Internet Web-Searching Instruction in the Elementary Classroom: Building a Foundation for Information Literacy

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The growing Internet accessibility for educational purposes has raised a range of issues regarding the means of integrating instruction about information access with the students' other learning experiences, the nature of the skills needed by children in support of developing information literacy, and the role of the school library media specialist in this instruction. The "SNAPdragon" Project was created to investigate how elementary school children can interact with the Internet by asking them to build an annotated directory of World Wide Web sites for other children. Much was learned in this preliminary study of six elementary classrooms, grades one through six, about instructional arrangements, searching skills development, and critical thinking in relation to Internet use.

OBJECTIVES

The growing Internet accessibility for educational purposes has raised a range of issues regarding the means of integrating instruction in such information access with the students' other learning experiences, the nature of the skills needed by children in support of developing information literacy, and the role of the school library media specialist in this instruction.

This project was the focus of an experimental graduate course taught jointly by faculty from the Department of Education (Kafai, with Philip Ender) and the Department of Library and Information Science (Bates) in the Graduate School of Education and Information Studies at UCLA. The group decided as the class focus to examine "Education on the Internet" through both the reading of theory/research and practical experience working with teachers and elementary school children. The emphasis for the first course was on examining how teaching through use of the Internet could be achieved and determining what Education and Library and Information Science (LIS) graduate students should learn about the Internet and about education and LIS research literatures to be effective scholars, master teachers, or library media specialists in this new area of research and theory.

The "SNAPdragon" project was created to investigate how children can interface with the Internet by asking them to build an annotated directory of web sites for other children. The project's general goal was to build children's information literacy skills. More specifically, the objective was to have children develop an understanding of what the Internet and web searching are, gain some skills in searching (varying with their ages), and develop their critical-thinking skills by evaluating the information they gathered from various sites.

Furthermore, the researchers wanted to provide children with a context in which the search for and retrieval of information would no longer be an isolated experience, but rather connected to their classroom learning and to a larger social goal—to share their insights with other children. Instead of keeping the annotated search results confined to individual classrooms, a collaborative directory was implemented that could be accessed by other children through the World Wide Web. The construction of an information structure such as a directory was seen as another powerful way for children to gain better understanding of existing web directories such as Yahoo, etc.

By observing students' efforts, the researchers could start to answer questions such as: Can children effectively use the search engines currently available? Can they find appropriate resources in a directed search? Can they evaluate and use

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the selected resources? The SNAPdragon Project was a first step and only a few classrooms were involved in the preliminary research. The insights gained in this small study, however, will help teachers and school library media specialists design better learning environments in regard to classroom management, the role of the school library media center in Internet instruction, children's information searching and information evaluation, and students' motivation and interest.

Background

The rush to connect schools to the Internet is in full swing. In the 1994 report *American's Children and the Information SuperHighway*, Lazarus and Lipper[1] concluded that it is critical that all children have access to the Internet and, furthermore, that children's needs must be given a high priority as technology strategies are developed and implemented. The National Center for Education Statistics report *Advanced Telecommunications in U.S. Public Schools, K–12*[2] documents, however, that as of fall 1994 "thirty-five percent of public schools have access to the Internet but only three percent of all instructional rooms (classrooms, labs and media centers) in public schools are connected to the Internet." In elementary schools, the figure is thirty percent connectivity at the school level.[3] While many schools have begun to give students Internet access, and allow them to browse and search for information and build their own World Wide Web pages, it is still an open question in what ways Internet activities can effectively be used and integrated with other classroom learning.

It is evident, merely from the use of such terms as "browse" and "search for information," that capability with Internet use should draw upon the expertise of school library media specialists in some fashion. "Challenge 4" of *Information Power: Guidelines for School Library Media Programs*[4] is "To provide leadership and expertise in the use of information and instructional technologies."[5] The excitement generated by the World Wide Web and its search engines provides a golden opportunity for teachers and library media specialists to work more closely on the development of curriculum and on the integration of information literacy skills into that curriculum.

The projects to be described, in which students used Internet information sources for their classroom learning, represented examples of development of many key elements of information literacy, as discussed by Doyle:[6] recognizing the need for information; formulating questions based on the needs; identifying potential sources of information; developing successful search strategies; accessing the information; and evaluating, organizing, and integrating the information into an existing body of knowledge. There are other important formulations of these skills[7] as well; all involve the fundamental concept that development of information literacy enables the child to engage in activist, self-directed learning. As Mendrinos notes: "Resource-based learning and high technology foster a nondirective teaching style in which the student controls learning within the framework of the curriculum."[8]

There is as yet relatively little LIS research on children's information use and information-seeking. Walter[9] provides an extensive survey of research to date on children's information-seeking. Solomon studied elementary school children's use of an online public access catalog. He found that even first-graders were able to use an OPAC and that difficulty with the variety of index terms was a significant problem for the children.[10] Likewise, Walter, et al., found that children ages nine to twelve were able to use both browsing and keyword-type catalog interfaces, though here, too, children had some difficulty finding the right terms to retrieve their desired information.[11] Gallo and Horton report results of a study in which high school teachers were given unlimited access to the Internet. They found that teachers could benefit from ongoing training related to their computers and the Internet.[12]

In the education field, a considerable number of studies have examined the educational potential of Internet-based projects for language arts and social and natural sciences. Many projects use telecommunication activities for learning writing.[13] The results indicate that providing students with an audience other than their peers or their teacher has significant effects on improving writing performance. In other projects, students build together a networked database that allows them to annotate and link their contributions to research reports.[14]

More recent projects use the Internet to give students access to scientific databases such as weather information and provide them with communication facilities and analysis tools for data display.[15] Studies that link instruction of information-searching strategies with specific subject learning are still rare. One notable exception is Linn's development of the Knowledge Integration Environment,[16] a hypercard stack with pointers on how to find and use scientific information on the Internet and to help students ages ten to fourteen ponder scientific questions.

THE PROJECT

Overview

For the implementation of the SNAPdragon Project, the researchers took advantage of an existing consortium of West Los Angeles schools, called School Network Action Project (SNAP). SNAP was started by the schools and Apple Computer and was funded by a series of other business and industry partners to provide all the participating schools with servers and Internet access. At the beginning of the project in January 1996, most of the schools (but not all their classrooms) had been connected to the Internet. There had not been extensive use of this connectivity, however, due to a series of technical problems.

To begin the collaboration, the researchers contacted all the SNAP schools in November 1995 asking teachers and technology coordinators to send in applications indicating their interest. Schools were informed that the SNAPdragon Project would run concurrently with a UCLA graduate seminar in which students would not only examine and discuss the educational benefits of Internet activities, but would also be required to hold an internship in a local school. By January, more than twenty applications had been received, and teachers, UCLA graduate students, and instructors met once in January to get to know each other and to select the sites. For this project, just six classrooms participated because the researchers wanted to match each classroom with one UCLA graduate student or researcher. The classrooms were selected so that at least one classroom from each of the four schools or school districts involved in SNAP was

included. Table 1 provides an overview of the grade levels, number of students, number of computers with Internet access in each classroom, and search topics.

Each classroom had a different setup, a different number of students, and a different search topic. These varying conditions for this initial effort proved to be very productive for understanding the ways in which web-searching instruction can be integrated with classroom instruction. For all the differences, it was hoped that the collaborative activity would provide enough "glue" to bring all the students and their teachers together.

The UCLA graduate students who interned at the SNAP school sites attended regular classes each week to receive instruction in the research and theory of both Education and LIS that related to the SNAPdragon experiment, and they were instructed in the practical aspects of searching the World Wide Web in classroom and laboratory instruction.

The SNAPdragon web site, containing the students' directory of favorite web sites, was set up and maintained at the UCLA Graduate School of Education and Information Studies by Ender, and can be accessed at http://www.gseis.ucla.edu/SNAP/snapdragon.html.

THE UCLA COURSE FOR GRADUATE INTERNS

The Interns

To provide instruction, the graduate student interns first had to be introduced to Internet searching themselves. The UCLA course for the graduate students combined theory and practice. In fact, it was an interesting challenge for the three instructors to identify the mix of materials that would be most useful for the graduate students' general education, as well as preparation for their internships working with teachers and children. In this sense, the joint work of Ender (the computer specialist), Bates (the LIS specialist), and Kafai (the Education specialist) modeled the kind of cooperative work that the technical support person, the school library media specialist, and the teacher need to do together to create effective classroom learning and development of information literacy with the Internet.

The first several sessions for the graduate students at UCLA consisted of part lecture/discussion and part instruction and laboratory practice in Internet use, especially World Wide Web use. To help students understand the network and the Web, Ender developed lectures, demonstrations, and laboratory practice sessions on the Internet, totaling about six hours, for the students. In the latter part of the course, the class was divided between classroom lecture/discussion and the time spent interning at the SNAP schools.

The academic portion of the course drew on two literatures. Kafai lectured and led discussions on the research literature of education concerning the use of computer-mediated communication in the classroom. Within this context, students reviewed the history of technology in education and examined theoretical foundations of learning over networks and using long-distance communication. Students studied a series of case studies that used the Internet in classrooms to enhance children's learning in science, language arts, and social sciences. In addition, students looked at social issues surrounding the access to the Internet.

Bates lectured on the research, theory, and practice of information studies, covering three major areas: (1) the concept of information itself and some of the underlying paradigm of the LIS field, in an effort to sensitize the students to some of the issues and outlook necessary to think like an information professional; (2) information needs and information-seeking behavior of children; and (3) practical online searching skills, drawing on what research has shown to be the most difficult areas for successful searching. In particular, students were shown how even some of the simplest search problems can be complicated by variety in vocabulary and differences in search engines.

The Schools

All schools in the study had powerful models of Macintosh computers, from LCIIs to PowerMacs. Figures given below for numbers of computers are solely for machines with Internet access, not the number of all machines in the classroom or school. All classes searched on the Netscape browser.

- The Corinne E. Seeds University Elementary School, a laboratory school located on the UCLA campus, contained three internship sites—two combined first/second-grade classes and the computer laboratory being used for third/fourth-grade students. The school student body was ethnically and socioeconomically diverse; one of the first/second-grade classes was bilingual (English/Spanish). The two combination first/second-grade classrooms each had six networked Macintosh computers for classes of thirty-three and thirty-one students, respec-

Table 1

Overview of Participating SNAP Classrooms

School Name	Grade	Students	Internet Computers	Classroom Search Topic	Curriculum Integration
Corinne F. Seeds UES	1/2	33	6	Airports/Iditarod	yes
	1/2	31	6	Ocean Animals	yes
	3/4	30	15	Black History/Poetry	yes
Open Charter School	3/4	64	1	City Building	yes
Westwood Charter School	5	9	1	National Parks	no
Hawthorne Elementary School	6	29	1	Ancient Egypt	yes

tively, each with one instructor. The combination third/fourth-grade classes had their Internet experiences as a part of a two-week-long computer class, which was held in a separate computer laboratory in the school.

- The Open Charter School is located in an ethnically and socioeconomically diverse section of the city of Los Angeles. As a charter school, it had enjoyed a high degree of academic autonomy over the years. In the 1980s it received support from Apple Computer to install computers in every classroom. The combined third- and fourth-grade class involved in this project had two teachers, sixty-four children, and one computer.
- The Westwood Charter School is a public West Los Angeles city school located in a middle-class, mainly single-family-dwelling neighborhood. An ethnically diverse group of nine students from a fifth-grade classroom participated. Students went to a laboratory separate from the classroom.
- The Hawthorne Elementary School is a middle-sized public school in the Beverly Hills Unified Public School District, with about 750 students in grades kindergarten through eighth. A sixth-grade class with twenty-nine students and one computer participated.

ELEMENTARY CLASSROOM INSTRUCTION

The six classes included the grades from one to six and had a wide variety of instructional arrangements. This variety enabled the researchers to get a good sense, in this preliminary study, of the various issues involved in providing Internet training in the classroom. Under each classroom configuration, the curricular content and instructional arrangements are first described, then the searching training, and finally mastery by the children.

The graduate students interning in each classroom worked with the instructors (with oversight from the Graduate School of Education and Information Science faculty) to develop the Internet experience for each classroom. One of the interns was a senior librarian in the UCLA University Research Library with a graduate degree in education; another was an extension student with computer background; and the other four were graduate students in education.

Class #1: Six-Computer Classroom: Grades One/Two

Curriculum and Arrangements. Students in this University Elementary School class ranged in age from six through eight. Some were still learning to read, while others were fluent readers. About one-third of the students had computers at home.

A rug surrounded by chairs was the area where students met as a class. There were several tables designated as work stations for small group activities as well as a reading corner. Students were introduced to the Internet by working in pairs (two pairs at a time) at one computer.

Students used the Internet for two of their class projects. They had been working on constructing a real-world-style community since the fall. When a field trip to an airport was anticipated, the decision was made to conduct a search on airports on the web. The second project concerned the Alaskan dog-sled race, the Iditarod. The teacher gave each student the biography of a "musher" (dog-sled driver) that she had obtained from the Internet. The students followed "their" mushers throughout the days-long race. The official Iditarod page included frequent updates of the race standings, which the teacher printed and reported to the class each day or so. She also posted a map of the route so that the mushers' progress could be tracked with flags. Even students without well-developed reading skills were able to find the Iditarod pages and recognize the status of their mushers.

Searching. In two rounds of work on the airport project, the children were shown how to move around on the page and how to follow up links. They were coached to type in the URL, or coded address, of the Big Bear Airport, and then were given a list of other airports with their URLs.

It was anticipated that students could explore those airport pages in which they might have some personal interest individually. This did not turn out to be a realistic expectation, however. In the second round, bookmarks of various airports—different ones for each computer—were put on the computer in advance so that students could simply click on the bookmark, rather than having to type the URL. ("Bookmarking" is a capability that makes it possible to click on a web page address and have it automatically recorded in the local computer, so it can be looked up later without having to type in the URL.)

Class #2: Second Six-Computer Classroom: Grades One/Two

Curriculum and Arrangements. This bilingual class had ten thirty-minute sessions using the World Wide Web. A school library media specialist was also present and available for help at each session. The children were studying "ocean life" over the course of the semester. Prior to the introduction and use of the Internet, the class discussed sea life, read about fish and ocean mammals, did some library research, and collected appropriate books to have available in the classroom throughout the duration of the project. Each student selected one ocean fish or mammal to learn more about. They were to use the Internet to find more information for their sea animal research reports.

Students found quite a bit of information on their topics. The amount of information, however, varied considerably from one species to another. There was far more age-appropriate information on dolphins, sharks, and whales than for seahorses, star fish, or eels, for example. It should come as no surprise that the web site that excited the most enthusiasm and fascination on the part of the children was one that contained a photograph of a human leg that had been partially chewed by a shark.

Searching. In this class, a different solution was tried regarding the Internet addresses of sites of interest on ocean life. Instead of bookmarking the sites, so children could simply click on the names of sites, the teacher and intern searched the web in advance, located appropriate sites, then wrote the URLs on a poster-sized chart for the children's reference. The teacher felt it was important for the children to type the URLs themselves, in order to gain a broader familiarity with the keyboard as well as the web browser's interface. This was a difficult and time-consuming task for the children, however, as they made many typing errors with the complicated URL address codes. An instructor needs to

make a decision regarding how much of the Internet learning time should be devoted to mastering keyboard skills.

Class #3: Laboratory Class: Grades Three/Four

Curriculum and Arrangements. In the Seeds laboratory school, each class in the third and fourth grade was attending a computer class in the computer laboratory one hour a day for two weeks at a time. Every two students had a PowerMac computer to work at in the fifteen-machine lab. During the first week, the students learned how to use word-processing and drawing programs. During the second week, they studied the World Wide Web. The graduate intern observed the second week of three series of third/fourth-grade classes.

The large number of computers for any given group of students was an advantage for this class. On the other hand, disadvantages were that movement back and forth between classroom and laboratory took up computer session time, and, more important, the laboratory arrangement tended to separate study topics in the lab from what the children were studying in their classroom. Coordination between lab instructor and classroom instructor was needed to bring these two sets of activities into harmony. The students studied poetry sites.

Searching. In each new Internet class the teacher gave an introduction to the Internet, described the goals of the class, and had a question-and-answer period. The teacher provided a specific site most of the time for the students to visit and evaluate. Near the end, he opened the experience and encouraged advanced students to use the search engines to find other types of information.

What was quite noticeable in this case was the disparity between students who had prior access and experience with the Internet, and those who did not. The students with prior Internet experience were more knowledgeable about the features and tended to dominate the interaction at the computer. They often decided which sites to visit and how long to stay on a page before moving on. The students who were experts tended to be boys.

Class #4: One-Computer Class: Grades Three/Four

Curriculum and Arrangements. The Open Charter School grades three/four class, with sixty-four children, was involved in a year-long project of building a city of the future, called City Building Education™. Since the children were already organized into various "commissions" for building the city, the intern and the teacher structured the Internet search sessions around these commission themes: *Historical Commission*: museum web sites; *Building and Safety Commission*: landmark web sites; *Imagination Commission*: artists/composers/filmmakers web sites; *Transportation Commission*: mass transit web sites; *Environmental Commission*: environmental web sites: *Social Services Commission*: web sites related to homelessness, unemployment, poverty, and disabilities; *Communication Commission*: web sites related to e-mail and sharing information over the Internet; *Agricultural Commission*: web sites related to food, gardens, and cooking.

Several times a week for a month, two hours of the school day were set aside for Internet time. The sessions were managed by having four of the commissions take half-hour turns sitting in a circle of chairs around the computer.

The search session was structured by the intern, who came to class equipped with addresses of web sites (URLs), and who then looked up the web sites as the children observed. This strategy was adopted because it seemed the most efficient way to describe how the web worked to large groups of children.

As the sessions evolved, the students took turns working different "jobs" related to the search. There was a "mouse master," a "reader," and a "scribe" to record each commission's annotations. These jobs were rotated for each web page search.

Searching. The Internet sessions in this one-computer classroom were focused on critiquing the web sites found (more in the "critical thinking skills" section). Web sites were selected in advance by the intern, and entered for the students by the intern.

In the process, these sessions also introduced the students to basic concepts about the Internet: how it is a network of computers linked by a spider's web of telephone lines; how the data go through telephone lines from computer to computer; how browsing can be done through the use of scroll bars, hypertext links (links to other bodies of information embedded within the current text being examined), and bookmarks. It was judged that this was the most information that the students could grasp at this point in their education; search engines and techniques for selecting search terms would have to wait. The researchers concluded that children at this age require support in their search process, particularly with scanning text and using hypertext links—at least when the number of students per computer is so high.

Class #5: Laboratory Class: Fifth Grade

Curriculum and Arrangements. This laboratory class of nine fifth-grade students represented the one instance in our project where the Internet instruction was not integrated with the classroom lessons. These children had adequate typing and spelling skills, were all comfortable with computers, and some had computers at home.

The children met in the lab for two hours once a week for six weeks. Generally, the first part of each session was used for discussion, mini-lessons, and problem-solving. Because there was only one Internet-linked computer available, the children were divided into self-selected collaborative groups of three. The children selected the topic "national parks." The three groups took turns searching the Net for sites containing information about national parks. The children preferred sites with pictures and colorful graphics. Sites composed of text only or with more than one or two pages were left unexplored. In general, children rarely spent more than a few minutes at any one site.

The most popular site was the Hawaii Volcanoes National Park site. It contained a map of the caldera superimposed over a photographic image of the area. The colors were vivid and most of the names and locations on the map were "hot buttons" that linked the visitor to a brief description of the selected feature or area. These hot buttons encouraged the children to explore at a greater depth than if the information had been contained in a single site. (Clicking on what looks

like a button on the screen provides a link to another section of the site, or to another web site.)

Searching. This group of nine fifth-graders meeting in the laboratory was able to learn and practice a lot of search skills. In the first two sessions they explored the Internet. They learned how to navigate, perform searches, use bookmarks, visit sites, and use hot buttons.

Halfway through the national parks project, they were asked to find six national parks as follows: two in Europe, two in the United States, one in either Africa or Australia, and an additional park not in the United States. This task was designed to encourage the children to perform more directed searches and to formulate alternative search arguments.

Finding European parks proved to be particularly difficult since the term "European" did not appear in the titles or descriptions of the parks located in Europe. The children had to be helped to come up with other terms, such as searching for parks in individual countries. In the process they learned some important lessons about how tricky searching using more general words can be.

Limited observation of these relatively computer-savvy fifth-graders suggests that children who are age ten or older are capable of finding resources on the Internet. Just as in the library media center, they may benefit from the assistance of an intermediary to help improve their results in negotiating the Internet. Their typing, spelling, vocabulary, and Boolean logic skills do come into play and can limit their ability to find appropriate resources. With direction, however, they are able to formulate search arguments and narrow or broaden a search depending on the previous search results, and they are capable of comprehending conceptual hierarchies when they have adequate base knowledge.

Class #6: One-Computer Class: Grade Six

Curriculum and Arrangements. The sixth-grade class in the Beverly Hills school was studying ancient Egypt in its social science unit. The teacher and intern agreed to have the SNAPdragon activity be part of the students' project reports for that unit. In addition to reading in their textbook or consulting resources in the library media center, students used the World Wide Web for finding additional information on specific topics of their choice about ancient Egypt. In a first discussion, students expressed interest in topics such as weapons and arms, fashion, and animals, that they intended to pursue.

In this case, the teacher was unfamiliar with the Internet, while some of the students had unusually good computer experience. Most of the students had computers in their homes and had seen their parents or siblings using one. Eighteen of the twenty-nine students had experience using the Internet itself. Furthermore, there were two students who had used HTML in the class. (HTML is the formatting language used to input and make accessible the contents of web pages.)

Because this was also the teacher's first contact with the Internet, the decision was made to take advantage of the large number of students with Internet experience in the class. Students were divided up into teams of five to six members. A team member who was considered to be an "Internet expert" then became the tutor for the team and guided the other students in their searches.

After the teacher and the intern jointly gave a general introduction for the class on the Internet and the SNAPdragon project, they then met with the tutors and gave direction on how to introduce the World Wide Web to their team members and how to assign and rotate different roles, such as mouse master or reporter. For the remainder of the project, the teacher set up specific times at which each team could convene and conduct their searches.

Searching. These computer-savvy sixth-graders were able to master the most sophisticated searching techniques of all the six classes studied. They were shown how to use different search engines, how to formulate and constrain their searches by using combination terms such as "ancient Egypt" and "weapons," and how to bookmark sites. The student teams were able to search on their own, under the guidance of the team's "tutor," independently of the other activities going on in the classroom.

WEB SITE CONTENT

The topics studied and searched by the students were mentioned above under "Curricular Content and Instructional Arrangements." Some general points are in order, however, regarding the web content.

In general, many web sites were not child-friendly. The use of big words and lots of text without pictures generated complaints by the students. In fact, text-only sites were often left unexplored. The researchers found that including the word "kids" in the searches usually turned up more colorful, interactive sites in plain English. These were the children's favorites.

Because of their familiarity with television, the children demanded high production values; they wanted quality audio, video, and heightened interactivity. For example, at a site found in the search for information on ancient Egypt, children could submit their name and have it returned in hieroglyphs.

In sum, the researchers found the following regarding web site content:

1. Children prefer web sites with high visual content and short, simple textual content.
2. Children are inspired to talk about their social views and surroundings when they view Internet sites featuring children's artwork and photographs from other places.
3. Children would like to see more animation and interactivity on the Internet.
4. Children have a low tolerance for long download times.

CRITICAL THINKING SKILLS AND INTERSCHOOL COLLABORATION

Web searching taught children about a major new information source, and, for the older students, provided some active searching skills. But to complete the experience as a means of developing information literacy, the project was also designed to help the students develop critical thinking skills by evaluating the sites they found on the web, then creating a directory of their evaluations for all other students in participating classrooms.

The variety of quality and function of web sites provided a rich field for learning. In viewing a site, children had to determine, first of all, whether its content related to their interests, then extract information for their projects, and, finally, write an evaluative directory entry for the site.

As with books, the children were quick to assume everything they found about their topic on the Internet was correct just because it was there. The children learned that the information they found on the web could be submitted by adults or by children and that the information came from around the world. Eventually, they learned to distinguish sales and marketing sites from more neutrally informational sites.

In general, it was difficult for the younger children—through the fourth grade—to evaluate the sites or to write annotations. They could determine what they liked, but had trouble articulating why they liked it. When asked why they liked a site, the common answer was "it had lots of information," or "it had good information." Their awareness was helped by talking about whether the information was easy to read. If there were both pictures and text at the site, they were asked if the pictures helped their understanding. Their favorite sites were often those created by other children.

With younger children, it was necessary to develop the annotations with the child. Older children were also reluctant to write annotations; they did not initially see the point or value in doing so.

When the SNAPdragon site became "live," that is, when the children could find their own directory postings on the web, they were delighted. It gave them a great sense of pride to know that children and adults from around the world could read their comments and also benefit from the information provided in their favorite sites. Students were much more engaged and willing to write annotations on sites when they realized that other students could see them on the web.

In one case, a student wanted to write "This site sucks" as his annotation. After he realized how widely his annotation could be read, he decided to expand his commentary! These sessions also gave students a chance to practice reading and writing. Issues of vocabulary came up repeatedly because many web sites included difficult words. (See figure 1 for example children's Web site annotations.)

THE ROLE OF THE LIBRARY MEDIA SPECIALIST

As this was a first experimental effort, the researchers believe that the use of the SNAP schools, the development of the SNAPdragon web site, and the development of curriculum for the graduate course were enough to tackle at once. Consequently, with the graduate interns acting, *de facto*, in the role of the school library media specialist, the researchers did not actively seek to involve the media specialists in the project schools for this project. The graduate student involvement, however, did provide insight into some of the kinds of roles the media specialist can assume in information literacy projects involving web searching. There are clearly abundant opportunities for—and arguments for—school library media specialist involvement in Internet instruction in schools.

World Wide Web searching is an obvious extension of the many other kinds of information searching that fall within the range of the library media specialist's expertise. As professionals engaged in life-long continuing education, they are likely to have mastered this technology and its use well before most of the teachers in a school have. In line with the proactive teaching role recommended for media specialists by Kay Vandergrift,[17] Internet instruction is a natural venue for the specialist to approach teachers and engage with them in curriculum planning and instruction. Having a higher comfort level with computers and with the Internet, the library media specialist can provide the missing link

Child's age: 5. Web site title: "Herp Pictures"

Annotation: I liked it because the pictures were very cool. My favorite picture was the corn snake eating the mouse. They should make all the pictures in color.

Child's age: 7. Web site title: "Jason's Snakes and Reptiles"

Annotation: I liked some of it. This page was not as interesting as Kyle's Herp page, there was not as much information. Jason is like me. He got his first snake when he was 6 and so did I. I think only kids who are really really really into snakes would like this page.

Children's ages: 8–10. Web site title: "Hands-on Children's Museum"

Annotation: We like that you can do things. This site has mazes. Some of the mazes are too easy and too big for the page. It would be better if they would shrink the mazes. We think other kids would like this site because people like mazes.

Children's ages: 10–11. Web site title: "Banff National Park Main Index"

Annotation: Format: Detailed information with text, pictures, and hot buttons. This site talks about animals that live there, what to do there, the weather, and what to bring. You can also read it in French or English. Comments: It has lots of cool pictures. Audience: Everyone. Interest: Great.

Figure 1. Example Children's Web site Annotations

between the teacher and the technical support person, as well as be the expert in information-searching techniques and information resource evaluation. The library media specialist's expertise in resource evaluation is particularly needed with Internet resources because the historical editorial controls provided by paper publishers are frequently missing in materials published on the Internet.

In some cases, the school library media center may be the first place in the school where one of the computers has web access. It then becomes a natural extension of the library media specialist's role to introduce teachers to the possibilities of using the Internet in the classroom. In fact, in one case in this study, the school's vice-principal approached the intern, saying that the teachers had expressed an interest in having her conduct a "World Wide Web workshop" for them.

Further, the library media specialist can identify good web sites for support of teaching just as has long been the case with identifying and purchasing materials supportive of curriculum. The library media specialist can provide moral support and additional help in the classroom when the teacher introduces the web. Finally, the specialist can be recognized as having a special expertise in the teaching enterprise: expertise in searching for information. This has always been true for library materials, but is not always recognized outside the walls of the library media center and inside the classroom.

Like all new arenas for human activity, the web and web searching will soon come to be seen as *someone*'s area of expertise. This is a golden opportunity for school library media specialists to fill that role in a school. But the stance must indeed be proactive. No one assigns the role—and someone else will surely occupy the area if library media specialists do not.

DISCUSSION AND CONCLUSIONS

In March 1996, the SNAPdragon Project was brought to a temporary completion. In addition to the students' annotations, the current web site featured digitized samples of drawings provided by the students. The researchers concluded our intervention with another meeting in March, to which all the participating teachers, some of the students, and other interested researchers and visitors came to share their experiences. While the SNAPdragon Project was not a systematic study of different classroom settings and students' information literacy skills, some valuable insights were gathered nonetheless.

All children, in first through sixth grade, were able to use web sites to advantage in their learning. All children could learn to scroll through a site and use hypertext links to other sites. Older children could learn to use search engines and the rudiments of Boolean logic. Once students had experienced some frustration in searching, they were then receptive to learning more about, for example, differences between search engines.

Students were able to extract information for their school projects from the sites. But selecting good sites in the first place was sometimes difficult for them. Titles and descriptions returned by search engines were sometimes misleading and difficult for the children to evaluate. This problem was compounded by their reluctance to read or scan the list of results. It appeared that only titles were used to decide which site to visit. Since the system was often slow, picking the wrong site precluded visiting additional sites.

The web searching process produced relatively few child-friendly sites. Visiting too many boring, uninvolving, or irrelevant sites can retard the value of the experience. This can be compensated for, in part, by selecting some good sites in advance for the students; otherwise, learning to pull good information from poor is a valuable part of a child' s information literacy learning.

Writing evaluative annotations of sites was a challenge for all children; younger ones needed to be prompted and assisted. Interest and enthusiasm for contributing to the SNAPdragon web site rose substantially when children realized that their annotations could be accessed by people around the world and would certainly be seen by the children at the other five test sites.

As noted in many policy reports and discussion, access to the Internet is an important issue, if only for the limited resources of computers, phone lines, and wiring. While providing all students with computers might not be possible, the researchers found that working with even one Internet-accessible computer turned out to be feasible, given certain classroom arrangements.

In general, the students' interest in Internet activities was high. It helped that the children saw "surfing the Net" as a "cool" thing to do. Their enthusiasm was further fueled by finding their own work represented on the web. This sense of having an Internet identity seemed to be of great value to the students.

While the project in its first installment was initiated and organized by adults, the researchers believe that having the students handle all aspects, from creating the site and collecting annotations to indexing the entries, will prove to be the best learning experience. In fact, one of the most valuable learning experiences for the members of the university course appeared when confronted with the task of categorizing the first SNAPdragon submissions. There was extensive debate on what category names to choose and how deeply to index the contents. In the end the Dewey Decimal Classification main categories were adopted.

In retrospect, the researchers wished that the children had had the opportunity to contend with the same issues. While the categorization of musical instruments, animals, and plants is a common activity in elementary classrooms, students usually do not deal with creating any kind of directory or index. Becoming information literate includes dealing, as end-users, with all the issues associated with organizing, accessing, and using information. The SNAPdragon Project challenged students to grow in these skills.

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