.

So far we have found no directly comparable data about teacher comfort from nationwide surveys. However, in a 1999 survey, only 10 percent of teachers reported feeling very well prepared to use computers and the Internet (Rowand, 2000). Another 23 percent reported feeling well prepared, and 53 percent reported feeling somewhat prepared. Also, based on an in-depth study of schools in California, Cuban (2001) found that most teachers showed little evidence of “technophobia” or resistance to using information technologies.

How Teachers Gained Their Technology Skills

When we asked the OLTR teachers an open-ended question about how they gained their technology skills, about 80% mentioned learning what they know in informal ways—from family and friends, or “self-taught,” often by “trial and error,” or just through experience at home and on the job. About half the OLTR teachers said they had participated in formal in-service training sessions through their school or district, and 20% had taken undergraduate or graduate-level technology courses. About 40% answered that they had learned about information technology from a combination of formal and informal means.

The OLTR teachers told us that their in-service training came from a variety of sources, both within their schools and from the district level.

Our LRC Director, which is a fancy term for librarian, she knows a lot about technology....She's the person that they have in their district that offers classes for teachers. She also teaches classes. You know, PowerPoint, Excel, whatever. So, she helps a little bit. She's the most accessible out of everybody in the building.

Our district technology person, he comes in and he offers classes to teachers. We'll have a little survey [asking teachers] what are things they're interested in, whether it's e-mails or spreadsheets, whatever, it could be anything. Anything that you have a need for that you informed about. Yes, we get a lot of support.

For comparison, in analyzing a 1999 survey, Smerdon *et al.* (2000) found that independent learning was the most frequently cited means by which teachers prepared for technology use (93 percent). Most teachers also reported that they had learned about technology through professional development activities (88 percent) and by learning from their colleagues (87 percent). About half of all teachers said they had been prepared for technology use by courses in colleges and graduate schools, and teachers who had less teaching experience (and thus were more apt to be recent college graduates) were much more likely to indicate that their formal education had prepared them to use computers and the Internet (Smerdon *et al.*, 2000).

(Note that the apparent differences between the OLTR teachers and the national sample could be due solely to the way in which the question was asked—we asked an open-ended question, but it appears that the national sample checked off a series of predetermined choices.)

TEACHERS' USE OF INFORMATION TECHNOLOGY

Teachers' Use of the Computers and the Internet

In response to open-ended questions during the focus groups and interviews, the OLTR teachers told us about a wide variety of ways in which they use computers both for their own professional purposes and with their students. Teachers' uses with their students are discussed [later in this report](#).

Use of Multimedia by Teachers

Almost all of the OLTR teachers told us about ways they use multimedia in their classrooms. However, many of the applications they use are CD-based rather than on-line, especially in the lower grades. A few secondary teachers told us that they subscribed to science Web sites so they could have ready access to high quality on-line multimedia for their students.

As detailed in Table 2, almost all of the OLTR teachers were familiar with a range of plug-ins used for on-line multimedia.

TABLE 2: PERCENTAGE OF OLTR TEACHERS WHO SAID THEY HAD USED WEB SITES THAT REQUIRED THE FOLLOWING PLUG-INS

	<u>Frequency of "yes" answers</u>
Adobe Acrobat Reader (PDF)	91%
Macromedia flash/shockwave	76%
Video files (.mpg, etc.)	76%
QuickTime VR	70%
Audio files (.mp3, etc.)	70%

We found no comparable data about plug-in use on the national level.

Teacher Engagement in Web Development

Fewer than half of the OLTR teachers said they had developed their own Web sites, and even fewer actively maintained their own Web sites at the present time. A number of teachers had developed Web sites as part of a college or in-service course, but had never followed up on what they learned by developing Web sites for classroom use. A few teachers have had their students develop Web sites, using programs like Microsoft *Front Page*.

We're doing The Hobbit, so they're doing a Web page based on The Hobbit....It's more for just their experience on going out and finding graphics and importing them onto [a] Web page. And text animations and backgrounds and font colors and font sizes. I'm really tricking them into analyzing this novel by masking it with, "Well, we're going to make a Web page."

Teacher Use of On-line Communication Tools

Among the OLTR teachers, e-mail was by far the most frequently used form of on-line communication, both at school and at home (Table 3). Many used e-mail professionally to communicate with administrators and other teachers, and some also were in regular e-mail contact with their students and parents.

TABLE 3: PERCENTAGES OF OLTR TEACHERS WHO SAID THEY USED VARIOUS FORMS OF ON-LINE COMMUNICATION

	Frequently	Sometimes	Seldom	Never	Don't know
E-mail	88%	12%	0%	0%	0%
Listserves	24%	18%	27%	21%	6%
Instant messaging	15%	21%	24%	36%	3%
On-line chat	18%	6%	12%	64%	0%
Bulletin boards	6%	9%	15%	41%	24%
Video conferencing	0%	0%	18%	76%	6%

Those teachers who used listservs often used them professionally, but those who used instant messaging and on-line chat almost always did so at home, for personal reasons.

Many teachers said they were unfamiliar with the term “bulletin boards” (Table 3). Some of those who had used them had done so as part of a formal class or college course.

Video conferencing was by far the least used form of communication. Those OLTR teachers who said they had video conferenced at least once most often had done so as part of a formal class or college course. Some teachers said they knew teachers or students who had successfully used on-line video conferencing, and some teachers thought their schools had the appropriate equipment available somewhere in their building. However, none of them said they had used it in their own classrooms.

Looking at the national level, in the 1999 survey reported by Rowand (2000), 23 percent of teachers said they used their school computers to communicate with colleagues, and 7 percent said they used them to communicate with parents or students. On-line groups based on bulletin boards, listservs, and related forms of on-line communication seem to be becoming an increasingly important part of American life. Based on a 2001 survey, the Pew Charitable Trust's Internet & American Life Project found that 84 percent of American Internet users had contacted an on-line group at least once, and that more than half of these users (56 percent) said they joined the group shortly after they first contacted it. About 23 million Americans said they were very active in on-line communities, e-mailing their principal on-line groups several times a week (Horrigan et al., 2001).

How the Teachers Use Technology with Their Students

Some teachers gave us long lists of the ways they used computers with their students. WE heard a number of responses like the following one.

Audio-visual stuff, of course. And then, we have obviously the word processing on the computers whenever we can. We've done some graphing by using the spreadsheets....I'll do a lot of research for Web sites and find the Web quests on different places. All the students really like that, because they think the Internet is like TV for them. So if they're on that, they'll play all day. And they'll learn something....For Science, I'll look for an expert site, like teaching about Earth Science. I'll get stuff off the U.S.G.S. Web site, a geological survey. And in my classroom, we have a monitor, and it's hooked up to a little computer. I can go to a Web page and turn on my TV, and anything on my computer screen is on the TV screen. So, I'll use that to show them things.

At this point in our focus groups, the inequities in the distribution of hardware, software, and expertise among schools often became obvious. Teachers from less fortunate schools would listen in awe, then say things like, "I'd love to be doing what he does."

The literature review includes a range of statistical data about how teachers use computers with their students (Gyllenhaal, 2002).

Student Access to On-line Communication

Most of the OLTR teachers told us that their students were not given free access to e-mail at school.

We have a district policy on students corresponding via e-mail from the school. They can't send e-mail at all.

The students can't have any e-mail access. It makes it very tough for them to communicate with anybody outside the school.

I know at our school, kids can't have access to e-mail. They can't check e-mail and stuff off our network computers.

Some teachers speculated that there might be situations where students would be allowed to communicate with each other using computers.

If it was some sort of online discussion that was going on in class, [and] we were there, walking around the room, watching they're talking with other kids. I don't know if they would be as strict about that. That might be something that we could let fly, as long as it was educational....I've never tried it, so I don't know.

As discussed in the literature review, this contrasts markedly with many students' home use of on-line communications. The United States Census Bureau reported that as of August 2000, e-mail was the most common use of the Internet at home among children. Among

children aged 3 to 17 with home access to the Internet, 73 percent used the Internet to send e-mail (Newburger, 2001). In focus group studies, students reported that many school administrators and teachers had not responded to the new ways in which they habitually communicate and access information at home (Levin & Arafah, 2002). Some authors have described students' frustration with the increasing contrast between home and school as a "digital disconnect" (Levin & Arafah, 2002).

SUPPORT FOR TEACHERS' USE OF TECHNOLOGY

We didn't collect quantitative data from the OLTR teachers about the quality of the technical support in their schools. However, based on analysis of our qualitative data, the overall impression is that technical support is extremely variable among the OLTR teachers' schools.

Most high schools and some middle schools seemed to have pretty good technical support on the premises. Most non-Chicago elementary schools seemed to have technical support on the district level, but only informal support in-house, often from a "computer teacher" whose main job was providing instructional support. Some Chicago schools received their technical support from university partnerships rather than from the school district. The quality of technical support may be declining in some districts (e.g., Springfield, which failed to pass a school-funding referendum for the coming year).

It was interesting to hear the teachers talk about the types and levels of support they receive from their technical staff. When we asked OLTR teachers about the *types* of support they received, they gave us a variety of answers. Teachers who had good support talked about tech people fixing computers, installing programs, and training teachers to use hardware and software. They also talked about receiving emotional support when they tried something unfamiliar or difficult and about getting e-mails with lists of interesting Web sites from their tech staff.

When we asked OLTR teachers about the *amounts* of support they received, they also gave us a wide range of answers. Predictably, teachers from schools with full-time support often told us about their positive experiences.

We do have two full-time support people. When I was in my other classroom, I had a computer and Internet access. And if I had a problem, you had to chase them down a little bit. But they were pretty responsive.

We have one technology person for our building, one primary. And then, he works side by side with the LRC specialist, who's also very technology savvy. But he's fantastic. We feel very supported in our building. If you need anything, if there's something not working on that computer, and I put a note in his mailbox, by the end of the day, it's fixed. Because that's his responsibility.

However, some teachers expressed less positive feelings about their full-time technical support.

We have full-time tech supervisors. They are in another part of the building and they're like ghosts. You know, we don't see them hardly ever. And they're nice people, but they're not people-friendly. They're just hard to deal with. You know, you can't go to them with a problem....They take care of major problems that affect the entire system. But if there's a problem with just our computer, it might be fixed within the end of the day, or it might not. And they're just not very sociable. It's just weird.

Teachers from buildings without full-time dedicated support staff seemed much less satisfied when asked how much support they received.

Not a damn thing....It's so hard to get something. They are so busy and we know [it]. They're there every day. The problem is that if they're charged to teach, then who provides the maintenance, you know?

The OLTR teachers told us that they also looked to other sources for technical support—especially students in the middle and upper grades.

Students are so savvy now. Not all, but quite a few of them. They pretty much know what they're doing and in many cases, more than I do, when it comes to computers. So, they can kind of troubleshoot themselves and try to figure things out.

I don't know what our tech guy does in their school. There's one guy. He's there all the time. And in my first year, I was so frustrated. I was fixing everything, and teachers were scared to use that, because if it breaks down, they don't know what to do with it. So, I actually set up a computer club. And now, I have students going around and fixing teachers' computers.

Survey data supported our impressions that, within Illinois, patterns of technology support seemed to vary greatly between Chicago Public Schools (CPS) and the rest of the state. Based on 1999 data analyzed by Solmon & Wiederhorn (2000), about half of CPS schools had technical support from staff hired to deal with computers, versus three-quarters of schools in the rest of the state. As a result, it reportedly took an average of 52.5 hours to repair a breakdown in CPS schools, compared with an average of 40.5 hours in schools in the rest of Illinois (Solmon & Wiederhorn, 2000).

BARRIERS TO TEACHERS' USE OF TECHNOLOGY

The OLTR literature review includes an extensive section on barriers to teachers' use of technology (Gyllenhaal, 2002). The review includes a reference to Smerdon *et al.* (2000), who found that the most frequently barriers reported by teachers were:

- **Lack of release time** to learn how to use computers and the Internet (82 percent)
- **Lack of time in the schedule** for students to use computers in class (80 percent)
- **Not enough computers** (78 percent).

Since the OLTR teachers somehow found time to participate in this project, perhaps it's not surprising that they didn't talk much about their lack of time to learn about or use computers with their students. However, some OLTR teachers did complain about the lack of computers in their classrooms or the difficulty with scheduling time for special projects in the computer lab.

Among OLTR teachers, we found evidence of two more barriers to computer use in schools:

- **Poor technical support**, either because there was too little support staff, or because the support staff did their jobs poorly, if at all. (See the section on [Support for Teachers' Use of Technology](#).)
- **Unreliable school networks**. (See the section on [Access to Multimedia](#)).

The literature review also cites a study of California schools by Cuban (2001), who stated that most teachers showed little evidence of "technophobia" or resistance to using information technologies. In contrast, a number of OLTR teachers told us about teachers at their schools who still resisted using technology. These teachers' lack of experience with technology seemed to affect their attitudes about computers, which in turn became barriers to their computer use.

We've got some of the more veteran teachers that haven't been around technology or haven't had to use this kind of technology. [They] don't see the need to learn how to do it.

TEACHERS' PREFERENCES FOR ON-LINE RESOURCES

Before we discuss specifics about what Shedd's on-line resources should look like and how they should be structured, we discuss some larger questions about what teachers seem to want and need in on-line resources.

Readers will note that many of the headings in this section are phrased as either/or questions. We can summarize our findings about these questions as follows: Whenever we presented OLTR teachers with either/or choices, as a group, they always wanted both! That's partly because K-12 teachers are an extremely diverse group, and partly because many of teachers' most pressing needs are not being successfully met by what's currently available to them on the Web.

What Are Teachers Looking For?

The OLTR teachers told us that when they turned to the Web for lesson planning, they were trying to fill specific needs related to their curricula. Sometimes they were looking for ideas that would become the core of entire lessons, but more often they were looking for information or individual elements that would complete a lesson they were already developing. Often they had to sift through large amounts of Web material to find something they could use.

Some OLTR teachers had great latitude in developing new lessons, but many teachers told us their curriculum was already so packed or tightly structured that they didn't have time to consider Web sites that didn't fill a specific curriculum-related need. These observations by OLTR teachers were very similar to what Gyllenhaal & Garibay (2001) reported from the *MuseumLink-Illinois* teachers several years ago.

Therefore, we conclude that *On-line Teacher Resources* developers should structure the Web site so that teachers can quickly determine what resources are available and quickly locate the resources that best fit their needs. We'll discuss specifics about how to do this later in this report.

For Teacher or Student Use?

Do OLTR teachers want Shedd to develop on-line materials that they can use themselves for lesson planning, or on-line materials that their students can use as part of lessons developed by teachers? Almost all the OLTR teachers currently can and do use on-line lesson planning resources. Currently some teachers have a difficult time giving their students access to materials on the Web, but based on current trends, it appears that many of these difficulties will be alleviated over time—at least for teachers of upper elementary and secondary grades.

Therefore, we conclude that teachers want and need both on-line materials for their own use in lesson planning and materials that their students can use directly, whether on- or off-line.

For most teachers, planning a lesson involves coordinating both teacher and student materials, and they said it would be wonderful if they could find them both in one place.

About Topics or Concepts?

The OLTR teachers' initial reactions to the content of Shedd's printed teacher guides were that they are centered on *topics, themes, or subject areas*—i.e. that the guides are about what's listed in the titles, such as oceans, fish, sharks, and so forth. Many OLTR teachers taught these topics in their classrooms, sometimes integrating them into month-long themed units on oceans or fish. These teachers knew immediately that they had found a resource they could use.

For teachers who didn't teach these topics, their initial reactions were that they couldn't use Shedd's guides. This initial negative reaction seemed most common among teachers of secondary grades. However, once these teachers opened the guides and started skimming the contents, they quickly realized that the guides were also about *concepts* that they *did* cover in their courses, such as adaptation, classification, buoyancy, and evolution. Then they realized that they would be able to use some of the activities in their classes.

Therefore, *On-line Teacher Resources* developers should ensure that teachers can quickly identify *both the topics and concepts* covered by the on-line lessons and activities.

This finding has important implications for:

- **Structure.** The overall structure of the *On-line Teacher Resources* Web site.
- **Searches.** The strategy for supporting searches both within the site and by external search engines. Teachers need to find these resources whether they are searching the Web by theme or by concept.
- **Titles.** The titling of individual lessons and activities, both in the site directory and at the level of individual Web pages.
- **Publicity.** Efforts to publicize the *On-line Teacher Resources* Web site.

Activities or Information?

All the OLTR teachers seemed to appreciate that the printed teacher guides focused on hands-on activities they could do in their classrooms with their students. The teachers told us that they liked to teach with activities—or, as the secondary teachers often put it, using labs—and they currently search the Web to find activities and labs that they can use.

However, many teachers also stressed the need to provide their students with background information about the activities, and they also searched the Web for in-depth information about the subjects and concepts that they cover. The OLTR teachers' desire for information seemed to take two forms:

- **Background information for teachers:** Many teachers—especially on the elementary level—told us that they lack in-depth knowledge about the topics and concepts covered in Shedd’s teacher guides. They wanted easy and appropriate access to background information so that they could answer their students’ questions. With the printed guides, they seemed to appreciate sidebars—they didn’t like having information integrated into the procedure sections of the activities, and they often didn’t notice longer background sections included several pages before a given activity. It seems likely that many teachers will appreciate finding the on-line equivalent of sidebars linked to the on-line lesson plans.
- **Background information for students:** The OLTR teachers also told us that they wanted access to background information that they could present directly to their students, especially background readings written on a level that their students can understand. Many teachers told us they had a hard time finding on-line readings at appropriate levels for their students. This seemed to be a major problem for middle school teachers. They told us that Web sites that cover the concepts they teach are usually written for high school students and above, and that sites with an appropriate reading level do not cover concepts in an appropriate depth for middle-school students.

Given the goals for the project, it seems that first priority for the *On-line Teacher Resources* developers should be to incorporate appropriately linked, in-depth background information for teachers.

If time allows, developers should also develop background readings tailored to students on various levels. If the *On-line Teacher Resources* grant does not include sufficient funds to develop student readings, then this should become a priority for future grants.

Classroom or On-line Activities?

All of the OLTR teachers said they want and need hands-on activities and demonstrations that they can use in their classrooms. Almost all of them currently search the Web for specific classroom activities to fill specific needs. A wide variety of classroom activities were presented in the teacher guides, and almost all of them attracted favorable comments from one or more OLTR teachers. High school teachers seemed particularly enamored with activities that involved their students in analyzing real-world data, and *On-line Teacher Resources* developers should keep that in mind as they develop activities for the upper grades.

What about on-line activities that students can use independently or in small groups, as part of a larger lesson about a topic or concept? Many OLTR teachers said they did not use on-line activities with their students, either because on-line access was difficult (or impossible) for their students or because they regarded their students as too young or inexperienced to access the Web on their own. However, those who did use on-line activities seem convinced of their value.

Most of the OLTR teachers didn't seem to consider on-line activities to be replacements for regular classroom activities, but as introductions to, follow-ups on, or supplements to the sorts of activities they have always pursued in their classrooms.

It seemed that upper elementary and secondary teachers were more likely to use on-line activities with their students, whereas lower elementary teachers seemed to use more CD-ROM-based activities and games. The high-school teachers seemed, by far, to be most comfortable with on-line activities, and several of them subscribed to on-line science Web sites that provided such activities for their students.

Therefore, *On-line Teacher Resources* should focus on providing activities that teachers can use in their classrooms, regardless of their students' level of access to classroom computers.

Because more experienced teachers value on-line activities, program staff should also develop on-line activities that support the lesson plans and that can be used directly by students, especially on the upper elementary and secondary levels.

Because access to the Web is still a problem in some classrooms, program staff might also explore the possibility of developing activities that can be downloaded and used off-line.

To Print or Not to Print?

Almost all of the OLTR teachers had convenient access to printers in or near their classrooms, as did 78 percent of teachers responding to a national survey (Ronkvist *et al.*, 2000). However, the OLTR teachers' use of their printers varied greatly. Some of them almost never printed anything accessible on the Web; others printed from the Web several times a week, incorporating the hardcopies into elaborate systems of files or notebooks that supported their daily lessons.

Because many teachers do print from the Web, we recommend that:

- **Developers should provide links to “printer-friendly formats” for *On-line Teacher Resources* Web pages**, especially complete lesson plans and critical parts of them, like materials lists and procedures.
- **These printer-friendly formats should include HTML and similar formats that do not require plug-ins.** Although almost all of the OLTR teachers had used PDF files, there's no guarantee that Adobe Acrobat will be available on the computer they currently are using, and installing plug-ins can take several days at many of the OLTR schools. **Even when formatting seems critical for a document, developers should include both HTML and PDF versions**, because both have advantages (Gyllenhaal & Garibay, 2001; Nielsen, 2001).

In What Ways Should Lesson Plans Address Learning Standards?

State and National Standards

The OLTR teachers told us that, in general, they were much more concerned about state standards than national ones.

[National standards are] not an issue at the high-school level, because it's just state standards. I couldn't tell you what the national standards are, really.

However, a few OLTR teachers said their districts focused on both state and national standards.

With our district, the curriculum committees are comparing not only state standards, but [also] the national standards, and incorporating both of those with the curriculum guidelines.

Teachers who were working towards national certification also said they were paying attention to national standards and sometimes bringing them to the attention of their schools.

I went through the national board certification last year, so I was inundated with national standards.

I'm going to be doing [national standards], because I'm going for national certification....So, I'm going to be responsible for seeing that the national standards are kind of being observed [in our school].

Local Implementation of State Standards

The OLTR teachers told us that their local districts had various ways to ensure that teachers met the state standards in appropriate ways. Some teachers told us that their districts had developed their own standards, based on the state standards.

[Our district] has their own set of standards. Some are piggybacked on top of [state standards]. Some become more explicit, more detailed.

In some districts, state standards were built in at the level of district curricula.

We're given curriculum guides that address the state standards, and then our instructional specialist from the district will come in and give us suggestions and ideas on ways to meet the state standards....I just assume that whatever we're doing is in line with the state standards.

[Our district] has curriculum committees, and they decide what the curriculum is going to be in the different grade levels. They build the curriculum models based on the state standards, and then they tell the teachers that they need to teach those things. The curriculum committees are teachers who are coming together and looking at our current curriculum and working to realign it constantly with current strategies.

In other districts, state standards seem to be accounted for at the school level, as teams of teachers work together to ensure that standards are met.

We work in teams for our different subject areas, and one of the things that we need to be sure [of is] that we're covering in the state standards. We map a course outline with the state standards, so, we can say that we're covering this topic and this is a way that we're going to do that, and this is the particular standard that it's covering. Then, if [as individual teachers] know that if we don't do that particular activity or if we don't do that particular thing, then we need to substitute something else that will also cover that particular standard.

In still other districts, teachers seemed to have a bit more leeway in how they meet the standards.

Once or twice during the school year, during like an institute day, all of us kind of re-evaluate our course outlines and how they address the state standards. I don't think we're quite as tied into lesson plans [as some of the other teachers in the group]. We kind of fly by the seat of our pants a little more. But I think we hit the mark anyway.

The teachers we talked with also had a variety of ways of ensuring that their individual lesson plans would help their students meet state standards. Teachers from the Chicago Public Schools explained how their system is designed to guarantee coverage of the state learning standards.

In Chicago, we have a course outline that we have to follow for each subject. So basically, just to cover the course outline, we have to [follow the standards]. That's all. And every time we make lesson plans, we have to see if [it meets state].

Most OLTR teachers, though, didn't seem too concerned about meeting state standards at the level of individual lesson plans.

You find something that's worthwhile and has to do with the content that you're doing, or the concept, then you do it. Then, if somebody would ever call you on the carpet and say, "Well, what standard is that?" you could go through the book and find one. Because the standards are well written, but they're also real broad.

To be honest with you, a lot of the standards are so loose, that just about anything we're going to do is going to cover that. So, it's more about covering the content area than covering the state standard.

In fact, covering state standards didn't seem to present major difficulties to most of the teachers we talked with.

[Covering state standards] isn't really a critical issue. But they make it seem like it's a critical issue, so everybody gets all hung up about it. But if you're doing good planning, you should be able to do that. After all, the state goals reflect what teachers have been saying for years that they do. So, that's all it is.

However, a few teachers mentioned that all the attention to state and national standards bothered them in some ways.

I don't [want] to have someone watching over my shoulder. That bothers me. If you're doing a good job, you should be able to do all these things.

Still, most of the OLTR teachers said that the on-line lesson plans should include references to both state and national standards.

I don't think it could hurt. If you know that a particular activity will cover state standard X, Y and Z, then you know that you've covered those standards, and it just gives you another formal documentation to be done on it.

As far as marketing it, you definitely want to have those in there. As far as myself, if I'm looking, that's the last thing I look at, though.

Going back to marketing this, the Shedd [lesson plans] on the Web. I'm sure that anyone in the United States, and therefore the world, could do it. But as far as the United States, you'd want the national standards on there also.

Although most teachers won't be consulting the standards in detail, we recommend that Illinois and national standards be listed in detail, both as a way of showing that Shedd is aware of the challenges that teachers face and as a resource for those teachers who will actually use them as they plan lessons.

Addressing Literacy Standards

There is no question that literacy is a big issue for many OLTR teachers, especially those from the Chicago Public Schools.

Here in the city, we [have a] lot of at-risk students. For example, the ones I deal with, seven out of ten Hispanics don't finish high school. So, we know what kind of job has to be done. And, yes, literacy is a big issue there. We have to develop special strategies to meet those needs. But then again, six out of ten blacks don't finish high school, so they're also at risk. This is the inner-city kind of environment.

I have to say that getting my students—any of them, whether it's AP or general Biology—to read anything out of the book is like literally pulling their teeth out. I mean, they don't like to read. And I can't say I blame them. I mean, it's boring. A lot of it is above their heads. It's a foreign language to them. And it's not nearly as entertaining as getting on the Web and doing something that's interactive. If you can get them to do something interactive, if they have to read, that's fine. But it's got to be something quick. I mean, they don't have a long attention span, period. And I know you cannot force it. They don't operate that way. So, literacy or not, I don't like it, but they don't read.

We weren't surprised when elementary teachers told us of the many ways that they integrated reading and writing into other subject areas. At the middle- and high school-levels some subject-area teachers said they didn't directly address literacy in their lesson preparation, although their schools had other ways of helping students how need extra support.

Honestly, I haven't had to deal with it. We have a reading program in our school, in order to kind of assess where students are at, and then, within our course, we pull out students who are low readers, and then, they get additional help, if needed.

I don't look at literacy standards, per se. But at our school, the way they divide the kids into different levels is mostly by their reading skills. And so, I get the low readers, the low level readers. What my and my co-teacher's concern is whatever reading we give them to do, can they comprehend it? So, I co-teach with a Special Ed teacher, and she usually takes stuff and rewrites it and does a reading level check on it. We try to keep the reading level between, say, fifth and eighth grade for a sophomore class, because we'll lose them. We'll lose kids, just because the reading is too hard. One of the things I'll be looking for is to make sure that the kids can comprehend the reading that's involved with whatever [OLTR] lessons are developed.

A few subject-area teachers said they were finding ways to incorporate at least some aspects of literacy in their science lessons.

We implement a reading program of vocabulary words of the day. Everybody does it in the whole school, and we're starting to think about doing some vocabulary just for the science lab. But that's out in the future.

I try to get a newspaper or a journal article, something that's current, up-to-date..., and I have them read it. I try to get a shorter one, because like you said, attention spans are pretty short. And then, they have to read it, but not just read it for the fun of it. Then, they have to write a write-up on it. They have to write down a paragraph about the issue. Then, they have to draw out all the evidence that's backing that issue up that was written in the article. And then, the last part, they love. That's their reaction to it. So, do they like it? Did it apply to them? Why or why not? And stuff like that. And that's how I really try to hit literacy in my classroom.

We have a reading program, and my choice is always [reading that has to do with] what we're talking about in science. I don't use anything else.... We do it once a week for 15 minutes, and I always test them on it. You're not supposed to; you're just supposed to let them enjoy the reading. But I want to think of the learning and make sure that they just aren't daydreaming. So, that's how I manage it.

We recommend linking the OLTR materials to literacy goals in several ways, including mentioning appropriate state literacy standards in the standards list developed for each lesson plan, and by providing a range of opportunities for students to use, develop, and practice reading and writing skills within the contexts of OLTR activities.

Addressing Technology Standards

Most OLTR teachers said their districts didn't yet have technology standards in place, at least not in a way that applied to most classroom teachers.

The technology classes are separate. Like, we're core teachers, so we teach the math, science, like that. There are separate technology classes that the kids take. .

I definitely push technology a lot on my students, but they're not pushed from the administration, really, because they're not tested. They don't even know how to test them yet. They don't know how to implement them yet.

Some teachers said they could see technology standards coming to their districts.

You can definitely see that they're moving toward making technology a mandated part of the curriculum, obviously, in some time in the near future. That's what I feel.

They're proposing to integrate technology standards, and I don't know if that's going to go through....I know on the new report cards coming out next year, there is a technology component, and the students are graded on it.

Therefore, it seems that OLTR developers should plan now for the future acceptance and implementation of technology standards at the district, school, and classroom levels.

We recommend linking the OLTR materials to state and national technology standards by mentioning appropriate standards in the lists developed for each lesson plan.

FINDING AND USING LESSON-PLANNING RESOURCES

Here's a short summary of what we've learned about how OLTR teachers find, evaluate, and use on-line lesson planning resources.

Finding On-line Resources

The OLTR teachers seemed to follow several major strategies for finding on-line resources they could use for lesson planning.

- **Search engines.** These included both general search engines like *Google* and *Yahoo!* and child-centered search engines like *Yabooligans*. We were interested to note that the OLTR teachers seemed to use search engines much more frequently than the *MuseumLink-Illinois* teachers who were studied in depth in 1998-1999 (Gyllenhaal & Garibay, 2001).
- **Knowledgeable people.** Teachers consulted with their schools' tech teachers, media center specialists, librarians, or their more tech-savvy fellow teachers—either in person, by e-mail or notes in their boxes, or by following links posted on Web sites developed by people they knew personally.
- **Trusted Web sites.** These included Web sites with collections of lesson plans or other links for teachers; Web sites developed by their district and specifically tied to their district's curriculum; university, governmental, and organizational Web sites; and selected commercial sites, including both free and subscription sites, such as *Scholastic.com*, *Yahoo!.com*, and *biology.com*.
- **Print sources.** These included more recent textbooks; magazines, like *Technology and Learning*, *Classroom Connect*, *Scholastic News*; children's magazines; and more general sources, like local newspapers.

Many teachers had a preferred strategy: Some started with a general Web search; others started first at a trusted site; and others started by asking people they knew *before* they went to the Web.

Some teachers said they didn't need to ask for resources—information just came to them.

We have the Library Media Specialist, who works alongside with our tech guy. He is forever sticking messages in my mailbox about different science sites. "Hey, I know you're studying this unit. Here's a Web site I found." Just tons and tons—too many to keep up with. But, I mean, it's great to have someone doing that.

Our tech support sends us an e-mail of interesting [Web] sites and sites of interest. So, I'll go and browse those and see what I want and I'll just mark it. She does that on a weekly [basis sometimes], otherwise, it's monthbly. So, I go through and check those when I have time.

Relatively few of the OLTR teachers told us they used listservs or on-line bulletin boards to find out about new Web resources. However, it seems likely that the tech teachers, media center specialists, and librarians who they rely on may be more apt to pay attention to those sorts of information resources.

Shedd developers and programmers should attempt to:

- **Publicize the OLTR Web site in a range of print and on-line media, including bulletin boards and listservs that would be used by tech teachers, media center specialists, and librarians.**
- **Become listed in a range of educational Web directories used by teachers (and their students).**
- **Optimize the OLTR site for the sorts of general search engines used by teachers to locate lesson plans by content/subject matter or scientific concept.**

In the next section, we discuss ways in which Shedd can reinforce its status as a trusted Web site.

Evaluating On-line Resources

Many of the teachers we spoke with seemed a bit naïve in their judgments about the credibility of materials that they find on the Web. Some of the strategies they used:

- **Suffixes:** They looked for suffixes that were associated with governmental, educational, or other non-commercial organizations, like “gov,” “edu” or “org.”
- **Contradictions:** They kept an eye out for information that contradicted other sources or that seemed at odds with what they already knew.
- **Trusted Web sites:** They used sites they trusted because they were developed by teachers or other trusted educators; because they were developed by trusted organizations; or because they had used the sites previously with good results. Examples of trusted sites included those associated with *National Geographic*, *Ranger Rick* magazines and *The Discovery Channel*

Although there are numerous Web sites that advise teachers on how to evaluate Web sites for possible classroom use—and provide evaluation forms for teachers to use as they examine sites—few OLTR teachers seemed to use these sites to guide their examination of prospective Web sites. Few, if any, used forms or other formal evaluation tools to rate the Web sites they found.

Based on our interviews with OLTR teachers, it seems likely that Shedd will start out with a great deal of credibility. There seem to be two types of credibility in the teachers' eyes:

- **Subject-matter credibility:** Is the site a source of accurate content information?
- **Educational credibility:** Is the site a source of sound pedagogical strategies?

Given the strategies that some teachers use to evaluate credibility, it seems likely that Shedd's Web site can lose credibility in several ways.

- **Subject-matter credibility can be lost** if errors slip through due to inadequate content reviews or poor editing.
- **Educational credibility can be lost** if suggestions on the site contradict what teachers regard as good practice—for instance, if grade-level assignments are too broad or materials lists are unrealistic or incomplete.

We recommend that Shedd developers and educators work to maintain teachers' trust as a provider of content that is both scientifically accurate and educationally sound.

Using On-line Resources

Overwhelmingly, OLTR teachers told us that they usually adopt only parts of the lesson plans they find on the Web.

Usually, it's like you have an idea, and you're just looking for a little bit of backup to use it with. For me, it's not like I'm just, 'what am I going to do tomorrow?'

On those occasions when they did use a whole activity from a lesson plan, they adapted it to fit their needs.

I think it's hard to take someone else's lesson plans. You take materials. You may get copies of articles or you may get Web sites and things like that. But you know, everyone's going to do things in their own way, so you may not follow their same sequencing, in terms of how to incorporate it. So, I guess bits and pieces would be the most accurate way of deeming how you use it.

[I use other peoples' lesson plans] for other ideas. If there's something maybe I've noticed or that tie in with mine. I don't necessarily use them, you know, just the way they are. Like if there's a good trade book that they know of that I don't know of. Another resource for the kids to use.

We wondered if less experienced teachers might be more apt to adopt complete lesson plans, but the OLTR teachers said even beginning teachers liked to write their own plans.

I took in a student teacher that I encouraged to do more science-related [activities] this year, because she wasn't comfortable. And I think she used regular books and things like that and just kind of

developed what she needed. She went on-line to get more materials and information. But I don't think she brought anything as a standard, put-together little lesson plan from someone else. I thought she was really kind of energetic and wanted to put herself into the lesson. I would think if you're new and excited, I don't know if you'd just want to take somebody else's.

They've got so much up there, they want to do their own thing. They don't want to be tied to somebody else's ideas.

However, teachers mentioned one situation where other teachers might be likely to adopt more complete lesson plans.

[Someone who] has now been forced to teach science or teach something that they're maybe not absolutely comfortable with. They may rely on someone else's resource.

In part this pick-and-choose behavior seemed to reflect practical realities, such as the difficulty of finding materials that exactly fit the teachers' needs and didn't violate the many constraints in the classroom—limits to time, money, and energy. However, one of the most important reasons teachers cited for picking and choosing among aspects of lesson plans was the need to adapt materials to the abilities and interests of their students. Teachers said they couldn't even use their own lessons as-is from year to year.

Because you get a different group [of students] every time. You know, it's the luck of the draw. Sometimes, you get kids that are very advanced, pretty much hands-on. And other times, they're very slow, as far as that goes. So, whatever the kids have, you can adapt whatever lesson plans are there.

That depends, too, on the class dynamics. The lessons that I do this year won't necessarily fly next year, because it's a whole different group of kids. So, you might think, OK. Boy, I have the best unit ever. And next year, you get a whole new group of kids. And, well, it just doesn't feel like it's going to work.

Professional pride also seemed to be involved—teaching is their profession, and designing unique and personalized lesson plans is an important aspect of teachers' work.

You're given that creativity, so you're going to pick and choose and get your own, as opposed to just borrow.

This pick-and-choose behavior was also noted among teachers associated with the *MuseumLink-Illinois* project (Gyllenhaal & Garibay, 2001). Some of the OLTR teachers who had worked on curriculum-development projects had noted similar behavior among the teachers they served.

You give the teachers the lesson plans that are in the curriculum guides, and then, they pick and choose what they want. And it isn't always the whole lesson plan that we created. It's aspects of it.

Although they usually just picked-and-chose from on-line lesson plans, many OLTR teachers still said they preferred to find on-line resources formatted into a familiar lesson-plan style. That seemed to be because many of them used a similar format to write up their own plans for a period, day, or week, and because they were used to finding other on-line resources in

that format. Some OLTR teachers implied that they made use of the lesson plan format by going just to the few parts of the plan that interested them.

If I go on-line, what I'll do is I'll go to a lesson plan Web site....I want to know what the activity is, what the objective is. And if the objective in the lesson plan is something I'm interested in doing, then I'll find ways to meet that objective my own way.

Many teachers also said they specifically searched the Web using the term “lesson plan,” because that helped narrow their searches to the sorts of resources they could actually use in their work.

A few OLTR teachers said they preferred finding resources that were not in a lesson-plan format.

Because it's confusing for me to try to think through how they're approaching it. I would rather just get the material, the bulk of it, and then, figure out how I'm going to introduce this or how I'm going to make use of this.

A few teachers also mentioned ways that Shedd could make it easier for them to adapt what they found on the OLTR Web site.

If it's in a Word doc or a whatever, it's easily molded by teachers, so, we can do those manipulations that we want to do with it. We can twist it any way we want a lot easier than scanning it in, hoping that it gets all the words correctly.

We recommend that the *On-line Teacher Resources* developers:

- **Develop activities and related plans within the lesson plan format, but...**
- **Consider methods to support teachers' pick-and-choose behavior.**

We discuss appropriate lesson plan formats in detail later in this report. However, at this point we're not certain of the best methods to support pick-and choose behavior. We suspect these methods could cover anything from the overall organization of the site to details of particular lesson plan elements. One method that we discussed with OLTR teachers was the possibility of including MS Word versions of entire lesson plans that so that teachers could readily adapt them to their needs. Although this appealed to some teachers, most OLTR teachers said they either hand-write their plans or fit them into computerized formats that wouldn't adapt readily to cutting and pasting large blocks of text. However, some formatted handouts for students might be made available as files that can be downloaded and opened in word processing programs.

CAVEATS ABOUT EVALUATING TECHNOLOGY WITH PROJECT TEACHERS

Many of the OLTR teachers—especially the Southern and Central Illinois representatives—were chosen because their schools seemed to be making good use of information technologies. Based on this observation and several other lines of evidence, it seemed likely that, as a group, the OLTR teachers are more skilled with computers than many other Illinois teachers. However, we discovered that there is a fair amount of variability within the OLTR sample, especially among teachers from the Chicago Public Schools.

These findings have several important implications for the use of OLTR teachers in formative evaluation of Web products:

- If OLTR teachers have trouble using a Web product, then we expect that many other Illinois teachers will experience similar or worse levels of difficulties.
- Even if a Web product works for the most of the OLTR teachers, we can't assume it would work for most other teachers. The *MuseumLink-Illinois* evaluators reported that, for this reason, they expanded their formative samples beyond the original pool of *MuseumLink* teachers to include teachers less sophisticated about technology (Gyllenhaal & Garibay, 2001).
- Given the variability within the OLTR group of teachers, we may be able to designate some teachers as experienced users and others as less experienced users, at least for the formative testing. We would still recommend bringing in non-OLTR teachers for the later rounds of testing.

RECOMMENDED BEST PRACTICES

Project Goals and Objectives

Based on what we've learned so far, here's what we can say about the overall goal for the *On-line Teacher Resources* Project:

- **Although one goal of the project will be to write high quality on-line lesson plans, the expectation should *not* be to have teachers use these plans “as is” in their classrooms.**
- **Rather, the overall goal for the project should be to help *teachers* write great lesson plans by providing them with resources they need in a convenient and accessible form.**

Because most teachers have ready access to the Internet, Web-based lesson plans are likely to be accessible to most Illinois teachers. Therefore the objectives become to:

- **Help teachers find the *On-line Teacher Resources* Web site given the various ways they locate on-line resources.**
- **Make it easy for teachers to navigate to exactly the resources they need once they reach the *On-line Teacher Resources* site.**
- **Create resources that are credible, easy for teachers to use, and will produce outcomes that are closely related to teachers' own goals.**

Design of the *On-Line Resources* Web Site

Based on our discussions with project teachers, we make several recommendations about the design of the *On-line Teacher Resources* Web site:

- **Home page.** Because the primary function of the project is to provide resources for teachers, the project's home page should be directed primarily at teachers. An effort should be made to see that this page is indexed by search engines and directories aimed primarily at adults—and particularly at Web sites that provide support for K-12 teachers.
- **Site-specific search.** The home page should include a site-specific search function, and site's individual pages should be indexed in such a way that teachers can find appropriate pages whether they are searching by topic or by concept (see the earlier section entitled, [About Topics or Concepts?](#)).
- **Directory.** The home page should include a directory of lessons, activities, and other resources—arranged both by topic and by concept. This directory should allow teachers to scan the home page and get a good idea of exactly what they can find on the site.

- **Students’ home page.** Since many pages on the Web site will be directed primarily at students, it seems reasonable that these pages should be linked to a secondary home page directed primarily at students. This page could be indexed for search engines and directories aimed primarily at students (*Yabooligans* and so forth).
- **Each lesson plan a separate module.** Although a given lesson plan may include many pages of text and activities, it should be presented to teachers in such a way that it feels like a coherent whole.
- **Separate URL for each page.** Many Web sites use frames or other applications in such a way that it is difficult or impossible to bookmark individual pages (without losing links to the menu and banner frames). The OLTR teachers told us that they frequently bookmark pages, both for themselves and for their students. Therefore, we recommend that the *On-line Teacher Resources* Web site be designed in ways to facilitate—and even encourage—bookmarking of individual pages.

Design of Individual Lesson Plans

What Elements Should Be Included

The OLTR teachers liked the overall format for Shedd’s printed activity guides, and it seems reasonable that all elements of that format be retained in approximately the same order that they are presented in the current guides. In addition, because the Web allows possibilities that don’t exist with traditional paper guides, we recommend including a variety of additional elements in the *On-line Teacher Resources* Web plans.

The following section includes discussions of lesson-plan elements for which we have data, either from the OLTR teachers or the literature review. There are other elements for which we have no data—for instance, given the limited time available, we were unable to discuss the “Extensions” and “Problems” sections of the *Oceans Activity Guide for Grades 6-8* with teachers, apart from their overall comments about the guides. Although these elements are not included in this discussion, they may still be worth including in the pilot version of the Web site.

We include two separate sections for this discussion:

- **Elements aimed primarily at teachers**
- **Elements aimed primarily at students**

Elements Aimed Primarily at Teachers

Branding. Every page of the Web site, whether viewed on screen, printed from the Web, or downloaded as a PDF file, should display:

- **Shedd’s name** and home page URL
- **The project’s name** and home page URL
- **The activity or lesson plan’s name** and URL

Descriptive title. The title should describe both the topic or subject area (e.g., fish) and the primary concept or concepts taught through the activity (e.g., adaptation, streamlining). Whenever possible, both the page title and the title displayed on the menu of activities should include both the topic and the concept.

Tagline. The *Oceans Activity Guide for Grades 6-8* guide includes a summary phrase or sentence directly under the title. This sort of tagline will be even more important on the Web, particularly if it appears in search results and as the first phrase read by teachers after the page title.

Grade level. The suggested grade level should appear near the top of every lesson plan and, if possible, in both internal and external search results.

The OLTR teachers seemed very sensitive to:

- **Overly broad** grade-level assignments—“K-8” was described as a “red flag” by one teacher.
- **Mis-assigned** grade levels—some teachers described some activities as assigned to the wrong grade level, usually because they seemed either too advanced or too simplistic for that teacher’s own students.

Therefore, one of the goals for formative testing should be to develop an understanding of:

- **Teachers’ perspectives on grade-level assignments** for individual activities.
- **Appropriate phrasing** of the grade-level assignments (in ways that limit the possibility that teachers will take offense when the assignments don’t match their perceptions of their own students).
- **Ways to adapt activities for more or less advanced students.** OLTR teachers suggested including ideas about how to adapt activities to different levels, rather than developing several different versions of the activities for different age levels. (In part that was because they thought they might revisit the lesson plan later and incorporate the different levels the second time around.)

Objectives. The OLTR teachers seemed to appreciate the short, clearly stated objectives at the beginning of every plan.

Goals and standards. As discussed earlier, the OLTR teachers had lots to say about state and national standards (see the earlier section entitled, [In What Ways Should Lesson Plans Address Learning Standards?](#)). Based on what they told us, we recommend linking the classroom activities, on-line activities, and other resources to both state and national standards using a format similar to the current teachers’ guides.

Science-related standards seemed most critical to the OLTR teachers. Literacy and other non-science-subject area standards seemed more important to teachers of the elementary grades. Very few of the OLTR teachers seemed concerned with technology standards, although that could change over the next few years.

Time. Although the OLTR teachers seemed to appreciate that this element was included in the Shedd's printed guides, they often quibbled with the suggested durations for the activities. We recommend working with the OLTR teachers during formative testing to develop:

- **Time assignments** for individual activities that seem appropriate to the OLTR teachers.
- **Details** about advance preparation time, day-of-activity set-up time, class time, clean-up time—and possible variations in the time for different age and ability levels—which might be included on a separate Web page linked to the short summary statement on the main activity page.

Materials. Materials lists were considered a vital part of the lesson plan, and the OLTR teachers had strong feelings about a number of aspects of these lists:

- **Complete lists.** Make sure the lists are complete. As one teacher emphatically noted, if the jars need their lids, then say so on the materials list!
- **Common materials** Make sure the materials are widely known and commonly available. One downstate teacher complained that she didn't know what a smelt was, and she didn't think her local supermarket carried whole ones.

Vocabulary. Some of the OLTR teachers appreciated the vocabulary lists, but others did not seem interested in them. They are probably worth retaining in some way, possibly as a link from the main lesson plan page. The linked page might include both a word list with definitions and a word search, a crossword, or another simple activity to help students practice their new words.

Procedure. Based on discussions with the OLTR teachers, we recommend describing the complete procedure on the main activity page. That's because teachers:

- **Skim first.** Teachers need to first skim and then study the procedure when they're deciding whether to adopt the activity or lesson.
- **Print intact lessons.** Some teachers will want to print the page with all major features intact. They would either keep the printout at their side during the lesson (in case there were any questions they couldn't answer) or put the printout in their files to refer to whenever they did the activity again.

There will also be situations where it would be useful to include a detailed procedure as a separate printout—for instance, if older students will need to follow written instructions to complete an activity or lab. In this case it would seem useful to include the printout in several formats, including:

- **HTML** (for convenient on-line reading)
- **PDF** (when formatting is important)
- **MS Word or RTF** (so that teachers can easily adapt the procedure to their own needs)

Background information for teachers. As stated earlier in this report, some teachers considered background information to be an extremely vital aspect of the teacher guides, and there seemed to be an overall preference for the sidebar format. We highly

recommend including links to background information—the hypertext equivalent of sidebars—rather than putting detailed information on the main activity or lesson page.

Graphics that support the lesson plan. The OLTR teachers seemed enthusiastic about the possibility of including more and better quality graphics with the on-line lesson plans. They spoke highly of:

- **Diagrams** that support and explain the activities detailed in the lesson plans.
- **Photographs** that show the “real thing,” since their students had rarely experienced the real thing firsthand.
- **Animations** that illustrate key scientific concepts in a clear and engaging way.
- **Interactive graphics** that students can manipulate on-screen to explore a concept in depth.

Many teachers wanted to print graphics to show their students, and others wanted to show the graphics to a large group on a screen. Therefore, it seems useful to include:

- **Smaller versions** of the graphics incorporated into the overall flow of the main activity or lesson plan page.
- **Printer-friendly versions** of the graphics linked to the main page (in several formats).
- **Screen-friendly versions** of the graphics linked to the main page (either formatted for a common screen size or programmed to automatically fill a number of screen sizes).

Handouts for students. Many OLTR teachers were very positive about the data sheets and other handouts included in Shedd’s printed guides. However, some of the teachers said they would need to modify the handouts, while others thought that they might even need to retype the whole handout. Therefore, as with similar cases discussed earlier, it would seem useful to include the printable handouts in several formats, including:

- **HTML** (for convenient on-line reading)
- **PDF** (when formatting is important)
- **MS Word or RTF** (so that teachers can easily adapt the procedure to their own needs)

In addition, some of the OLTR teachers suggested developing short follow-up activities to print out for the students, like word searches, crossword puzzles, and so forth. They said they often use these sorts of activities to fill short time intervals at the end of a period or between major activities.

Related on-line resources for teachers. Whenever possible, the on-line activities and lesson plans should include links to related Web sites with background information and related activities. (Of course, this implies an ongoing maintenance budget, so that someone periodically can weed out and replace dead links.)

Lists of print resources for teacher use. Gyllenhaal & Garibay (2001) summarized their findings about teachers’ needs for print resources based on the formative evaluation of

the *MuseumLink-Illinois* project. Shedd's developers should consider listing several types of print resources in the teacher section:

- **Background information** for teachers' use.
- **Trade books for student use**, to help teachers extend the activity for student literacy.
- **References cited**, which may increase the credibility of the site for some secondary teachers.

Comments from teachers who used the activity. Several OLTR teachers told us how much they wanted to find out how other teachers had used a given activity, lesson plan, or other Web resource. Gyllenhaal & Garibay (2001) reported similar requests from many of the *MuseumLink-Illinois* teachers. Developers should consider providing the following types of information—in the teachers' own words whenever possible:

- **Success stories.** Short descriptions of how teachers successfully adapted the activities to their own classrooms.
- **Less successful uses of the activities.** Teachers' own descriptions of some of the problems they encountered when using the activities—and, if possible, how they solved the problems.
- **Extensions to the activities.** Descriptions of how other teachers had gone beyond what was included in the on-line lesson plan.

Technical support of teachers. Especially when working with multimedia, it seems likely that some teachers will need technical support that goes beyond what is easily available to them in their schools. This conclusion is based on our discussions with OLTR teachers, and on earlier experiences with the *River Link* project (Beaumont *et al.* 1999; Beaumont & Perry, 2000). For instance, teachers may require two types of technical support for installing and trouble-shooting plug-in programs:

- **At school.** Some teachers are allowed to install plug-ins on their own, and some are required to enlist tech support staff to do the installation. Developers should consider ways to support teachers in both situations—and then do user testing of both approaches.
- **At home.** Teachers accessing on-line activities from home may need to install plug-ins on their own, or with the help of their partners or older children. Program developers should include clearly worded, user-tested directions and advice for installing these programs, along with links to the appropriate Web sites.

Elements Primarily for Student Use

On-line activities for student use. We reiterate the observations discussed earlier in this report:

- **Supplements.** Remember that most of the OLTR teachers seemed to consider on-line activities to be introductions, follow-ups, or supplements to classroom activities.
- **Older students.** At least at this time, upper elementary and secondary teachers seem more likely to use on-line activities with their students. Among the OLTR sample, high-school teachers seemed, by far, to be most comfortable with on-line activities.
- **Real world data.** High-school teachers, in particular, want real-world data for their students to analyze.
- **Off-line activities.** Because classroom access to the Web is still a problem in some classrooms, developers should explore the possibility of developing activities that can be downloaded and used off-line.

To give a feeling for what OLTR teachers consider good examples of on-line activities for students, here are some of their suggestions based on what they saw in the teacher guides:

- **Simulated lab.** A simulation of the buoyancy experiment on the Web site (for teachers who couldn't or wouldn't do it in class because of the mess).
- **Interactive air bladder.** A simulated fish with an air bladder that students can manipulate (to see how it affects the fish's position in the water).
- **Interactive graphics.** An on-line version of the camouflage activity found in one guide.
- **Learned names of body parts.** An interactive version of the fish diagram with labels for body parts.
- **WebQuest or similar activity.** Provide some starting questions for students to research on the Web, starting either from a list of sub-sites on Shedd's Web site and sites elsewhere on the Web, or using a search engine.

Background information for students. As discussed earlier, we recommend developing readings for students at appropriate grade levels. These could be included as:

- **HTML** (for convenient on-line reading)
- **PDF** (when formatting is important)
- **MS Word or RTF** (so that teachers can easily adapt the procedure to their own needs)

Graphics for student use. Developers should consider giving students direct access to the major graphics linked to the teachers' lesson plans (described above). These could be included in or linked to the background information.

Related on-line resources for students. Appropriate links for students could be appended to the students' background information pages.

Lists of print resources for student use. Lists of appropriate print resources for students could be appended to the students' background information pages. These could include:

- **Background information** for students.
- **Related fiction books** for students.
- **References cited**, modeling good practice for older students.

Technical support for students. Students accessing the on-line activities from home may need to install plug-ins on their own or with the help of parents. Program developers should include clearly worded, user-tested directions and advice for installing these programs, along with links to the appropriate Web sites.

Testing and Extending the Best Practices

As the *On-line Teacher Resources* are developed and testing through formative and summative evaluation, we will be able to test, improve, and extend this list of Best Practices as well. We also plan to include revised versions of the best practices list in future OLTR evaluation reports, and we eventually hope to publish it for a larger audience.

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APPENDICES

APPENDIX A: Topical Framework

On-line Teacher Resources
Front-end Evaluation
John G. Shedd Aquarium
Topical Framework

Submitted by Selinda Research Associates
May 28, 2002

Teachers' Access to/Knowledge of/Comfort with Technology

General knowledge

- How have teachers gained their current technology skills? What sorts of career development trajectories and/or changes have teachers followed as their knowledge increased?
- What inhibits teachers from using technology? In what ways have teachers been able to overcome these inhibitions?

Multimedia programs

- How do teachers find out about Web and other multimedia programs?
- What Web and multimedia programs seem to be used by teachers? Which seem to be easy/harder to use?
- What sorts of multimedia programs do teachers seem to avoid? How do they make that decision?
- What experiences have teachers had with bulletin boards, chats, listservs, and other forms of on-line communication? What might encourage or inhibit their use of these features?
- To what extent and in what ways do teachers engage in Web development? Do they work alone, with other teachers, with students, or with their schools' technology staff?

On-line activities

- In what ways do teachers currently use on-line resources, such as lesson plans and other forms of teacher support?
- What makes an on-line resource attractive to teachers?
- What on-line teacher resources seem to work well, and which don't work as well?

Use of Technology in the Classroom/School

Technology standards

- To what extent are classroom teachers aware of national, state, and local technology standards?
- Where are technology standards addressed in their schools (special labs and classes, regular classrooms, not at all)? If teachers are responsible for students meeting technology standards in their own classrooms, in what ways do they integrate them into their classroom teaching?
- In what ways do schools' cultures accept or reject technology? What influences these attitudes?

Student access and comfort

- What types and degrees of access do students have to technology at various schools? In what ways does student access vary by grade-level and school system type (e.g., urban/suburban/rural or other typology)?
- How does their access and use at home compare with their access and use at school?
- How comfortable are students with technology?
- Do students have access to computers equipped with Macromedia/Shockwave, QuickTime VR, and streaming video and audio programs like Windows Media Player? If not, how difficult would it be to install these plug-ins, given their schools' technology personnel and policies?
- What factors might encourage or inhibit the use of Bulletin Boards, Chats, and other forms of on-line communication by students?

Teacher access

- Where do teachers have access to the Internet in their schools? How reliable and fast are their connections? In what ways does teacher access vary by grade-level and school system type (e.g., urban/suburban/rural or other typology)?
- Do teachers have access to computers equipped with Macromedia/Shockwave, QuickTime VR, and streaming video and audio programs like Windows Media Player? If not, how difficult would it be to install these plug-ins, given their schools' technology personnel and policies?
- How does their access and use at home compare with their access and use at school?
- How many teachers use home computers for class preparation, and in what ways do they use them?
- How frequently do teachers print out digital materials for classroom use?

Tech support

- How often are tech people in the school building? What sorts of support are they able to provide to individual teachers?
- In what ways do students assist in tech trouble-shooting?
- What other forms of tech support do teachers use?

Internet use

- How do teachers find materials on the Internet?
- When teachers look for activities for their class on the Internet, how do they determine the validity of the content?
- What types of Internet sites are most useful to teachers?
- What would teachers want to see more of?

Teachers' Preferences for On-line Lesson Plans

Nature of the on-line lessons

- Do teachers prefer materials to be directed at teachers only, or would they want on-line components for student use? (i.e. would they be able to use on-line components with their students?)
- In what ways do teachers use lesson plans that are currently on the Web? In what ways do teachers use printed lesson plans, and in what ways do they differ from Web-based plans?

Teacher support

- What sorts of information do teachers feel would support their use of on-line technology? What information do they feel is missing? What format would teachers want to have this information take (print, printable on-line materials, CD)?

Tech support

- In what ways can outside organizations facilitate better communication between teachers and their schools' tech people?

Best practices in on-line lesson plans

- What are the best practices for developing on-line lesson plans?
- What features should be included in an on-line lesson plan? What sorts of on-line components seem to facilitate use of lesson plans?
- What overall format seems to be most effective and easiest to use?

Content for On-line Lesson Plans

- How does the content in Shedd's current grade-level activity guides fit into the teachers' curriculums?
- What content is appropriate for each grade-level group (K-2, 3-5, middle school, high school)?
- How large of a component does literacy need to be in the lesson plans, since it is core to Chicago Public School mandates as well as those of other school districts?

OLT Teachers

- In what ways, if any, do the OLT teachers seem to differ from other teachers (in Illinois and nationwide) with regard to access to, knowledge of, comfort with, and use of technology?
- What unique experiences and skills will individual teachers bring to the project?
- What caveats do literature and/or our experience suggest when evaluating technology with teachers?

APPENDIX B: Information About Respondents

Grade Level	City	Subject Taught	# Years Teaching	Reason Recruited for Project
Project Teachers, Chicago Area				
Pre-K	Chicago	Gen. Ed.	28	Principal has had extensive contact with Shedd staff
K	Chicago	All Subjects		Teacher is on Shedd Teacher Advisory Council
1	Chicago	Gen. Ed.		Principal has had extensive contact with Shedd staff
1	River Grove	All Subjects		Teacher has extensive history taking School Programs classes
3	LaGrange	Self-Contained Classroom	21	Teacher has extensive history taking School Programs classes
5-6	Chicago	Bilingual Gen. Ed.	15	Teacher has had extensive contact with Shedd staff
7-8	Wheeling	Sci, Social Studies	6	Teacher has had extensive contact with Shedd staff
9	Berwyn	Biology, Food Science	10	Teacher has extensive history taking School Programs classes
Project Teachers, Southern and Central Illinois				
K	Carbondale	Gen. Ed.	5	School Report Card exceeds State average; strong technological programs
1	Springfield	Gen. Ed.	3	School Report Card exceeds State average; strong technological programs
2	Carbondale	Gen. Ed.	21	School Report Card exceeds State average; strong technological programs
4-5	Springfield	Gen. Ed.	30+	School Report Card exceeds State average; strong technological programs
5	Springfield	Gen. Ed.	30	School Report Card exceeds State average; strong technological programs
5	Springfield	Gen. Ed./Gift. Resource	8	School Report Card exceeds State average; strong technological programs
6	Springfield	Gen. Science	9	School Report Card exceeds State average; strong technological programs
7	Springfield	Gen. Science	4	School Report Card exceeds State average; strong technological programs
8	Springfield	Science	6	School Report Card exceeds State average; strong technological programs
9-10	Springfield	Bio, Physics & Earth Science	7	School Report Card exceeds State average; strong technological programs
9-12	Byron	Biology	7	Teacher has extensive history taking School Programs classes
10-12	Springfield	Chemistry	4	School Report Card exceeds State average; strong technological programs

Appendix B, Information About Respondents, continued

Grade Level	City	Subject Taught	# Years Teaching	Reason Recruited for Project
Teachers Who Participated Only in the Focus Groups				
1-8	Chicago	Computer Teacher		Teacher has had extensive contact with Shedd staff
2-3	Chicago	Montessori		Teacher recommended by one of Shedd's Teacher Advisory Council members
2-3	Arlington Heights	Special Ed.		Teacher recruited by a friend
3	Chicago	Gen. Ed.	2	Teacher has had extensive contact with Shedd staff
5, 6	Chicago	Math, Science, L.A.		Teacher is on our Teacher Advisory Council
6-8	Wheeling	Math/Sci./Soc. St.	4	Teacher recommended by Shedd staff
6-8	Palatine	Communications	4	Teacher has had extensive contact with Shedd staff
9, 12	Rolling Meadows	Biology/AP	7	Teacher has extensive history taking School Programs classes
9-12	Chicago	Biology, Marine Biol.	20+	Teacher has been heavily involved with Teacher Services offerings
10, 12	Orland Park	Biol., Anat./Physiol.	8	Teacher has been heavily involved with Teacher Services offerings
10	Orland Park	Biology	3	Teacher recruited by a friend
9-12	Chicago	Biology, Marine Biol., Environ. Sci.	4	Teacher has extensive history taking School Programs classes
10	Chicago	Science & Chem.	8	Teacher has extensive history taking School Programs classes

APPENDIX C: Discussion Guide for Focus Groups

On-line Teacher Resources
Front-end Evaluation
John G. Shedd Aquarium

Focus Group Discussion Guide May 30, 2002

Follow teachers' discussion and ask questions as new subjects are brought up. Try to keep within the topical framework but don't be limited by it either.

- Introduce self [what you're doing, why it's important to talk to them, etc.; explain that you're an independent consultant]
- Explain process. Get their permission to tape record. Ask if they have any questions before getting started
- Introductions from teachers [name, school, grade/subject they teach; what interested you most about participating in this discussion today?]

Opening Questions/Standards

1. Illinois has a lot of different standards for teachers to meet. What strategies do you use to make sure that you meet all the standards? [Probe: If you incorporate new materials into your lessons, how do you make sure they contribute to meeting the standards? When looking at new activities, is it helpful to see which standards they address? Do you tend to look at the district curricula tied to the state standards or at the state-level standards themselves? What about national standards? How do literacy standards fit into your curriculum?]
2. What about technology standards? Does your school incorporate them? [Probe: How are they being taught in your school?]

Technology Support and Use

3. What kind of support are the tech people in your school able to provide to you as an individual? [Probe: How often are they in your school building? If the tech people aren't available, whom do you turn to for help? Do need more support from outside the school?]
4. Compare your access and use of computers and the Internet at home and at school. [Probe: Do you use your home computer for class prep? Why/why not? What sorts of prep do you do at home?]

Resources and Lesson Plans

5. What more traditional technologies, such as slides, videos, audio tapes, etc., do you use to supplement your existing curriculum so that you don't have to create everything yourself? [Probe: We've talked to teachers in the past who said they don't use entire lesson plans created by someone else, but select activities from these lessons plans to supplement their existing lesson plans. Is that representative of the way you use them? Where do you find printed lesson plans outside of textbooks—other supplemental books, museums, educational organizations, PBS, etc.?, How do you decide which ones to use? How do you tend to select the activities—do you take a whole unit, a group of activities, one activity, or adapt an activity?]

6. Do you ever use materials that are currently on the Web? [Probe: How did you find out about them? How do you decide which/whether to use them or not (i.e. what criteria do they use to decide what to use)? Do you have trusted sources? Why do you trust those sources? Do you use these any differently than printed resources? What types of on-line activities, if any, do you prefer for your students' use? How much do you tend to pre-research a topic for your students (i.e. do you need a quick overview before giving research resources to students)?]

Closing Question

7. Here are examples of some activities created by Shedd for teachers. Which ones, if any, would you choose to use in your classroom? [Probe: Why would you choose those? How would you integrate them? Does the format tell you everything you need to know? What if they were on-line activities?]

For high school group: Read description of Conservation class.

For elementary school groups: Give each teacher an activity guide and let him or her look through it. Shedd will choose the guide to use.

APPENDIX D: Protocol for Phone Interviews

On-line Teacher Resources
Front-end Evaluation
John G. Shedd Aquarium

Teacher Interview Protocol
June 28, 2002

Try to keep within the topical framework but don't be limited by it.

- Introduce self [what you're doing, why it's important to talk to them, etc.; explain that you're an independent consultant]
- Interview will take 45 minutes or so
- Explain process (no right or wrong answers, confidentiality). Get their permission to tape record. Ask if they have any questions before getting started

Introductory Questions:

Confirm grade/subject they teach and how long they've been teaching.
What interested them most about participating in this discussion today?

Standards

1. Illinois has a lot of different standards for teachers to meet. What strategies do you use to make sure that you meet all the standards?
[Probes:
If you incorporate new materials into your lessons, how do you make sure they contribute to meeting the standards?
When looking at new activities, is it helpful to see which standards they address?
Do you tend to look at the district curricula tied to the state standards or at the state-level standards themselves?
What about national standards?
How do literacy standards fit into your curriculum?]
2. What about technology standards? Does your school incorporate them?
[Probe: How are they being taught in your school?]

Technology Support and Use

3. What sort of access do you have to computers in your classroom?
[Probe: Elsewhere in your school?]
[Complete questionnaire at this point]
[continue interview]

[Follow-up probes from the questionnaire:

Discuss what they think of as “multimedia.” Do they prefer to access multimedia by CD-ROM or on-line? What sorts of multimedia would they like to see more of?]

4. What kind of support are the tech people in your school able to provide to you as an individual?
[Probes:
How often are they in your school building?
If the tech people aren’t available, whom do you turn to for help?
Do you need more support from outside the school?]
5. Compare your access and use of computers and the Internet at home and at school.
[Probe:
Do you use your home computer for class prep? Why/why not? What sorts of prep do you do at home?]

Resources and Lesson Plans

6. What more traditional technologies, such as slides, videos, audio tapes, lesson plans, etc., do you use to supplement your existing curriculum so that you don’t have to create everything yourself?
[Probes:
We’ve talked to teachers in the past who said they don’t use entire lesson plans created by someone else, but select activities from these lessons plans to supplement their existing lesson plans. Is that representative of the way you use them?
Do you develop your plans using a template or standard format?
Where do you find printed lesson plans outside of textbooks—other supplemental books, museums, educational organizations, PBS, etc.?,
How do you decide which lesson plans to use?
How do you tend to select the activities—do you take a whole unit, a group of activities, one activity, or adapt an activity?]
7. Do you ever use materials that are currently on the Web?
[Probes:
How did you find out about them? How do you decide which/whether to use them or not (i.e. what criteria do they use to decide what to use)?
Do you have trusted sources? Why do you trust those sources?
Do you use these any differently than printed resources?
How important is it to you that the plan be tested in classrooms or developed by teachers?
What types of on-line activities, if any, do you prefer for your students’ use?
How much do you tend to pre-research a topic for your students (i.e. do you need a quick overview before giving research resources to students)?]

Closing Questions

8. Shedd sent you an example of a printed activity guide that they created for teachers. Which ones, if any, would you choose to use in your classroom?
[Probes:

Why would you choose those? How would you integrate them?
Do you study the ocean and its life in your classroom?
How about freshwaters, such as rivers and lakes?
What other grades in your school study these topics?
If you just use pieces of plans, should we consider providing a menu of pieces instead of an integrated lesson plan?
We asked you to take a particularly close look at _____.
Does the format tell you everything you need to know?
What if the interactive parts were on-line activities? How would you do them differently?]

6. How have you gained your current technology skills?
7. Have you ever used a Web site that had any of the following:

Adobe Acrobat Reader (.pdf; see below for example)	Yes	No
Macromedia Flash/Shockwave	Yes	No
QuickTime VR (see below for example)	Yes	No
Video files (e.g., .mpg, .avi, .rm; see below for example)	Yes	No
Audio files (e.g., .mp3, .wmf; see below for example)	Yes	No

Examples of file formats from Web pages:

Adobe Acrobat

Activities

Available on the Web


Available as a PDF (Portable Document File), you will need [Adobe Acrobat Reader](#) to read and print these files.

[Pictionary with the Past](#)
[Mississippian Regalia](#)
[Pottery-making Methods](#)

[Additional Readings](#)

Video file


WATCH IT



[low-res](#) [hi-res](#)

Everyone has something to say about bullies.

You'll need the RealVideo plug-in to view a video clip. If you don't have RealVideo, [click here](#).




QuickTime VR

Explore our virtual-reality tours of the ZOOM studio. You'll need QuickTime and its web browser plug-in to view them. You can [download QuickTime](#) for free. We also took some great behind-the-scenes [snapshots](#), which are only available here! Click on the camera to sneak a peek!

Online chats with the cast:
[April 22, 2002](#)
[February 20, 2002](#)

QuickTime VR versions:
[Season IV ZOOM Control Room Tour](#)
[Season IV ZOOMroom Tour](#)
[Season III ZOOM Cast Tour 1](#)
[Season III ZOOM Cast Tour 2](#)
[Season II ZOOM Cast Tour](#)
[Season II ZOOM Crew Tour](#)



[ZOOMsnaps](#)

Audio file

NPR Hourly News

The NPR hourly newscast is updated every hour and is available "on-demand" in RealAudio and Windows Media:

[Listen with RealAudio](#)

[Listen with Windows Media](#)

[Download Audio Players](#)

[Audio Help](#)

If these "plug-in" programs weren't already available on your computer at school, how difficult would it be to install them given your schools' technology personnel and policies?