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Social and Behavioral Research Institute

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INTRODUCTION

In the Fall of 2000, the CSU Chancellor's Office in conjunction with the CSU Information Competence Assessment Task Force contracted with the Social and Behavioral Research Institute (SBRI) at CSU San Marcos to conduct Phase II of a study to provide momentum for an information competence assessment project. Phase I, a survey study conducted by SBRI during the academic year 1999-2000, established a base line of student information competence, making conclusions about the breadth and depth of student's competence.

The survey results also revealed the kinds of information resources that students readily think of using and how well acquainted they are with these resources. The Internet or computer was only one of many resources mentioned by students. Other resources commonly mentioned were text materials such as books, reference books, or publications by organizations; other people who might be expected to have first hand knowledge; and data obtained by conducting one's own research (e.g., survey, interview, observation, experiment) in the actual world.

The goal of Phase II. was to shed light on students' work processes in seeking, evaluating, analyzing, and using information. We sought to describe how students achieve certain outcomes as well as how closely students' routine ways of working approximate the ideals of the ACRL Standards. This report discusses the variations we found in student work processes and products, explicates the reasons students achieve

certain results, and presents findings about the skills in which students lack proficiency, and suggestions for imparting such skills.

RESEARCH METHODS

Intended to enhance and expand on the Phase I. survey, Phase II. consisted of a multi-method, qualitative study of students as they accomplished an information task within a two hour period. Four tasks were designed to maximize opportunities for students to demonstrate their skills in meeting assessable outcomes found in the ACRL Standards. (See Appendix A.) The tasks were also related to the Core Competencies identified by the CSU; however, these competencies are stated in broad terms without identification of measurable outcomes and therefore, did not lend themselves to assessment.

One hundred students were invited to come to one of four CSU campuses on a Saturday to participate in accomplishing one of the four information tasks. In order to study the routine processes of students, four types of data collection and analysis were employed: 1) video and audio taping of the day's activities taking place in assigned rooms, i.e., the introduction and presentation of the tasks to students, focus groups of librarians alone, and mixed discussion groups of faculty, librarians and students, 2) ethnographic work involving observation and informal interviewing of 16 randomly selected students, four at each site, as they worked, 3) computer screen capture to record students' moment by moment interaction with computers used in their searches, and 4) task sheets that required students to fill out answers to essay questions regarding their

research and to provide information about their background and experience with the specific subject of the task and with the library in general.

No one of these types of data by itself can adequately explain student performance. Screen captures alone are insufficient without the ethnography and focus groups giving explanations about why students did what they did. Ethnography alone fails to capture the precise movements of students while using computers, and the later reflections on a range of related topics obtained in focus groups. Videos of group meetings lack the record of what students actually did moment to moment while working on the task. Written essay answers to questions give limited information about the student experience. The strength of this research project is the multi-method approach from which we can view the same phenomena from several different angles.

Student names were randomly selected from samples obtained from the Offices of Institutional Research at each of the 21 participating campuses. The students received a stipend of \$100, travel expenses, and lunch. In addition, one librarian from each of the 21 campuses was invited to participate in a librarian/faculty focus group in the morning and student, librarian, faculty discussion groups in the afternoon. The librarian was asked to invite a faculty member from their campus.

The number of students who actually attended the four events was 76. Students were called and reminded of the event two days beforehand and were mailed a packet of information a few days before. Alternates were lined up to replace cancellations. Despite

these efforts, there were a number of "no shows" and cancellations within a few hours of the starting time. Faculty participation was only half that of librarians with 20 librarians and 10 faculty attending from the 21 campuses.

The research sites chosen for their geographic location were: Fullerton, San Jose, Northridge, and Sacramento. The exercise took place in the libraries of the campuses with the exception of San Jose where a nearby building was used for the morning introduction and lunch. Librarians at those sites assisted in making arrangements for rooms and equipment and in solving other logistical problems. A team of twelve researchers from the SBRI traveled to the sites and participated in data collection.

After a general introduction at each site, students were divided into four groups with each group being given a different task to do. Each group was facilitated by a senior member of the research team from the SBRI. One librarian and one faculty member were also assigned to each group to observe students being given instructions and to participate in afternoon discussion groups. Because of the low attendance of faculty, some groups had only library representation.

While the students were doing the assigned task for two hours, the librarian and faculty participants met in a separate group to talk about the kinds of things they anticipated students would do or that they hoped students would do during the allotted two hours. In thinking about their expectations, the groups often segued into other topics related to information competence, providing additional useful data.

After lunch, the four groups of students, librarians and faculty convened for two hours. During the first hour, the facilitator asked students to talk about their experience doing the task. Probing questions were asked in order to get a full description of students' experience. During the second hour, librarians and faculty joined in querying the students as well as responding to questions from students. At three times - before beginning their work, right after completing the work, and at the end of the day - students were asked to fill out short forms regarding: 1) familiarity with the topic, 2) what they had found and what they would do if given more time, and 3) their experience with Library instruction, using the Library and accessing the Library from off-campus.

VIDEOTAPES AS DATA

The rich, complex material obtained through video and audio tapes holds an inexhaustible number of topics to be explored. Videotapes of events are retrievable data, enabling the researcher to have access to not only what was said and how it was said but to much of the context within which the interaction occurred. Before analyzing data, all video data was systematically coded and categorized using a method developed by educational anthropologists and micro sociologists in the 1970s. This requires numerous, repeated viewings, not only of the tapes as a whole but of individual excerpts as well. Linda Pulliam was responsible for analysis of this part of the data.

I began by watching the approximately 32 hours of videos two times each to familiarize myself with the data, making sparse notes about recurring topics and useful

information. In subsequent viewings I made more extensive notes that aided in developing my focus on six topics: 1) the expectations of librarians and faculty; 2) the role of reference librarians; 3) actual reality and mediated reality and how they relate to the Standards, L/F expectations, and student work; 4) the perception and use of time; 5) narrowing the topic, and 6) hints at best practices. At this point I often stopped and rewound the tapes to verify accuracy of transcripts and my own perceptions.

In the next stage, I chose two topics to pursue for the preliminary report (June, 2001) and refined the coding of the transcripts obtained from audio tape while watching the videos. (SBRI engaged a professional transcriptionist for audio transcripts.) Coding resulted in the development of categories and the data was rechecked to verify it belonged in a specific category. During multiple viewings of the tapes two questions were asked: 1) what does the data tell us? and 2) what does the data tell us about the Standards?

For this final report, I have used the remaining four topics identified earlier, melding them into an analysis of student performance using the ACRL Standards as a template; a discussion of the importance of context; and an analysis of the interplay of procedural and conceptual strategies. I have constructed this analysis not only with the tapes and the written materials students submitted but also by using the ethnographer's fieldnotes and notes from the screen capture data (not the actual screen captures.)

THE ETHNOGRAPHIC METHOD

Data Gathering

One student assigned to each of the four tasks was randomly selected to be followed or "shadowed" by a graduate student trained in qualitative and ethnographic methods of data collection for the two hours that they were involved in accomplishing the task. Students were told that we were interested in knowing how they went about accomplishing the task, that there was no right or wrong way, and that the ethnographer would be asking them to talk about their process what they did and the decisions they made. Ethnographers encouraged the students to gather information in the ways they ordinarily would if this were a class assignment or a task to be accomplished in daily life, and told students that they were not going to be judged on their performance.

The ethnographers were instructed not to assist students in carrying out their tasks, and were careful not to influence the information gathering process, at times reiterating that there was no right or wrong way to proceed but that students were to pursue the searches in the ways that they ordinarily would. The ethnographers' questions were general and open ended and included prompts such as: How did you decide to select that key word? Tell me about what you are doing now? How did you select that search engine or database? etc. As the ethnographer shadowed the students, they took down jottings to help them recall what happened and subsequently wrote fieldnotes detailing the students' activities.

Linda Shaw was responsible for training the ethnographers and writing the analysis of their work.

Strengths and Limitations of the Data

The strength of our ethnographic data lies in the rich detail about the ways people actually understand and are involved in every stage of the information seeking process. However, the findings from this report are limited in that we randomly selected students to follow without consideration for whether or not they were representative of the study sample or the larger universe of CSU students as a whole. This means that our findings cannot be generalized with certainty to the larger population of CSU students. Nonetheless, actually looking at how people go about finding information provides insight into their strengths and weaknesses as well as the constellation of factors that shape their efforts in a holistic way.

ORGANIZING THE SCREEN CAPTURE RESEARCH

The screen capture component of the Information Competence research project has been developed, organized, and implemented by Nancy Oiyee Hartwig and Barry Saferstein of CSU-San Marcos's Daniels Discourse and Media Lab. During Phase I of the Project, we began designing a way to empirically document students' information seeking activities during the Project's second phase. We designed the screen capture research by reflecting on our prior research projects that involved recording, cataloguing, and analyzing audio and video data. These projects examined work processes in the television production industry and classroom learning tasks featuring computer use in

high school science classrooms. These studies of work, technology, learning, and expertise apply research methods developed in the areas of cognitive sociology, ethnomethodology, and discourse analysis. The data recording, processing, and analysis facilities of our Daniels Discourse and Media Lab provided us with resources to undertake a comprehensive study of the students' computer activities for the Information Competency Project.

In order to capture the computer activities of students during the Phase II research, we contacted library faculty and network analysts at the four campuses selected as research sites.¹ Our initial plan was to capture the computer activities of 6 to 8 students at each site. However, due to the availability of library instructional computer labs with 15 to 20 work stations, we took the opportunity to capture the work of most of the students who participated in the project.

We arranged for Network analysts at each site to install Camtasia Recorder (the screen capture software used for the Project) on all of the lab computers. Between January and June, 2000, Professor Saferstein had tested the use of Camtasia Recorder, Winzip, and Quick Time to capture and analyze various computer tasks.² Prior to the first research date scheduled at CSU-Fullerton, we visited the lab there twice to test the installation and operation of the screen capture software. For the research activities,

¹Our thanks to the following library faculty and technical staff at each research site for their assistance in organizing and completing the screen capture research in the library instructional computer labs: Carol Bednar and Roger Harrison at CSUF; Sue Curzon, Ann Perkins, Michael McFarland, and Eric Willis at CSUN; Jo Bell Whitlatch, Altaful Khan, and Blake Morris at SJSU; Linda Goff, Ben Amata, and Jim Hayes at CSUS.

members of the SBRI research team assigned one student to each computer in the library computer labs. The computers in the labs were numbered. The SBRI staff placed a computer number on the nametags of students from all four of the task groups. During the morning orientation sessions, the research team explained to the students that when using computers to work on their information tasks, those with numbers on their name tags were to use the computer with the corresponding number in the computer lab.

The library faculty liaisons at CSUF and CSUN also arranged for students to receive printing cards that enabled them to print material they found during their searches at printers in the library if they wanted to do so. The labs at SJSU and CSUS contained printers that the students could use without need of copy card.

Data Collection

At each site, we installed Camtasia and customized the screen capture settings on the Friday prior to the Saturday research sessions. On the day of the research, students assembled in rooms assigned to respective tasks at 9:30 A.M. to receive the printed task explanations. Camtasia screen capture was started prior to the time that students entered the lab to work on their assigned tasks. We also arranged two camcorders in each lab to record a panorama of lab activity. The video has provided us with a record of where students were sitting and their movements within the lab. This allows us to see what the students were doing when the screen capture data reveals no computer activity. We also

² This testing of Camtasia was aided by a student assistant, Kevin Lavin

installed audio recorders between lab work stations to record students' discussion or questions.

When students were finished reading and clarifying the tasks, they proceeded to work on the tasks. Many went to the assigned computers at or shortly after 10:00 A.M. The printed schedules and the morning orientation and task discussions directed them to stop working on the tasks when they felt they had completed them or at noon. At noon, any students who were still working at the assigned computers were asked to stop and return to the rooms where they had received their task information.

At CSU-Fullerton, we were able to set up screen capture at 20 computers in the Pollak Library's instructional lab. Twenty students used the lab computers. We obtained 20 screen capture files.

At San Jose State University, we were able to set up screen capture at 18 computers in the Clark Library's instructional lab. Thirteen students used the lab computers. We obtained 13 screen capture files. SJSU had 5 fewer students working on computers than anticipated due to low turnout of students who had indicated they would participate in the project.

At CSU-Northridge, we were able to set up screen capture at 16 computers in the Oviatt Library's instructional lab. Sixteen students used the lab computers. We obtained

15 screen capture files. One computer at CSUN crashed toward the end of the screen capture session and the file was unrecoverable.

At CSU-Sacramento, we were able to set up screen capture at 15 computers in the University Library's instructional lab. Fifteen students used the lab computers. We obtained 15 screen capture files.

WRITTEN MATERIALS

Students had been asked to fill out forms before doing the task, immediately after doing the task and at the end of the day. (See Appendix A for sample forms.) These forms gave us information about the students' background both in regard to knowledge of the task topic and in regard to their library and computer experience. They also allowed students to think through plans before doing the task and to report on what they had found out and what they would have done if given more time. The answers in these forms were used in two ways: answers to the multiple choice questions were quantified in order to make statements about students' experience and background as a group. Answers to the essay questions as well as the multiple choice statements were used to look at individual students' experience in conjunction with the data from videos of focus groups and the ethnographic fieldnotes. Linda Pulliam, Ph.D. was the person responsible for analyzing this data.

WHAT IS IN THIS REPORT

In the following pages devoted to the findings of this study we focus first on one segment of the student experience: working at the computers. In the section on ethnographic fieldwork we then broaden our focus to include what students did throughout the time they were involved in working on the task, not just when they were using the computer as a tool. Information seeking, evaluation, analysis and use, after all, call for much more than working at a computer. We next look at how the Association of College and Research Libraries (ACRL) Standards might be applied to student performance and the questions raised in attempting to do so. Finally we move to a more conceptual analysis of some of the central issues in information competence that were embedded in student work and the ensuing discussions i.e., the importance of context, and the relationship of procedural and conceptual strategies. We conclude with student suggestions for best practices and with our own recommendations.

WORKING AT THE COMPUTER: FINDINGS FROM SCREEN CAPTURE

The screen capture data provide instances of students' information searching procedures. We do not claim that any student's search displays that student's complete knowledge of how to seek information. We do find that each student displays some of her or his routine search procedures, and that the data set displays tendencies toward information seeking routines in which students apply their specific knowledge about:

- 1) what constitutes information that is adequate for completing common tasks, and
- 2) ways to find such information.

We have noted patterns of information seeking that are common among the students. We have examined how students use computer interfaces and operate within online environments when seeking information and access to library resources.

Analysis of the screen capture data has produced the following findings:

- Students tend to use the WWW rather than library catalogs and databases.
- Reliance on the WWW as a source of information may discourage students from developing the skills and evaluative criteria supported by the ACRL standards.
- The online environment may influence the ways students choose and refine search terms, leading to similar search strategies.
- Students' selection and revision of search terms does not meet the ACRL standards.
- Students do not use online databases and catalogs effectively.

- Students often give up easily when trying to use library databases and catalogs.
- Libraries can enhance students' information seeking skills by expanding their function as places for teaching and learning information competency, rather than functioning primarily as repositories of information resources.

Students tend to use the www rather than library catalogs and databases.

Of the 63 students whose work we recorded with screen capture software, 28 used the World Wide Web exclusively to work on their tasks while at assigned computers. Only 3 students used the library databases/catalogs exclusively. Of the 35 students who did use library databases/catalogs, only 17 spent more than 30 minutes of the allotted two hours searching in library databases/catalogs. Nine of the students who used library catalogs/databases spent less than 15 minutes searching there.

Reliance on the www as a source of information may discourage students from developing the skills and evaluative criteria supported by the ACRL standards.

Students would access web search engines directly from computer 'desktops', from hyperlinks in web browsers (Netscape or Internet Explorer), by typing search engine names in web browsers, or by clicking links in university library web pages. Students would begin web searches by typing search terms based on key words in tasks such as, 'pesticides', 'child farm workers', 'health problems', and 'farming corporations'. These searches would produce a variety of links. Students' scrolling through the lists or moving the mouse pointer over lists indicated that they often perused only a few of the results. Web searches instantly provide distractions. When students search a library database or catalog, or browse library stacks or journal collections, materials that pique

their interests but are unrelated to the task at hand may sidetrack them. However, in such cases, they are not instantly presented with titles and descriptions that diverge in content, format, and medium from the materials they seek. (Please see Appendix C, Figures 1-4, for photos of WEB SIDETRACKS: CSUS08 (ISLANDS))

Web sidetracks differ considerably from walking through stacks and noticing an interesting but diverting book title. In the latter case, a student's perusal of the book does not immediately transport the student to another part of the library, to some place outside of the library, or to a movie or video screen. The use of web search engines often creates such digressions.

For example, while working on the pesticide and farming task, AG (CSUS02) visited a number of different sites, including Barnes & Noble, the United Farm Workers, the National Center for Farmworker Health, and The Modesto Bee newspaper. AG visited many links that did not seem directly applicable to the task (e.g., contact information for various organizations, how to distribute the newsletter for the NCFH, how to make donations to the NCFH, and making a presentation at a migrant conference). While students may find interesting information, the links they visit are sometimes unrelated to the task, and their information searches of these sites are ineffective in regard to completing their tasks.

In this case as in others, the student's effectiveness in finding information appropriate to the task is influenced not only by visiting sites that do not contain task

specific information of high validity and reliability, but also by how the student sought information while at these sites. For example, AG did not use The Modesto Bee's search function to look for news relating to pesticides. Instead, the student selected 'health' from the drop-down menu and scrolled through the first ten links. The student then selected 'top story' from the side menu and again scrolled through the first ten links without visiting any of them. The student selected 'local' from the side bar menu and scrolled to the bottom of the page without clicking on any links. (Please see Appendix C, Figure 5, for picture of SIDETRACK: MODESTO BEE LOCAL NEWS LINK, CSUS02)

Whether AG's intent was to look for information about pesticides or simply to browse hometown news, the student was not exhibiting effective information seeking procedures that would maximize the number of useful, reliable, and valid sources found during the time available for completing the task.

Encyclopedia databases accessed on the web were used by some of the younger students. Encyclopedia sites prove to be poor choices as sources of information relevant to the tasks. For example, LW (CSUN03, ART) linked to Encyclopedia Americana Online. There, LW used the search terms 'Aztec pottery', 'Maya pottery', and 'Navajo pottery' (limited to articles/titles). Each of these yields 0 results. At one point, LW broadens the search to 'Aztec' (limited to full text), getting 108 results. This is an example of the false sense of successful searching students develop by using broader or more general terms. LW then tries 'Navajo' (limited to article/title) with 5 results. During this part of the search, the student prints information on pre-Columbian art and architecture,

Maya architecture, and Navajo history and language. However, LW began the search looking for information about pottery. This is an example of a student letting the results of a poor search influence the information saved for future use. While we can view this as student ingenuity or exposure to interesting information, such searching does not enhance the student's information competency.

In another example, MB (CSUN09, PESTICIDES) tries to find an appropriate library database, finally choosing Encyclopedia Americana (either because it is familiar or just because it appears as a choice on a selected page. MB types the search term 'pesticides and children' (limited by article/title) getting 0 results in an Americana Online search. She then changes the search limit to 'full text', using the same term, 'pesticides and children', and gets 17 results.

Some students followed this strategy, in which search terms remain the same, but the limits are changed to yield results. It does demonstrate a degree of expertise in refining searches. However, when applied to online encyclopedias or to web sites that contain information of little reliability or validity, it gathers information of dubious value for use in either university or corporate settings.

Such searching could be useful to students, if they were to glean terms from the encyclopedia sites that they would use subsequently to refine their searches. However, we found few incidences of students modifying their search terms due to information they found. More often, students would save articles they found relevant, and then repeat

the search in another search engine, website, or database using similar terms or by using different terms that were not derived from prior searches.

The following example shows that web searching does not require students to use ACRL standards in order to produce information that may be adequate for some tasks. As many students do, IP, (SJSU08), applies terms from the task statement to the search. However, possibly due to a misreading or typing error, the student types 'global warning', rather than 'global warming' using the search engine, Yahoo. (Please see Appendix C, Figures 6-12, for photos related to this discussion.)

Yahoo produces a list of 6 links that contain the words, 'global' and 'warning'. By chance, the second link on the list ('Global Warming: Early Warning Signs'), deals with global warming, the task subject. Having found a relevant link with the 'global warning' search, IP continues to use the word 'warning', instead of 'warming'. In a subsequent Yahoo search based on the task information, IP types 'global warning hoax'.

After pursuing the search in this manner, IP eventually moves to the SJSU Library web site, typing 'science' in the 'Search The Library Website' box. IP does not apply search terms refined during the prior web search, but broadens the search. This generalized search strategy is not productive. The student later decides to use the Library web site's 'Search The Library Catalogue' function. With search limits set to Journal Title, IP types the term 'globa warnig'. The student does not correct the typing error or change the search limits to 'keyword' or 'subject'.

IP scrolls through the resulting list of results. As is the case with many library catalogue search engines, a search term producing 0 results is located among an alphabetical list of library holdings. In this case, the journal title, Global Risk Assessment Issues Concepts And Applications, appears near the notice, 'globa warnig', 0 results. The student selects the journal link. The journal link produces a catalogue entry, which includes the subject term, 'political stability'. IP selects this link.

As these examples show, by applying search procedures that produce some results when using web search engines, students can find information sources both on the web and in library databases that might be adequate, though not preferable, for completing assignments. However, accomplishing these results requires very few of the information competencies listed in the ACRL standards. More importantly, such searches neither display nor help students to learn the analytical and conceptual skills that they should develop during the course of a university education.

The online environment may influence the ways students choose and refine search terms, leading to similar search strategies.

Students tend to choose a database by examining lists and hyperlinks showing what is available. Often, they do not select databases that are best suited to their task. The students often displayed hesitancy or uncertainty in deciding what buttons and links to click. They would make a choice, then quickly return to the page containing the choices and scroll through it or make another choice.

For example, after more than 2.5 minutes of scrolling through the information sources presented on the CSUN library's arts & humanities page (returning to the library home page once), LW (CSUN03) selects 'humanities abstracts'. (Please see Appendix C, Figures 13-17, SELECTING A DATABASE: CSUN03 SEQUENCE)

In contrast to database searches, the screen capture data suggest that web searches provide students with a false sense of success in their searching. Using the web, students often get many results using a very general search term (such as a single word) due to the ways that search engines function. The following table presents one of the more blatant examples of this search strategy.

WEB SEARCH TERMS: SJSU02 (DV)

Search Engine	Search Term	Number of Hits	Site Type	Act
NETSCAPE	islands	160 categories		
AKS JEEVES	islands			
ASK JEEVES	islands			
ALTA VISTA	islands	1,752,635	.COM	PRINT
ALTA VISTA	islands	1,752,635	.COM	PRINT
ALTA VISTA	islands	1,752,635		
ALTA VISTA	islands	1,752,635	.COM	PRINT
ALTA VISTA	islands	1,752,635		
LOOKSMART	islands	2005		
LOOKSMART	islands	2005	.COM	
LYCOS	islands	3,860,881	.COM	PRINT
LYCOS	islands	3,860,881		
HOTBOT	islands			PRINT

The rows containing the same search engine indicate that the student examined the list of links or selected one of the links. The links that the student visited were all commercial sites (.com). The student printed material from 5 of the sites. This approach to is more like fishing than searching for information. In the best cases, students increase the quantity of search results by changing the search limits while using the same search terms. Rarely does a student investigate the benefit of systematically refining search terms and changing search limits. When they do not find useful information by refining search terms or searching library databases, students routinely revert to the web searches based on search terms that they have previously abandoned. As the time allocated for the task dwindles, they often save material from those early web searches. The large number of web links that such procedures produce lead students to develop mediocre searches.

In many of the searches, students do not exhibit procedures that would meet various ACRL standards. Yet, as in the example above, web search engines enabled many students to examine or save materials that might count as information and might have relevance to a task in some broad sense. However, such searches do not display information seeking skills that a student should gain from university study.

Students do not effectively use online databases and catalogs

Library online interfaces provide various ways for students to access databases such as categorized lists of hyperlinks to databases or direct links to databases. However, students often did not make good use of the databases, often failing to use search terms

appropriate to databases. The screen capture data point out a difference between search terms that produce lists on the web and those needed to produce lists in databases. The data also show that students do not display adequate knowledge of how to use the database interfaces to pursue and refine searches.

For example, during the 62 minutes (approximately) that working at the computer on the 'Islands' task, JH (CSUS08) used a total of only 8 different search terms during her web and library database searches. Three of these sought web resources ('encyclopedia', 'maps', 'www.geography.org'). The remaining 5 terms she used were 'island', 'islands', 'island formation', 'longest island' and 'continental islands'. She continued to use these very basic terms despite finding either no results or thousands of results.

WEB SEARCH TERMS: JH (CSUS08)

Search Engine	Search Term	Hits
GOOGLE	islands	6,000,000
WEBSITE	island formation	0
WEBSITE	island	0
WEBSITE	island	2
YAHOO	island formation	226,000
YAHOO	island	226,000
YAHOO	island	226,000
YAHOO	island	226,000
YAHOO	encyclopedia	10 sites
WEBSITE	island	
WEBSITE	longest island	
WEBSITE	island formation	
WEBSITE	maps	
WEBSITE	continental islands	
WEBSITE	www.geography.com	

LIBRARY SEARCH TERMS: JH (CSUS08)

Database/Catalog	Search Type	Search Term	Limits	Results
HSU catalyst cat	KEYWORD	island formation		2762
1 st search geoRefS	KEYWORD	island		63,423
eureka	SUBJECT	islands		194
1 st search Basic-geoRefS	KEYWORD	islands		49,353

This search is typical, especially in regard to web searches, in its use of only a few unsophisticated terms. Of even more consequence, is the failure to systematically refine search terms. Rather we find students reverting to terms that have been unsuccessful or too successful (finding thousands of irrelevant sites).

Students often give up easily when trying to use library databases and catalogs

If students begin a database search lacking confidence that the database contains the kind of sources useful to the task, the students will not persist in using the database. Since other databases are a click away, the students at times will jump from one database to another without successfully locating useful information due to lack of knowledge about the types of sources available in the various databases and ways to use the databases effectively.

In another example, MK (SJSU07) typed into a journal title database the same search terms ('agriculture' and 'pesticides') previously used in a library catalog search. This produced 9 results for the term 'agriculture'. MK then tried more specific search terms ('agriculture and pesticides', 'pesticides and health') that produced 0 results. The student then typed in a broad search term 'pesticides' that yielded 0 results. MK then returned to the search function and typed 'agriculture' again producing the same 9 results. MK looked at two of the 9 results before trying another library database.

SAME SEARCH TERMS USING CATALOG AND DATABASE:SJSU07 (MK)

Database/Catalog	Search Type	Search Term	Limits	Results
catalog	KEYWORD	agriculture		4358
catalog	KEYWORD	pesticides		404
journals database	TITLE	agriculture		9
journals database	TITLE	agriculture and pesticides		0
journals database	TITLE	pesticides and health		0
journals database	TITLE	pesticides		0
journals database	TITLE	agriculture		9

The student used search terms in the journals database that were similar to the terms used in the library catalog search. In this case, we do not know if the student was aware that the journals database searched for titles rather than content or keywords. This type of mistake can be corrected by providing students with online and posted reminders, as well as with Camtasia tutorials. In addition, the design of the interfaces can be improved to emphasize the different types of databases.

Students' selection and revision of search terms does not meet the ACRL standards.

Students have learned that using more specific search terms, whether searching library catalogs and databases or the web, will result in fewer but better matches. For example, a CSUS catalog tip states that 'sports' is too broad of a term to be effective, 'sports medicine' is more specific, and 'sports medicine united states' is most specific. However, First Search suggests, "to improve your search, use fewer terms." World

Almanac recommends, "use fewer terms to describe your search." While these suggestions may be appropriate when using a specific database or a library catalog, students may not know or understand when to use more specific or more general terms.

Generally, most students search in the following ways:

- Begin with more specific search terms and then try broader terms when the more specific search terms yield 0 results
- Begin with broad search terms, narrow them, and then return to the broad search terms when the narrower terms fail to produce results
- Begin with a very broad search term and scroll through pages and pages of results, linking to various citations rather than narrowing the search.

In the following example, ES begins with narrow search terms and then tries a broader search term when the more narrow terms yield 0 results. ES performs a subject search using the library catalog. The student begins by using some very specific search terms, ('history of improvisational acting', 'history of acting', 'improvisational acting', 'improvisational theater') all of which yield 0 results. Finally, a single, general search term is used ('improvisation') and results in 12 matches.

SPECIFIC TO GENERAL SEARCH TERMS: CSUS01 (ES)

Database/Catalog	Search Type	Search Term	Limits	Results
catalog	SUBJECT	history of improvisational acting		0
catalog	SUBJECT	history of acting		0
catalog	SUBJECT	improvisational acting		0
catalog	SUBJECT	improvisational theatre		0
catalog	SUBJECT	improvisation		12

The following example is one where the student (AW) begins the search by using broad search terms, narrows them, and then returns to the broad search terms when the narrower terms fail to produce results. AW accesses the Environmental Protection Agency's Integrated Risk Information System database (IRIS) via the library database index. AW begins the search with a very broad search term 'pesticides'. This produces 250 results. The student does not look through any of the results but returns to the search function and tries two additional searches using more specific terms ('pesticides california', 'pesticides farming'). Both of these searches result in 0 matches. AW then returns to the search function and repeats the original search, 'pesticides', which again produces 250 results. The student then scrolls through the first ten results but does not look at any in detail.

GENERAL TO SPECIFIC SEARCH TERMS: CSUN12 (AW)

Database/Catalog	Search Type	Search Term	Limits	Results
iris database	KEYWORD	pesticides		250
iris database	KEYWORD	pesticides california		0
iris database	KEYWORD	pesticides farming		0
iris database	KEYWORD	pesticides		250

Many of the students begin a search with a very general search term and scroll through pages and pages of results, linking to various citations rather than narrowing the search. For example, JW (CSUS10) begins searching the library catalog using the search term 'pesticide'. This produces 330 results. The student then scrolls through about 120 links and does not attempt to modify the search terms.

BROAD SEARCH TERM, SCROLL THROUGH PAGES: CSUS10 (JW)

Database/Catalog	Search Type	Search Term	Limits	Results
catalog	SUBJECT	pesticide		330

The data reveal that most students do not make search terms much more specific, and, if they do refine search terms, they do not continue to revise them beyond one or two additional searches before switching search engines or databases. Often the revisions consist of trying different combinations of 3 or 4 words in different databases or search engines--despite the term's lack of effectiveness in earlier searches.

For example, SK (CSUS12), begins a database search using Ebscohost, key word, 'child farm workers', getting 2 results. SK then changes the search term to 'pesticides' (Ebscohost keyword search, full text) and gets 1351 results. Next, the student changes the search term to 'pesticides and health problems' (Ebscohost keyword search) and gets 12 results. The student switches to an agriculture database (keyword search) and types 'child farm workers', getting 1 result. Using the same database, SK changes the search term to 'health problems and pesticides', with 0 results. Then, the student moves the search to Lexis-Nexis, (keyword search) using the search term 'child farm workers' with 0 results. Continuing to use Lexis-Nexis, SK types the search term 'pesticides', finding 1 article. The student then switches to the Infotrac database, first typing 'child farm workers' (subject search), then changing the search term to 'pesticides and health problems', getting 32 results.

SAME SEARCH TERMS, DIFFERENT DATABASES: CSUS12 (SK)

Database/Catalog	Search Type	Search Term	Limits	Results
Ebscohost	KEYWORD	child farm workers		2
Ebscohost	KEYWORD	pesticides	full txt	1351
Ebscohost	KEYWORD	pesticides and health problems	full txt	12
AgNic database	KEYWORD	child farm workers		1
AgNic database	KEYWORD	health problems and pesticides		0
Lexis-Nexis	KEYWORD	child farm workers		0
Lexis-Nexis	KEYWORD	pesticides		1
Infotrac	SUBJECT	pesticides and health problems		32

While this strategy produced some results, the student repeated the same search terms in different databases rather than using information gained from results of the search to refine the subsequent search terms in order to explore a database more fully. Reasons for such strategies may include the student's unfamiliarity with specific databases, the student's lack of knowledge about how to use databases, and the design and operation of databases.

Few Boolean Searches

Students generally do not use Boolean operators when searching the WWW. They do not consult online help offered by search engines to learn how to better use search terms to refine their searches. Since different search engines have different ways of limiting searches and the ways that search engines select and sort data is a mystery, students' neglect of Boolean operators may represent a choice related to their experience of the web environment, rather than ignorance of Boolean operators. Some databases or search engines are Boolean, some are not. Many search engines and databases automatically add 'and' to the search. Library catalogs and databases eliminate frequently used words. Some are supposed to automatically link search terms, but do not seem to do so. Many students use 'and', but rarely other Boolean operators, such as 'or' or 'not'.

Many of the students' web searches produce lists of numerous links that are not related to the task. Working within this ambiguous web environment, under routine constraints of task time and assignment deadlines, students may decide that it is more pragmatic to use search procedures that apply universally to any search engine and

database rather than learning the particulars of each one-especially when the large quantity of links found in many web searches makes it difficult to assess the effectiveness of Boolean operators in refining searches.

The Teaching /Learning Functions of Libraries and Online Resources

If students had been working on course assignments, perhaps they would have used a larger variety of search terms based on course materials and discussions. However, our screen capture data strongly suggest that, generally, the students do not effectively refine searches by applying the terms, concepts, and information that they encounter during their searches. This is a type of information competency that is central to meeting the ACRL standards. Expertise in systematically refining searches is key to efficiently finding a range of valid and reliable information about a topic. Such information competency is valuable in the workplace, possibly even more so than in a university setting where courses and assigned readings provide guidance to students.

One way for students to develop knowledge of a particular database would be for the students to explore it by being persistent while using it. This is where the different teaching/learning and resource functions of libraries and online access to them have an effect. Providing easy online access to many databases and websites may serve the library's objective of providing a variety of resources to students and faculty who have adequate expertise in searching for information. However, the accessibility of a multitude of resources by itself does not serve the function of teaching students and helping them to learn information competence.

It may be beneficial for students lacking such expertise to do more thorough searching in one database in order to develop and practice the skills that comprise information competency. Guidance in this might take the form of courses, online or digital tutorials, librarians or student information assistants who move around the library computer workstation areas, and signs posted near workstations suggesting how they might choose and explore a database.

DETAILING STUDENT WORK PROCESSES:

FINDINGS FROM ETHNOGRAPHY

Organization of This Section

The purpose of the ethnographic component of this report is to provide insight into the ways that students think about, seek and apply information. Data about information competence gathered using testing or screen capture procedures may suggest the patterning of search practices but can say nothing definite about the strategies and logics of the people who engage in them. Conclusions about information competence based solely on such "endpoint" data thus may distort, rather than clarify, the meaning of these outcomes. Process oriented data address information competence based on an appreciation of contexts, constraints, and meanings of information practices from students' own points of view. The value of detailing student work processes and their meanings is diagnostic. Insights into students' "ways of knowing," their strengths and challenges, provide an important knowledge base for developing the "best practices" needed to assess and build information competence.

The guiding questions for this ethnographic study of student work processes include: Where do students seek information? How do they find it? and How do students select and apply the information they find?

Ethnographic Findings

Analysis of the ethnographic data reveals the findings listed below. These findings indicate general patterns and tendencies regarding students' working styles. They are not meant to characterize every student's information seeking routines and

procedures. The body of the report provides a more nuanced portrait both of these trends and exceptions to them.

Where Do Students Seek Information?

- Students embrace the virtual library for its convenience, flexibility, timeliness, and access to large amounts of up-to-date information.
- Students use the Internet as a "gateway resource" for introductory information and as a stepping-stone to other search media.
- Students use favorite search engines and databases for their efficiency; ease of use, and for the amount and quality of information.
- Students rely less on traditional "bricks and mortar" library resources.
- Students achieve well-rounded searches using non-technological sources.
- Technologically based information sources telescope (and possibly limit) the information that students retrieve.

How Do Students Find Information?

- "Plans of action" guide student searches.
- Students approach searches holistically, assessing the distinctive contributions of diverse information resources.
- Students struggle to come up with key words.
- Unfamiliar search environments pose significant barriers to the use of information resources.

- Students engage in general searches to generate a robust pool of information from which to discover "gateway" resources.

How Do Students Select and Apply Information?

- Search methods (including the characteristics of the on-line environment), rather than critical evaluation of resources, guide selection of materials.
- Students with little knowledge of the topic selected sources based on background knowledge and personal experience.
- Students selected information based on expectations of the assignment.
- Students selected information based on perceived needs and preferences of their audiences.
- Students' concerns for credibility and balance led to seeking primarily fact-based, rather than idea-based, information.
- Students' concerns for credibility and balance led to selecting information based on form (e.g., representing both sides) rather than critical evaluation of content.
- Student problems related less to an inability to locate information than in their ability to locate relevant information and to make use of the information they found.
- Successful searches require strategies for expanding students' knowledge bases.
- Selection and application of information required orienting and reorienting to the task.

WHERE DO STUDENTS SEEK INFORMATION?

Students Embrace the Virtual Library

Nearly all students in the study drew heavily on computerized information such as library databases and the Internet as resources for responding to the tasks. Most sought information that could be gleaned from non-technological sources -- books or journals in the stacks, friends, etc. -- but typically only after exploring resources available on the computer. This ethnographer's description of the student she followed is typical of many students in the study:

Afrika finds her computer easily and begins right away to tell me that she ALWAYS starts with a Web search and turns slightly toward me offering a look and a positive nod that sends a confirming message. I am glad that she mentioned this because I always wonder if the students that we are tracking are oriented to use the computer just because we assign them one. But Afrika makes it clear that she is following her typical approach.

Students liked the convenience and flexibility of the computerized "virtual library," which allows them to adapt information seeking to other demands in their lives. For example, access to the library by computer from home enables students to work more efficiently, saving travel time to and from the library, and permitting them to accomplish library work while fulfilling other obligations (child care, etc.). Using the computer also enables students to work on their own schedules, for example, at odd hours when the library might be closed. Several students said that they normally were able to do almost all of their research without leaving their bedrooms. Jean's comments regarding the

convenience of computerized information searches reflects the sentiments of a number of students in the study:

She said she is more comfortable using the computer at home, which she could use at anytime during the day or night, besides she could wear those great "not-out-of-the-house clothes" she loved so much.

Students Prefer the Internet as a "Gateway" Resource

Students often began their searches for information using the World Wide Web rather than another computerized library databases that provide access to book holdings or journal articles. Several students noted the timeliness and efficiency of the Internet, which provides access to a large amount of the most up-to-date information in one place. Students noted that the Internet's "one-stop-shopping-feature" provided a foundation or informational base that could later be used to extend the search using other sources. In commenting to the ethnographer about why he began with an Internet search, one student who knew very little about the topic explained that it would provide the overview he needed to launch his search:

Bob and I walked out of the task room and he said, "Okay, where is the computer room?" I ask, "Do you always start with a computer search?" He said, "I don't know anything about this topic, so I would go to the computer and do a GOOGLE search and get some general information.

Another student who typically draws from a range of sources for a "well rounded search" turned to the Internet after meeting with little success using other information resources.

The unfamiliar computer environment posed a significant barrier to the use of a broader range of resources:

Randy said he wanted to find periodicals, magazines, and journals. He said that he like to have well-rounded research, which I interpreted as getting information from many sources. He got out of Eureka and then went to databases and periodicals. Randy told me that he is not familiar with this method of research. I asked if it was because all the information is combined or because he was just not familiar with this library's Web page. He said a little of both. Randy then changed his strategy to just doing an Internet search. He said, "Considering the circumstances," he would do an Internet search.

Other students used the Internet as a stepping-stone for deepening their searches:

Helen immediately went to the Internet. She stated that she always began her research, whether at home or on campus, with an Internet search. It had been her experience, throughout her academic career, that if she first entered the data on the Internet, she could then move right into the search in the library database because she could move right from one media to the other with the access on campus.

Students Choose Favorite Search Engines and Databases

Precisely because the Internet and other computerized search resources offer a wealth of information, students must find ways to make their searches manageable.

Students' choices were purposeful and typically involved the use of a favorite search engine or database that yielded a sufficient amount of information organized in ways that the student found helpful. One student who said he always uses YAHOO! or GOOGLE cite as reasons efficiency, ease of use, or the amount and quality of information that these sites yield. Bob likes says that he uses GOOGLE because: "I think it's the best. It gives you the biggest amount of hits." Another student emphasizes manageability, noting the organization of information on her favorite search engine:

She started a YAHOO search saying, "I like this because I like the categories. They have a great breakdown of every imaginable category."

Another student also stresses the quality of information in her enthusiastic endorsement of one search engine:

Afrika says that she discovered GOOGLE last year and emphasizes that she uses this engine because it seems to return the best information. She says that it is the best engine that she has found. I tell her that I am partial to GOOGLE also. She says that it "finds what you want."

Other students chose search engines for reasons that are more social than informational or technological. For example, in one case, the student used a search engine because communicating with the computer using the engine most closely resembles human communication styles with which she is familiar and comfortable:

The student starts a search, typing in <http://www.ASKJEEVES.com>, saying she is going to her favorite site. When asked why it is her favorite, she

replies that she can ask him questions, not just do a word search. She put in the exact title of her task: " The pottery of Aztec, Maya, and Navajo Cultures." Several questions come up with a window to choose answers to her search. "It's easier when you are searching a lot of different key words or a list of subjects to use ASKJEEVES. With other search engines, you must use a 'Boolean' search."

A number of students appear to have evaluated several search engines before settling on a favorite. Others say they regularly use a particular search engine because it was recommended by a friend, implying that endorsement by others, rather than first-hand assessment, plays a significant part in their choice of favorite search engines:

Maricella typed in www.GOOGLE.com. The page that came up stated that this site was not responding or could not be found. She then typed www.YAHOO.com. I asked her how did she decide to use YAHOO! and she said that it was one of the engines that she normally uses because it was the most known.

While most students started their searches using favorite Internet search engines, a few also searched using other library resources that had proven helpful in the past:

Maura returned to the Web site to try a different search engine. She said she remembered a paper she had written a long time ago using Lexis-Nexus

Students Rely Less on Traditional "Bricks and Mortar Library" Resources

In the extreme, reliance on Internet search engines seemed so complete that a few students failed to make use of other, more traditional library-based resources such as books or journals located in the stacks:

The student makes his way to the computer assigned. He begins to tell me what he will look for: popular islands, and island stuff on TV, and Web sites. He says that he can look up books, but typically, he would not do that.

Another student was interested only in full-text articles that she could download from the Internet or computerized databases.

The student went right to the lab and to the CSUSJ home page and said, "I'll just see what holdings they have in full-text."

This student uses books but only those found online:

She says she sometimes does start with some books or the Internet to get an overview of the subject. But she doesn't use books anymore. When she does, her school offers entire sections of books online. Usually, she says she finds an official Web site.

Yet another student relies so completely on the Internet as well as information from databases that she can download from home that she rarely uses books or even enters the library:

I hardly ever go to the library to search the stacks physically. I just sit at home and print the full-text articles...I don't like books. I rarely walk into

the library. I can count on one hand how many times I've been to the library. When I was a junior and transferred, we had a library orientation. That's the last time I went to the library.

Similarly, Jean revealed that her first step toward completing an assignment would not have been a visit to the campus library:

The only time she would reasonably use the campus library system was if she were on campus for some other reason, there was immediate access to a terminal, or if she had to remain on campus between classes and had completed all assignments for the entire day.

One student abandoned her computer search for a trip to the stacks to look for books after growing frustrated by the difficulties she encountered attempting to get access to full-text articles in an unfamiliar information environment:

The computer is driving her nuts, she says, and it is affecting the entire process. She says she is thinking about going out to look at the magazines. At this point she has just stayed in the computer lab searching the Internet and has not done what I would call an academic search. She did scan the list of databases the school has on-line several times but didn't spend any time with them. For example, she did not use a database such as EBSCO or JSTOR but used popular search engines such as ASKJEEVES OR GOOGLE.

While the fact that the information resources of choice seem to be those that were not easily accessible using the computer, at least a few students valued information gleaned from more traditional library-based information sources such as books and journals found in the stacks. Several students talked about the distinctive contributions of these information resources. One student, for example, said that she reviews books because, "They are good for getting an overview of "what's out there." Another student who preferred journal articles as the "best" resource similarly used books for an overview of the topic:

Asked if he used books, he said sometimes, but journal are the best, most detailed [source], while books and the computer give an overview, more general.

Assessments of the distinctive contributions of diverse information resources sometimes led students to pursue information resources a coordinated sequence. Afrika, for example, turns to books after consulting an the Internet to gain an overview of the topic:

Afrika finds her computer and begins right away to tell me that she ALWAYS starts with a Web search But she adds that she also likes to use periodicals and journals that are available at the San Francisco State library, "That would be my second stop." Noting that the San Francisco State library has a nice periodical section and that the government documents section is particularly strong, she adds, "I really like that stuff."

Reversing the ordered sequence followed by most, the Internet is the information resource of last resort for this student:

I asked him to describe what he would normally do when researching. He said he would look for books, then magazines He would do an Internet search last.

Another student echoed these preferences:

The student told me that she looks for journals, then books, printing out the call numbers, and then searches Web sites.

Like several others who turn to the Internet later in their searches, this student consults other sources looking for an overview, key words, and concepts in order to "make the Internet work for you."

These information-seeking practices suggest that students approach their searches holistically, assessing the distinctive contributions that diverse information sources provide to the overall task of seeking information for their projects. Even more subtly, their habit of using information resources in a particular order reveals that students assess the contribution that information from one source will make to their ability to get access to and utilize information gathered from the others.

Students Achieve "Well Rounded" Searches Using Non-Technological Sources

While students relied heavily on computer-based information resources, many were resourceful in drawing upon a range of non-technological resources that enabled them to get a "sense of what's out there." For example, several students said that they would supplement library and computer resources with information from friends who may have knowledge or experience related to the topic. Afrika said that typically she would follow her Internet search for information related to Web site construction by seeking out friends with expertise in that area:

You know, at this point I would call some people. I would call a couple of friends to get information about how to go about building a Web site. I ask her whom she would call, and she tells me that she has a friend that does Web development for a living and another friend that is a photographer who created a Web page about her pictures.

Similarly, this student said she would supplement information gathered using the Internet with what she could learn from a range of non-library resources:

Maricella told me that she would read the Web sites for information to become familiar with the subject and print out only the ones she liked. She also said that she would ask someone. I asked her whom she would ask. She said that she would ask a teacher, a relative and friend. She said she would also fine magazines. She would look on the Internet to find magazines. She also said she would ask a librarian as a last resort, after she went through her research process, if she needed additional help.

Like Maricella, only few students involved in the ethnographic component of the study said that they would seek the assistance of librarians. One exception to this trend is a student who regularly consults a government documents librarian with whom she has built a relationship over time:

Afrika tells me that the fellow who runs the government documents section at her library is very, very helpful. She says that the librarian for that room has "been there forever" and he is a "really nice man, he's the nicest man. I always go to him." She adds that he always helps her find whatever she needs.

This student would also seek out events related to her topic and people who have direct experience or a "vested interest" in it:

As we walk, Afrika states that she happens to know the San Francisco museum has an exhibit on this subject. "I would probably go to the exhibit and then back to the library and talk to a librarian. Secondary data is okay, but I prefer to talk to people professors, librarians, museum people who have a vested interest in the topic.

Another student working on Task #3 concerning the impact of pesticides on child farm workers would approach friends who had direct experience with this topic:

Kristin said she would set up some interviews with friends she knew who did farming or migrant work in the San Joaquin Valley. One friend had a

lot of knowledge of the quality of the soil, use of pesticides, and the damage done to both the soil and the workers.

Jean, who also worked on Task #3, said she would e-mail members of a group listed on a Web site whom she thought might have direct knowledge of the topic:

Jean discovered a category [on the Web site] dealing with "benefits and alternatives" [in farming]. She became more intent on the screen, began smiling and said this link would produce some additional avenues of resources. In particular, she explained that she would contact "The Chicago Farmers'" site by e-mail to ask for particulars from their perspective on the assignment. She felt this contact would give some experiential information, and she would be able to "pick their brains" about specific articles or studies.

Students also sometimes drew upon one another, not so much for information about their topics, but for assistance in conducting their searches:

After expressing frustration that she isn't getting anywhere with her Internet search, another student across the table suggests a new search engine, METACRAWLER. Another person in the lab sitting beside her suggests GOOGLE for a good search engine.

Finally, in some cases both the choices and the successful use of technological resources depended on several non-technological aspects of students' searches. For

example, students often gravitated to sources of information that enabled them to apply what they already knew about the subject. For example, the student mentioned earlier who worked with the search engine ASKJEEVES said that the site helped her to locate sources because it was divided into geographical areas that enabled her to draw upon the fact that she knew that pottery comes from the southwestern region.

Moreover, familiarity, if not with the subject then with the surroundings, was a significant issue to several students. While comfortable seeking information using their home university's resources, the new surroundings that they encountered in this study required them to learn novel computer configurations and break with their familiar routines frustrated searches for several students. This was particularly true for the following student who rarely ventured into the library but sought library resources on line from her home:

Toni says that she is very frustrated being in a new place trying to do this research. She decides to go to the librarian and tells her she just wants to walk through the journals. The librarian says they are organized by call number, not subject, and Toni gives up. She is frustrated. She goes to the computer and reads the title of all journals, writes down the call number of The Journal of Ceramics. She states that if the full-text of journals was on line, she would just use that and not physically look at the journals in the library She says, "I can't believe how spoiled I am. I would normally be at home in my room with my feet up." She walks around the periodical section of the library looking for a call number she had written down.

Unable to find it, Toni is sighing and frustrated. Finally, she goes to a reference librarian who tells her it is a reference number and not a call number. The librarian goes to her computer and finds a journal called Art and Perception and tells her the location. She is happy since this saved her time and she didn't have to find it herself She states she has never seen all the journals bound before.

In sum, this review of students' uses of information resources reveals a tendency among most to focus searches on information that is immediately and directly accessible using the computer. Ethnographers Tami Thompson and Dale Deden noted that it is difficult to determine the impact that the conditions under which the searches were conducted—the short time period, unfamiliar search media, and the non-academic nature of the task assignments—may have had on the choices and range of resources that students used. Nonetheless, our findings reveals a central irony of techno-centric information gathering: While technologically based information resources promise to make more information more accessible, they also may telescope (and possibly limit) the information that students actually retrieve.

Moreover, it is important to consider the implications of students' preferences for Internet resources that provide access to the most current information on a topic over books or even journal articles. While the ability to gain access to the latest information is a tremendous asset, information seeking practices that focus primarily or exclusively on such sources run the danger of implicitly over-valuing current, often fact-based

information, simply because it is new over extended, in-depth discussion of ideas and topics often found in books.

HOW DO STUDENTS SEEK INFORMATION?

As discussed in the previous section, nearly all of the students began their searches by attempting to get an overview of "what's out there." Their next step typically consisted of identifying a "pool" or "critical mass" of information that they could later sift through and evaluate for its relevance to their tasks. When asked if this was typical of her process, one student stated that she usually spends 15 hours collecting this kind of preliminary data for a course project.

Students Struggle to Come Up with Key Words

Gathering a "critical mass" or "pool" of information often required the use of key words in conjunction with a database or search engine. But most students had difficulty identifying key words. Unfamiliar with library resources for developing them, most employed very general terms or phrases that were often derived from the statement of the task:

Afrika enters the term "Island Web sites for Children." She gets a list of items that seems unrelated to what she is seeking. There are a few sites that have the terms "children" and "island" in them. Many have information about island tourist areas that have sights of interest to children, or they have demographics about children on particular islands.

I ask Afrika how she decided to use that search phrase, and she says, "I really don't know. I am not very good at phrases."

Another student working on Task #3 related to pesticides began with the combination of key words "children" and "pesticides." When these failed to yield useful searches, she tried one word after the other taken almost directly from wording in the task:

As we were sitting down, Jean brought out her paper with her assignment sheet opened to the second page. She had highlighted several words in yellow, which she explained were the keywords with which she would begin her search. She chose "pesticides," "health problems," "farming," "business," and "alternatives."

In the instance described above in which the student used the keywords "children" and "pesticides," the search brought up 52 hits, mostly with the word "children" but not many with both key words. This led her to come up with other key words, this time entering the words "effects of pesticides." But this search yielded just two articles that she thought might be only somewhat useful. Next she combined three key words that she thought would probably yield a group of articles that was too large and that would include topics that were too wide ranging. But she reasoned that at least these key words would give her a group of articles related to the topic that she could work with. The ethnographer comments:

Well, broad was not the half of it, she had 2233 article hits come up on the screen. She explained that this technique was one she didn't like to use,

but when all else failed, or frustration set in, she had been known to use it. She scanned down the list of about the first 50 articles and checked five or six that "sounded interesting." She generally stopped when she got to about fifty, as long as she felt this would provide a good start on pertinent data.

Maura was similarly pleased when the key word "pesticide" produced a pool that she felt was large enough to contain useful information:

Maura opened Ebscohost and entered the word "pesticides." Whoa, 1351 hits, she was pleased with this number because it would allow her to do the narrowing down of articles rather than being stuck with one or two that did not really go where she wanted the task to go.

Just as successful searches are sufficiently robust to likely contain "pertinent data," volume played a role in students' decisions to reject sources if the pool was too small:

He did not look at any of the hits from the search using the key words "Mayan pottery" and "teaching" even though there were several that might have been useful. Instead, he started a new search using the words "Mayan pottery." I asked him why he didn't look at the previous hits and he said, "Not adequate enough, not enough hits, only a handful." Volume seems to be what he is after when it comes to Internet searches.

Searches using the key words derived in this manner seemed to entail a great deal of trial and error, mis-starts, and dead ends. Occasionally they produced useful sources, but more often than not, the searches were unsatisfactory, and the student had to try again. One student employing the same approach tried one key word after another from the statement of the task only to come up with either too few or too many resources:

The student goes to INFOTRAC and puts "Aztec pottery" into the search box and gets two hits. They are two journal articles, one is American Antiquities, and she reads quickly through the abstract and says, "Clothes, no good." She reads the abstract from the second article and says she doesn't like it, the wrong subject, not about pottery. She starts a new search: "Ancient" and "Culture." But this brought too many hits, hundreds of them, and she attempts to narrow the search with Aztec and Navajo, no good, nothing, no hits with that combination. She puts in "Aztec" and "Pottery" but gets no hits and is very surprised at the outcome of her search. She puts in the word "Aztec" and gets one hit, goes to the article and reads the abstract and says it's no good not about pottery.

Another student who felt confident about her search came up empty handed:

Maura began to do a search using EBSCOhost, one of the library databases. Her first search did not produce any hits, which surprised both Maura and myself. In modifying the search, she decided to enter the terms "child farm workers" because this was the population of people that had been specified in the task. From this search, Maura got only two hits and

again mentioned that she thought she would have gotten more resources. She said she was surprised on both of these searches because she was confident that they would bring up some "foundational articles."

These searches exemplify students' uses of key words: rather than research key words prior to a search using library resources (i.e., reference material or the expertise of librarians), students use terms that are readily available from their experience, prior knowledge of the subject, or wording of the task to generate lists of sources. Sources on the lists may be directly useful in responding to the task or indirectly useful as sources for key words to be used in subsequent searches. Students often talked about the experience of scanning these lists of articles or books as "waiting for words to jump out at them:"

The student began her search entering the key words, "Pottery and Ancient Culture." When I asked about the choice of the key word "culture," the student responded, "Just to see. It's one of those words in the assignment." The search got her a list of titles, for example, "sexuality in ancient cultures" but she said they were not pertinent. She continued to just scan the screen and the titles from her searches. "Nothing is popping out," she says.

An example of a word "popping out" appears in another student's search for information related to Task #1 on global warming:

Kristin found the home page for the library and began to scan the Arts and Humanities page for the words "cultural" and "farm workers." Her eyes

were darting across the pages she pulled up, never stopping or focusing on any one in particular, although I saw several sites that could have contributed. I asked what she was doing at this point, considering her rapid scanning process. Kristin replied that she was "hoping for something to pop out."

These data show that students struggle to come up with key words and concepts that will enable them to get a handle on the search. They try in various ways to generate information using words from their task, links on Web sites, words from books or other media, and their own and others' knowledge of the topic. Relying on what ethnographer Alma Neill termed the "hope factor," students attempted to generate source lists that were both sufficiently robust to yield useful material but at the same time small enough to be manageable. The following student working on Task #2 related to Web development provides insight into how this process works:

Afrika tells me that she has a hard time developing good search terms, especially now, since she says of seeking information on Web development, "It's not my thing." But once she has a list of links to choose from, she seems to be able to accept or reject sites very quickly, even if the search term was only marginally effective in producing the exact thing she seems to have in mind.

In some instances, students delved more deeply into the subject, relying on other search media, for example books, as the source for key words that they will later use in a

computer search. The following student, for example, located the area containing information related to Task #4 concerning the arts curriculum, looking in indexes and tables of contents for words related to the subject. Our ethnographer observes:

Toni finds her way to the book stacks with books on pottery. She moves very slowly, looking at the book titles. She takes a book, Ceramic Form and says it sounds like how to make pottery. Reading the index she says, "I don't see anything," and puts the book back. She chooses the next title, Hispanic American Pottery, looks at the index and states that she sees no key terms from the task. She puts it back. Next, she chooses the title, Encyclopedia of American Pottery and slowly scans through the index. She sees the word "Mayan" and states that these are names of artists and puts it back. Next, she chooses Ceramics of the World and when asked why says, "Because it is 'the world.'" She checks the table of contents, finds "North American Ceramics," and then turns to the chapter, General U.S," stating that she is looking for where types of pottery come from. She sees that what they are showing comes from New York and states that she doesn't think that Aztecs came from New York. She goes to the index and says, "This book is my favorite because it's easy to see what the book has no Navajo, no Mayan listed. I will check this book out. It's large and has a lot". She chooses another book, The History of Pottery, scans the index and sees a section on Mayan history and said, "I'm looking for some info on history."

Summing up her process she said,

Usually by that kind of search, a key word will come up over and over and that will be a word to search on the Internet.

While most struggled to come up with key words, one student used a search engine that enabled her to avoid them altogether:

[After several unsuccessful attempts to find sources using key words] she starts a new search, this time typing <http://www.askjeeves.com>. "I'll go to my favorite link," she says. I asked why this is her favorite link, and she said, "You can ask him questions, not just do a word search." She puts in the exact title of her task: "The pottery of Aztec, Maya, and Navajo Cultures." Several questions come up with windows to choose from for the answers to her search. She says, "It's easier when you are searching a lot of different key words or a list of subjects to use ASKJEEVES. With other search engines, you must use a "Boolean" search.

All in all, student use of keywords seems aimed at crafting a "personal database," a meta database of sorts, consisting of sources culled from the larger Internet databases and sources available on the Internet. Clearly, this analysis suggests that student strategies for generating key words entailed a good deal of trial and error and guesswork. Indeed, one of the only students who not to use trial and error methods to come up with key words brought considerable background knowledge to the task:

It was extremely interesting to see this student because she searched in ways that one would not usually see. For example, in using key words, she had chosen "pesticides" (okay, that seemed feasible since it was one of the highlighted words), but also "tropical regions" and "laws on pesticides," "child labor," and "sanitizing," and "agronomy." The "agronomy," "topical regions," and "sanitizing" seemed to be following in a direction that was rather unique. Her explanation was that her grandfather was a world famous agronomist, and she was very familiar with his field of expertise.

With few exceptions, most students seemed to be fishing for words and concepts--guessing at possibilities in a trial and error fashion -- until a term "pops out at them" or they hit upon those that yielded a robust list of sources. While students' key word searches may seem impoverished and unsystematic, information seeking at this early stage, if viewed from the students' points of view, was often purposeful and conducted in the context of an overall plan. In what follows, I will discuss the processes of information gathering utilizing the plans students devised for completing the tasks.

"Plans of Action" Guide Most Student Searches

Students often envisioned their searches in advance, deciding the resources they would draw upon and strategic approaches to using them. Jean conducts her key word search in the context of such a plan:

At the onset of the Internet search, Jean chose to enter the general key word "pesticides." She explained that once the search results appeared on the screen, she would be able to narrow the field of resources at her leisure. The scanning process begins with the Web sites to see if they contain more than one of the key words highlighted in the beginning of the process. If a site appears to be a possible source of information, she would read the short description of the information available there. If this method then rendered the result of "more than one" she would click on the link to determine if this was a "keeper" and saved it to disk rather than reading it at this time. If not, Jean moved back to the list of sources.

Helen followed a similar process while working on Task #3 concerning pesticides and child farm workers:

The first bullet on her sheet was a note to search the Internet for "pesticides." A site she seemed very excited about, Agro K, was one of the "meaty" sites. She felt secure that this was a good site because it had data on new organics; this fell in line with the alternatives that might be proposed to the corporations. After scanning this site and the information available, Helen chose to have this printed for reading more in-depth at a later date. She said her style was usually to complete several of these random key word searches, scan the information, link to any other site that might provide something applicable, and print when she found an article that had enough information that she could use it for either

reference or as an additional link to articles that would provide more pertinent data, that were what she deemed "professional" enough.

Several students' plans included assessing the assignment to determine the scope of their searches:

Kristin's search netted 589 hits. As our time was beginning to slip away (only one half hour remained), she said she would select only a few sites, pick out some articles to print and try to wrap things up. As she scanned the articles, I asked what her "normal" amount of source materials would be for this type of an assignment. She reread the actual task and said, "This would call for about nine or ten books or articles in addition to the interviews. I would spend about eight hours in interviews, four, two-hour sessions. Then, either the night before or two nights before the paper was due, I would wrap it all up in one sitting I do my best work when under pressure.

As noted above, students' plans included first generating a pool of resources that was sufficiently large to yield a limited number in some cases as few as one -- particularly rich sources -- an article, book or Web site. Using this strategy, one student said she hoped to find a Web site that "really has everything." This student felt that as a matter of efficiency, it was important to find a particularly rich, authoritative article that would avoid needless duplication of the research that others had done:

[In discussing the methods of conducting research that she usually uses]

The student said that previously when she had done a marketing project, she could only find one article, but that article "had it all." She said, "I follow other people's trails. If I like their writing, their sources, their style, no reason to do a bunch of research yourself. Why redo someone else's work? Just search for that one article that will be the 'gateway' to information. There are some authors who are very specific and do an annotated bibliography and walk you through it. I need an author who is detail oriented like me... I can't imagine just standing around the stacks and reading articles. Pointless to just read all these articles."

Much in the same way students looked for key words, several students' "plans of action" included the search for a "gateway" source. That is, rather than deciding ahead of time what information they needed and searching for it, students looked for sources in their "pool" or "critical mass" of information that would guide them in formulating an approach to accomplishing the task. Students' concern with generating a "critical mass" of information led them to look for sites and to assess as "keepers" those that yield further resources. Here the student rejected a site because it was "too general," meaning that there was no bibliography that would contribute sources that he needed:

In the course of looking up Aztec pottery, the student "somehow" got linked to the University of Florida, saying that it "just came up." She picked the Aztec empire and said, "It looks like someone's assignment, no

bibliography, that's no good. It's nice to find a bibliography; it gives good sources to go to." She left that site, saying it was too broad.

This idea, the process of getting an overview as a way of creating a search engine in the mind, was confirmed for me when she later tells me about how she approaches people for information. Afrika says that asking people is easy because they want to help but also because it "gives me a way to quickly find out what is out there."

One student talked about this process as finding one particularly rich article that would "take you in a certain direction." Another spoke about searching for books and journal articles that would help her "develop a slant." In the following excerpt, the ethnographer captures the process that leads to the student's moment of discovery:

*The student [working on Task #4 related to arts in the curriculum] went to the stacks to look for books. She looks at a large picture book of the century of jazz and states, "No good, " after a quick scan. She decides to move down a few shelves in this section after saying, "Nothing is jumping out at me." She wants more history and chooses several books with cultural and social themes. One title, *Why Music is My Flag*, seems to appeal to her. When I asked her what made her choose that one, she said it relates to music as a culture rooted in ethnicity, even though it is not about the blues [more specific topic for this task]. She quickly, but thoroughly, scans the tables of contents of several books and chooses some. She says that another title, *Riding on the Blue Note*, "turns me on*

because I like the quotes it begins with because they link to my philosophy. Louis Armstrong and Thelonious Monk, my mind is moving in the direction of these quotes. This is the slant that I want in the presentation a broader focus, more my philosophy. I'll pick this one because it is about why jazz happened, not just about the people, why songs are the way they are, what songs represent, why they played certain songs, what the four chords mean." She has her focus and is moving in a specific direction.

The student described previously whose key word search yielded an unwieldy 2233 sources pursued the strategy of reviewing the abstracts of the first 50 articles looking for one particularly good source:

Helen was sure that she could tell from the citation if the articles would be applicable enough to use in the paper One of the articles entitled, "New Deal to Clean Up Plant " caught her immediate interest. After clicking on the "View Abstract" and reading through a short portion, she exclaimed, "This one is really good. It seems as though it is right on for this paper!"

Another student who also employs the strategy of looking for a "gateway article" limited her searches to on-line, full-text articles:

Toni says that usually one or two articles will lead to a huge amount of articles or hits and have sources to other information. This is the way she always does research, with on-line, full-text articles.

Students also looked for a rich collection of Web sites with links that promised to yield useful information. Because this student has difficulty coming up with useful key words, she uses a familiar Web site with links that have proven useful in previous searches:

Afrika tells me that she has a hard time developing good search terms, especially now when she's seeking information on Web development because, "It's not my thing." But once she found a list of links to choose from, she was able to accept or reject sites very quickly, even if the search term was only marginally effective in producing the exact thing she seemed to have in mind. On one search attempt, she found a "geography for children" link. She offers a, "Hey!" and clicks the site. The site is loaded with links. There are dozens of things to choose from. Afrika tells me that this is her thing. She points to a link that says, "Terra Server" and tells me that it is pretty cool. I ask her what made her choose that site over the others, and she tells me that it is a site that she has used before.

Yet, there is a subtle sense in which resources that students apparently pass over may be understood to be useful. New materials they find in subsequent searches led them to reconsider the value of material they had previously rejected. In observing a student scan a Web site quickly and move on, the ethnographer observed this process:

She decides to click "BACK," saying that she was looking for something that an earlier site had available. I thought that it was interesting that she now said that the earlier Web site was useful and good but that she hadn't

taken anything from it.

Ethnographer Dale Deden insightfully characterized these search practices as "creating a search engine in their minds" about what is out there and available. That is, part of the information-seeking process seems to entail orienting oneself to what is available, mentally noting it, and continuing to look.

I will conclude this discussion with an extended discussion of Jean, a student who responded to Task #3 concerning the impact of pesticides on child farm workers using key words in the context of a well thought out, self-consciously applied plan. The method she uses is one that she has long employed across a range of assignments and tasks:

Jean had developed a systematic method of researching. When I asked about how she saw the project developing, she said, "I use the same system that I learned in junior high. It has worked well with all the papers, projects, and presentations I have ever done, so I don't see any need to change it unless it quits working.

Jean's method contains well defined, sequentially ordered steps that she adapts to a number of contingencies that include the nature of the assignment and the practical circumstances of her life:

As Jean worked through the key word process, she began to take notes of some sort on the steno pad that was provided for the study. She replied,

when prodded, that it was a two-column set-up in which she put the location of the book in the first column and what it contained that had caught her attention in the description on-line. She explained that she began with books when she was at the library. Once she had reached a certain number of books, she felt comfortable with (the number depended on other factors such as time, depth of project requirements, and classes to attend).

The key word search for Jean, like most students, entails some guesswork, but is conducted in the context of an overall "plan of attack":

Soon, Jean turned to her "plan of attack" which included a key word search. I noted that " agronomy," the first word that she searched for, was unusual and took a mental note to ask her about this later. Jean appeared to be working in a rhythmic fashion, jotting more information resources. Under agronomy, she scanned the sub categories, explaining that she liked to scan the topic headings to get a sense of whether the book or article would fall within the key words chosen for the research. With this method, she hoped to find articles or topics that related to the combination of the key words highlighted earlier. The concentration factor seemed intense as she read over the various titles quickly.

In sum, students' searches might at times appear to be filled with guesswork and hit or miss attempts to find information, especially if measured against professional

standards. Yet, our data reveal that if seen from the students' points of view, most searches were purposeful and were guided by a logic and procedures that students found over time to enable them to conduct their searches. It would be misleading, however, to leave the impression that students were equally knowledgeable, skilled, strategic, or confident. Indeed, Toni was an extreme case of a student who either seemed to lack or to be unable to articulate a very developed approach to the task:

I asked her if she had a plan. She said, "No, I'm just trying to find sources. Usually just by browsing, it will lead you to where you want to go. One article will usually take you in a certain direction...She states she usually gives herself two hours and then goes and finds someone to help. She is yawning and sleepy-looking and it is 11:00. She does not appear to be stressed or anxious over the fact that after sitting at the computer for one hour, nothing has come up that she is interested in. She has still not written anything down, and she has not referred back to the assignment written on the paper. She is entirely focused on the title of the assignment and has not paid any attention to the rest of the assignment. Never during the task search did she mention that her task would be a presentation in front of a school board, that it was about advising the district about the content of a high school course, or that the assignment was somewhat of a competition to see which course would be chosen.

HOW DO STUDENTS APPLY AND SELECT INFORMATION?

The analysis to this point has focused on the ways that students employ resources -- the Internet, computerized databases, and non-computerized sources -- to identify and

gather information. But what do students do with the information contained in sources once they find it? How do they apply information to the task questions? Unfortunately, observing for only two hours permitted less opportunity than we would have wished to understand these processes. Nonetheless, we were able to gain partial insight into the ways that students applied the information they found, that is, how they initially assessed information and decided whether and how it would be useful.

It is important to note that in exploring students' search practices, we often focus on the resources they use or how skilled they are once they sit down at the computer. We pay less attention to how information environments, through the choices they provide, pre-screen or pre-structure access to information. This means that by virtue of the materials they contain, the key words they recognize, or the links they provide, choosing one or another information resource -- JSTOR, EBSCOhost, Sociological Abstracts, or GOOGLE, for example -- facilitates and limit access to information.

We, of course, all hope that sound principles for gathering the "best" information guide student searches, that they understand the kinds of information available from each resource, and that they avail themselves of the information contained in several. Our data show, however, that for the most part, students restricted their use of resources to just a few favorite or familiar resources. Unfortunately, we have no idea about the impact that the short period of time for completing the assignment may have had on this finding. But as noted previously, efficiency and accessibility often played a large role in determining the information that students seek. For example, while the availability of full-text articles

and books on line is a wonderful resource, like others, this student's decision to use only full-text articles automatically excluded those that were not available in full-text format:

Sammy enters the term "Hawaiian Islands." He explains that this search returns too many choices, pointing to the number of total items found using these search terms. He glances for a moment at the first page of items that are listed and also says that there are not any that are full-text.

Here ethnographer Dale Deden noted that although some of the sources that Sammy found using these key words might offer useful information, his method (and the format that information came in), rather than critical examination, guided his selection of sources.

Hence, while much of the focus has largely been on students' use of technology, much more than technical proficiency -- the ability to manipulate databases or the Internet -- was necessary to successfully respond to the tasks. Indeed, students' greatest challenges consisted not in coming up with sources but in assessing what was the "best" or most useful information and how to apply it to their tasks. Even those who relied heavily on methodological criteria and implicit technological choices found that these methods always yielded more information than they could use. At some point, all students had to employ assessment criteria and practices of their own. The last section of this report focuses on how their processes and criteria -- students make decisions about what information helped them with their assignment and which to discard.

As noted in the previous section, students often engaged in very general searches focused on looking for "gateway sources," information that provided entree or promising leads to both a sufficient quantity of information but also to information that was relevant to the task. The problem for students who had difficulty with the assignment was not in their ability to find quantities of information; rather, they often had difficulty locating relevant information. But the search for relevant information presumes a prior set of skills, those entailed in identifying what the task consisted of in the first place.

Tracy read the assignment again and looks at the Sac State site and says, "I know where to get things for Bio, but this topic seems too general." She goes on to say that she doesn't know where to start and she is not sure where to go without a starting point.

Students like Tracy who had the most difficulty finding information tended to have the least clarity about what they were being asked to accomplish. Finding a "slant" or way to approach the task was often the first order of business. The search for "keepers" or "gateway" sources focused on finding materials that would yield both quantities of information but also would help to define an approach to the task. Since most students knew very little about the task topics, what skills and strategies did they employ to assess what they found? Our data show that students base decisions about which sources are useful and which are not on knowledge from their experiences and backgrounds, their perceptions of the needs and responses of audiences, their concerns for credibility and balance, and on their evolving and shifting understandings of the tasks.

Students Assess Information Based on Prior Experience

As students began their tasks, prior experience and knowledge of the subject often shaped decisions about what information to seek and how to assess what they found:

Tracy, the biology major who initially seemed at a loss about how to find information related to Task #2 started from what she knew "something scientific":

She pauses for a moment and then leaves the Sac State site for YAHOO! saying, "I hope YAHOO! can give me something I want to see." She tells me that what she has in mind is "something scientific" but that she doesn't have anything specific in mind. I ask her to tell me how she will know it when she sees it, and she says she doesn't know.

Sammy also started his search for information related to Task #2 with what he knew about islands based on a geology course he had recently taken:

Sammy tells me that he will look up "island erosion" because he says, "Anytime you have formation, you also have deformation" He goes on to explain it to me again, saying that anytime something is created, something else must be destroyed.

Similarly, in working on Task #3 related to the impact of pesticides on child farm workers, Kristin decided that information from a link to the Central Valley listed on the Environmental Protection Agency Web site would be useful because she was familiar with that area and knew people there.

Still another student working on Task #2 also began with her experience and knowledge of the topic. But because in this case, she knew nothing about islands, she decided to define the term. After learning valuable background information about islands from an on-line dictionary, she decided that this source information would be a useful resource for the Web site to introduce other newcomers to the topic:

In an effort to "define it" [islands], Afrika finds an on-line dictionary and prints out a really comprehensive list of meanings for the term "island."

In response to another student who asks how they, referring to middle school students, will use the dictionary, she says, "I don't know, but they'll need to know what it is, and it seems like a good starting point. It will be a good tool, if nothing else to show the kid that there is a whole lot out there."

Students not only drew upon their own past experience but said they would seek out others with expertise or direct knowledge of task topics. Jean said she would ask her grandfather who is an agronomist for information related to the impact of pesticides on child farm workers:

On the way to the computer room, Jean said that she would use her grandfather first as a knowledgeable reference because of his expertise, and she knew he would be able to guide her in providing some avenues of that would be rich with information. Second, she would approach her instructor who had assigned the project to clarify the quest or guide her if

she gave him the beginning source to see if she was going in the right direction.

Because students typically began the assignment knowing very little about the task topics, they spent much of their search time orienting themselves, attempting to acquire a knowledge base from which their searches could proceed. Most students eventually located materials that enabled them to expand their searches. But some of those who had problems were often those who were never able to get their "search legs." This extended description of the science student, Tracy, illustrates the problems encountered by a student who never moves beyond her own experience as the basis for her search. Tracy begins with what she knows, searching a science related Web page but seems to spin her wheels at every turn. Here she locates information but rejects most of it because it is not sufficiently general:

Tracy takes Bob's advice and tries "geography.com" as a search term.

This provides information about the American Geography Association.

Within this page, she finds a number of different articles in the database culled from all of the American Geography Association's journals. She reviews them but rejects every item she glances at, citing the level of expertise needed to understand those items.

She returns to the site hopeful about its possibilities for yielding other sources and finds a promising list of contacts. But having failed to learn anything new that would help take her to the next step, she feels no farther along than when she started:

Tracy returns to the homepage of the American Geography Association and notices that there is a link on titled "Ask the Geographer." She tells me that she believes it will contain something she is looking for. The "Ask the Geographer" page lists several geographers and their e-mail addresses. Geographers are listed by specialty. Many of the categories are ones that I have never heard of. I ask Tracy what link she would choose. After looking at the links for a bit, she tells me that she would contact a Bio-Geographer. She explains that she would feel comfortable doing this, and that she has often felt comfortable contacting people like this.

I can tell from her body language that Tracy is a little frustrated. She exhales boldly and with a sigh of discomfort. In addition, she turns to me and says, "I have no idea what I am doing. I am wasting my time."

Feeling at a loss for how to go forward, Tracy goes back to a Web site she had looked at before:

From here she goes back to the process of using the "www" address-seeking approach. She inputs the address for the encyclopedia site again but is not able to tell me how she decides to use this approach. Because she had some success with this site once before, she believes that she will have a successful search again. But, the address does not work. Now Tracy is more frustrated than before. For a moment, she looks composed and tries the address one more time. Again, it does not work.

With this setback, she again reverts to familiar material and to personal experience for the next search:

She then says, "Oh well," and signs. She tells me that she was planning to look up "Oceanic Islands" because they are listed as one type of island on the printout she made earlier, and that she was planning to look up the "continental" islands because they are listed as the second type and therefore would seem to make sense.

Because the address doesn't work Tracy decides to look for things under the "Hawaii" search term. She tells me that she remembers seeing Hawaii listed as an oceanic island on one of the Web sites that she has visited already AND that her roommate is currently IN Hawaii on the beach or partying. I reflect for a moment and wonder if Tracy's proximity or relationship she has with a person who happens to be in Hawaii currently affects her choice of a search term.

This Web site finally provides materials that Tracy thinks would be useful for the task pictures of islands:

She also tells me that she thinks she will find pictures that would be interesting. She says that these will be key. She lets me know that she will save the pictures on a disk and bring them to her neighbor. But on a site called "Hawaii.com" she finds a picture gallery. She notices that most of the pictures are tourist oriented and that they are not useful to her

because she wants something that looks like an island, or that "shows the whole thing in the water." After looking at few of the shots, Tracy finds a silhouette picture of one of the Hawaiian Islands and decides that it is close enough, "This is kind of what I want." Having found one, she continues to go through the rest of the photos that are available. She finds a couple of more of them, checks to see if they have made it to the disk, and moves on.

When she seems finally to have decided upon an approach to the task pictures that illustrate different types of islands Tracy tries but fails to find the right key words to pursue her search. She grasps at another key word, but finally runs out of time. She ends the session dissatisfied with her progress:

She says that she feels comfortable with the items she has for "oceanic islands." She goes on to tell me that she will look for something that shows a continental island.

She searches and searches but is unable to find anything using that term. All of the searches come up with no links. Immediately she concludes that she has seen the term "Aleutian Islands" on some of the pages and that it would make a useful term.

It is now it is time for Tracy to meet with her group to share information that they each have found. She tells me is dissatisfied with the items that she is bringing to the group.

In sum, most students, like Tracy, began knowing little about the topics related to the tasks. Most began by orienting searches to their own experiences and backgrounds. As Dale Deden observed, while most who used this method actually succeeded in finding a good deal of information, they rejected much of what they found in favor of general information or information that was somehow familiar. Finding, seeking, and using information depended on reaching a knowledge threshold, that is, students had in some fashion to quickly learn "something" about a topic to locate information and to assess what they found. Problems related to searches were, in part, less about students' abilities to locate information than their inability to make use of the information they found. Fortunately, many students devised ways to expand their knowledge bases significantly, even in the short period of our study, enabling them to locate increasing amounts of useful information.

Students Match Information to Expectations of the Assignment

In attempting to select and apply information, students repeatedly attempted to find a "match" between the information and their perceptions of what the task required. Even if they did not know a great deal about the topic, they could use other cues and bits of information to establish a "take" on what kinds of information to look for. One student working on Task #4 used the context in which the assignment was to be carried out -- the schools -- to decide what information she needed:

First, I need history on these three cultures. Then I need to know how the pottery is made, and then what the different symbols mean in the pottery.

Because if this is going to be taught in school, then they need to know all of these things. I don't know if it's going to be a hands-on class too. After

we talked about the plan, she wrote it down in her notebook. Then she listed each culture. As time went on, she made a check after she found something about that key word.

By contrast, Afrika rejected a promising Web site link after determining that it did not contain the kind of information that she thought the task called for:

Afrika finds a link that is called "Web site creating and consulting." She clicks and browses the site. She tells me that the site is "too professional" it offers services and not advice or useful information. She points to a few of the subjects listed on the page and notes that they are selling services "which might be useful later on" to the neighbor that she is trying to help with the task. In other words, she means that she needs more basic or early stage information and that she is not yet ready to hire anyone to make a site for the neighbor.

Helen engaged in a similar process while working on Task #3 concerning health issues among child farm workers:

Helen then stopped and clicked onto another link from the same site that was called "Mothers & Others" that had come up in response to her new search using "children's health" and "pesticides" as key words. Helen became intent on the screen again, concentrating on the specifics of health issues. As her eyes darted quickly across the lines on the monitor, she told me that the information was more focused on how to keep children safe

from exposure to genetic engineering. She felt it was more centered on "advertising" than on the area she wanted to draw from.

Similarly, Sammy rejected a source as "nothing good" because he deemed its contents inappropriate for an academic assignment:

Sammy tried to narrow the number of items available by using what he tells me is "Boolean logic" to connect "Hawaii" and "Islands," and this returns fewer items. He chooses the first one, glances at it quickly, and states, "Nothing good." He tells me after going on to another search that there was too much stuff like "Clinton stuff." He tells me that he means that the search returned too much non-academic stuff, too much stuff from the mass media. He calls it "junk." I guess he means that much of what was available in the search were tabloid-style articles.

Still another student working on Task #4 took quite a different approach in her effort to match information to expectations of the assignment. Rather than attempt to find information that "fit" the assignment, she found information that gave her an idea about how to tailor the task to her liking. Using the new information to reframe the task, she specified how the information could be used in her presentation:

She looked at the index of the journal first, then scanned the topics of the articles, and went to the one she was looking for that she had written down. She found another one that she liked and said, "This is a cool article about how slaves brought the music with them. This can make a

good case in the presentation about how the oral tradition has been lost in all of our cultures, not just the African American Culture. She continued to refer to how she was building a case to present in the presentation.

Students Assess Information Based on Perceptions of Their Audience(s)

Closely related to students' assessments of information based on task expectations were assessments of sources based on the needs and preferences of their audience(s). As one student put it, "I am trying to make a presentation that will capture the audience." Helen takes into account the needs, interests, and capabilities of her audience when she rejects a source, presumably because the information is too sophisticated:

She next commented on a site that included "words that you need a dictionary just to read what the article was about." She decided to pass on that one.

In another instance, Afrika decided that information about Web development software for middle school children was relevant to advising her middle school friend about creating a Web site:

This search offers links that have different terms in them. After scanning the links on the screen, she sees one that reads "web development software" and decides to click on this link. I ask what made her decide on this link, and she says, "We would need software." As she looks at the new site that comes onto the screen, she notices that most of this software is

shareware or other free software and, as a follow-up to her last statement, says, " and I would want it to be free."

In assessing information, students took audiences into account in yet another way. While some students selected materials with the *needs* of their audiences in mind, others thought about audience *reactions* when they looked for sources that would further their own goals. Since the tasks called for students not only to gather information but also to use it to persuade others, several students sought and selected information for its audience appeal. One student said that she wanted to find material that would enable her to find a "slant" for approaching the subject because she was in competition with other members on the school board and needed to sell the idea to the group. Similarly, Jean said that her plan to interview Chicago farmers concerning the impact of pesticides on child farm workers would give her paper a unique slant:

She mentioned that with the information available at the library, anyone would have access to those resources, and many may come up with the same style of paper. By utilizing her grandfather's [an agronomist] knowledge and expertise, plus finding this site, Jean was sure that her information would be different from others.

In searching for sources related to the effects of pesticides on child farm workers, Helen focused not only on the content of the source but on the impact that the amount and format of the information would have on the audience:

She continued to talk about her desire when doing a paper to "dazzle them" with more information than they can digest in one setting, including statistics and colorful charts This young lady was really beginning to get into the project.

Another student chose information with similar audience concerns in mind:

I asked how he decided on those [sources for the task], and he states that for presentations, "People like pictures. They don't like to read. I need to convince them." He is very focused on this being a presentation and the fact that the audience must be convinced.

Still other students made quite different choices based on assessments of what another audience, their professors, prefer. Helen based decisions to seek information on professors' assessments of information drawn from scientific journals:

[After using Internet sources] At this point Helen chose to change the focus of the search to the main library journals where she might be able to get scientific articles. She knew that almost every professor she has ever had loves those "scientific" journals.

Because Maura knows what her professors value, she uses information from the Internet only when the "good kind" is not available:

Maura started one last search on the Internet. She said the library would be more beneficial for the scientific information, which professors usually preferred. Search engines on the Internet gave more of the recent,

sensationalized stories but could lead to some usable information if one was short on the "good kind."

Another closely monitors reactions from professors along the way:

Tracy tells me that she typically saves things to her disk or prints them out and takes them home or to a professor who can help her assess the value of the information to an assignment that she has been given. She says she always reviews papers in steps with her professors because she nearly took a low grade on a paper and wants to avoid that in the future.

Maura's task was complicated by her sensitivity to the preferences of more than one audience her professor and fellow students. An effort to balance these diverse interests guided her choice of materials:

YAHOO! provided a link to a Web site called Pest Action Network that was said to provide "newsworthy" data, not necessarily based on scientific information. They had a newsletter that Maura said she would order to give an example to the class of what some organizations are providing for interested parties.

With diverse audiences in mind, Kristin was fortunate enough to find a source that she thought would satisfy both:

Kristin returned to the monitor and clicked to a link that mentioned, "Yakima Valley farm workers." She said that name had a familiar ring to it, so she would check it out. This article brought a real big smile to

Kristin's face, and she chose to print this one saying, "Finally!" In scanning the article she stated that she saw good information regarding the history of farm workers as well as some statistics and charts that, "always seem to impress both students and professors."

Students Assess Information for Balance and "Credibility"

Anticipating responses of a different sort from their audiences, students preferred information that would be perceived to be "credible" and "balanced." While not characteristic of all students, for some, this meant seeking primarily fact-based information:

He chose a title, "Global Warming: Physics and Facts " I asked him what about this title made him select it. He said he chose it because he thought that he could get facts and that it was based on a course at Gerrytown University.

Another student similarly assessed the quality of information by the facts that it contained:

Initially, Maura anticipated at least two journal articles, long enough to give her the most details, plus a couple of books and maybe observations or an interview. She said she would consider that "good enough." When I asked how or by what standards she would determine the quality of the material, she said that the ability to present useful facts in a fact-based report would portray to the reader or audience a confident presentation.

She explained that if she does good research that provides a factual, interesting topic, people would walk away having increased their knowledge from what had been shared.

As noted in the previous section of this report, some students' concerns for credibility defined in terms of fact-based information led them to avoid information from the Web altogether. Some were more selective, accepting information from some sites while rejecting others:

I followed Pete to the computer lab. He began his search by looking up the Web site that a friend had recommended but mentioned that he didn't think it was a credible source. I asked him how he determined that the site wasn't credible, and he said that the site address was a ".com" not an ".edu" or ".org."

Another student was similarly willing to trust information contained in sites that appeared to represent an organization:

She finds a Web page titled, "Navajo Nation" and says, "This is an official site, and you can be certain it's accurate information. This is important, especially if you are looking at a particular cultural group."

Before Pete accepts information from any site, he inspects it, looking for further assurances that the information is credible such as the credentials and titles of those who placed information on the site:

He came across a selection on the site entitled "recommended sites." He entered a site using that link, and I asked him what interested him about it. He thought that it related to the issue of global warming because it talked about CO₂, one of the chemicals linked to global warming which produces a hole in the ozone. He selected this title and commented that CO₂ Science Magazine (the page that came up) was an ".org." I asked him to clarify the importance of the ".org" and he said that he thought it was non-profit. He began reading from the magazine, which said that both CO₂ and the temperature were up. He said, "However." He questioned how they came up with their information. I asked him what he was looking for as the cursor was skimming over the authors' names. He said that he was looking for credentials and titles but none were listed.

Some students approached the credibility issue by routinely seeking information that would make their information seem "well-rounded" and balanced:

Helen then moved from the Agro-K site saying that although this site could provide some additional information, she had learned that it is important to include more diverse resources rather than relying on "one great site." She added that if one chose to get too much information from one source, it could be found to be biased. She believed that bias was something that could get you in trouble when doing an oral presentation. It was better to build a knowledge base from diverse research in order to address any questions or provide informational "tidbits."

Commenting on this issue, another student said:

I usually try to make papers reflect both sides of an argument and then let the reader decide.

Some students relied on what they had learned from one kind of audience - professors who would evaluate their work. In the context of a class assignment, for example, they frequently mentioned that they would decide to include or exclude information based on their understandings of how professors would view and evaluate it. Rather than critically examine information contained on the Web site, Helen employed "rules of thumb" that she had learned from professors:

[In a discussion about whether to use information found on Internet sites] Helen said that she had been able to gain some experience on what her professor's want when they present an assignment, and how, especially, the Internet information would be received as reference data. She said any address that ended in .org or .gov would be great for statistical data, charts, or graphs. They most often presented quantitative information. Those would always be accepted as more professional: "just anybody could go onto their own Web site and write something without any corroborating facts."

One student said that she does not take any data from the World Wide Web but does get new ideas, theories and what people are saying about a topic. Some students

rejected information found on Internet sources simply because they reflected a clearly articulated point of view. For example, Maricella seemed to reject an article because it took a position on global warming, or so it seemed, after considerable probing by the ethnographer to get to the source of the student's assessment:

She came across a site that was entitled "India Times." She pointed to a paragraph, which I read out loud. The paragraph linked global warming to the use of oil and environmental damage. I asked what she thought when she read that. And she said that it was not true. Concerned, I had to ask her what she thought was not true the article or global warming. She said the article. I asked how or did she just sense that it was not true. She said she sensed it. I noticed that she was reading this article longer than the others. I asked what about it caught her attention. Was it the way it was written? I understood her to say that people try to create "hype" to worry others. I restated what I thought I understood her to say: that the article was trying to get people to worry about these things and that she felt it was not true. She agreed.

Similarly, Pete, used the fact that it engaged controversial issues as one reason for rejecting information presented on a Web site:

He scanned the rest of the article and it mentioned that there was no correlation [between rising CO2 levels and rising temperatures]. He went back to the previous page and said that it was an anti-CO2 site. I asked him what he meant, and he said, as he moved the cursor across several

words that had "anti-" in front of them, that this site looks for controversial issues and then tries to disprove them and that was biased.

In sum, achieving credibility and balance in their selection of information appeared to rest on students' abilities to represent multiple points of view. Their cautious approach sometimes led students to reject sources simply because they advocated a position on an issue. Students' tendencies to invoke "rules of thumb," rather than to directly examine information, means that, once again, methods for conducting searches, more than direct, critical examination of its content, guided the selection of sources for the tasks.

Selecting and Using Information Requires Orienting and Reorienting to the Task

While matching information contained in a source to perceptions of the task was integral to selecting and using information, a number of students found that determining what the task was "really about" to be elusive. Conversation among these students, for example, reveals that after believing that they had successfully responded to the island Web site task for a while, they concluded that they really had not understood the assignment:

One student maintains that he task may not be oriented toward Web development but that the real emphasis should be on islands. "But, he says, I'm not sure." He continued saying, "After all, if she had knowledge of Web sites, she might know that there are space limitations and that she can't really put everything." After a quick moment of thought, he declares

that the task is to provide the neighbor with "relevant and important facts about islands."

These data show that the selecting and applying information was not as straightforward as simply matching sources to the task and assessing their "fit." Rather, evaluating sources and assessing their relevance to the information requirements of tasks was an ongoing interpretive process, one in which the meanings of both the task and the sources sometimes changed as students discovered new information and reassessed what they had already found.

More subtle indications of students grappling with the meanings of these tasks appeared when students continually referred to the sheets on which the tasks were written, as if to make certain that they understood and were responding correctly:

Maricella did a subject search in YAHOO! and typed the word "global warming." She then said that she hates science. Maricella asked me what the word hoax means. I said that it meant not true, a lie, or a deception. She chose a site titled, "The U.S. Environment Protection Global Warming" (I did not get the exact site name). I asked her how she decided to go to this site. She said because she was looking for Global Warming problems. She looked at the paper that had her task question listed. She looked back at the computer. I asked her if she was looking for something specific. She said no. She then clicked on "In the News." I asked her how she decided to choose that. She said she just wanted to see if it related to

the topic. She looked at her task question again. She looked at the screen again. I asked her what she was thinking about. She said that it was not what she wanted.

Calista engaged in a similar process in her attempt to access the relevance of information she found on a Web site:

Calista selected a Web site that demonstrated the process of global warming through animation. The demonstration ended with three boxes. One showed a picture of cow, the other of trees, and the third showed a factory. When she put the cursor over each one, text would come up discussing that particular threat. Calista then picked up the paper with the task question on it. I asked her what she was looking for now, and she said, "To see how to answer the question." She looked back at the site and read information beneath a photo of a climatologist. She quickly got out of this site.

In these examples, matching the source to the assignment entails a back and forth process in which efforts to understand the task are integral to assessing the relevance of sources. Moreover, while understandings of tasks shaped students' searches, the process of evaluating information for its relevance also deepened, shaped, and sometimes altered understandings of the task as well.

She very quickly but thoroughly scans the content of several books and chooses some. She says, "This title about 'Riding the Blue Note' turns me on. I like the quotes it begins with because they link with my philosophy

Louis Armstrong and Theloneous Monk, my mind is moving in the direction of these quotes. This is the slant I want in the presentation. I'll pick this one because it is more why jazz happened, not just about the people, why songs are the way they are, what songs represent, why they played certain songs, what the four chords mean". She has her focus and is moving in a specific direction.

When asked the meaning of the books she chose she said, "They make me see an era and a time span on the project." She said she like the focus of a book entitled, "I'm White, My Music is Black" (something like that). After one and a half hours, she looks at the task question again and says her slant is great, a great way to teach multicultural education touch people in a broad way especially high school students.

In the dramatic instance noted above, a student who had seemed in command of her search suddenly experienced a shift in meaning that made her think that she had so "misunderstood" the task that she had been gathering the "wrong" information:

We make our way to the room (after using the Internet for some time and calling friends). On the way Afrika pauses for a minute, pulls out the assignment sheet and, with a reflective tone, says aloud something like "OK, so what is the task here?" She reads it aloud and remarks that the assignment really seems to focus on the "islands" rather than "Web development." She gives me a look as if she is disappointed. She says that she really didn't have to do all of that work to get information about a Web site.

Deciding what the task involved and what information was relevant to it required students to determine and redetermine what the task was about. As students' understandings of both the task and relevant information evolved, their understandings were simultaneously shaped by the information they found and the ways they could imagine incorporating it into the assignment. This engaged students such as Afrika in frequent monitoring and (re)focusing of their searches to insure that they were on target.

REFLECTING AND MAKING SENSE: FINDINGS FROM MICRO-ANALYSIS OF VIDEOTAPED DATA

APPLYING THE ACRL STANDARDS

This section uses the Association of College and Research Libraries (ACRL) Standards as a template for reflecting on the performance of two students in particular, one assigned to Task #2 and one assigned to Task #3. Other students are mentioned in comparison to the two students, though the entire performance of these others is not discussed. In attempting to map student performance onto the Standards, I focus on Standards One, Two and Three, parts of which Tasks #2 and #3 were designed to assess. Using all the data available on both students - i.e., ethnographic fieldnotes, transcripts and videos of group meetings, essay questions and forms filled out by the students, and notes from screen capture analysis (not the screen captures themselves) - I give a detailed account of students' activities in relation to the desired outcomes named in the ACRL Standards. Throughout this section I raise questions drawing attention to the complexity of determining whether a student meets the criteria stipulated in the ACRL Standards.

The two students were selected from the 16 students followed by ethnographers. Other criteria for determining which two students to present here included the quality of the data from all sources (for instance, one student was eliminated because his work on the computer had been lost; another student was eliminated because the ethnographer reported he smelled like "weed" and behaved as if he were stoned; another student was not chosen because the ethnographer's notes and the screen capture notes were quite

discrepant.) In order to protect students' identities I have used pseudonyms for all students.

Upon first considering the data it appeared that Student #1, Maura, was quite proficient in determining information needs, and subsequently seeking, evaluating, analyzing and using information while Student #2, Tracy, was comparatively lacking expertise in these skills. However a micro-analysis of the data shows that these initial impressions do not hold up under careful scrutiny. While Maura appears quite skilled in some areas it is doubtful that she meets all the assessable criteria stated in the Standards for an "information competent student." Part of the doubt stems from the wording of the ACRL Standards and outcomes as much as from what the student did or didn't do.

More intriguing is the case of Student #2 . Although it appears that for a Senior Tracy falls below expectations for being information competent, as we examine her experience more closely situational factors combined with prior experience seem to shape the behavior that makes her appear less competent. In the end, I couldn't help but wonder if Tracy had the potential to display greater competence if she had not been motivated by meeting what she perceived (incorrectly) to be the expectations of the research team.

Case #1: Maura

Student #1, Maura, is a 20 year old female from Chico State University. She is a Junior and a Business major and was assigned to Task #3. (See Appendix A.) The group Maura is assigned to files silently into the room and listens as the facilitator describes the

activity and reads the task. The facilitator asks the group to think about how they would approach the task, to take time to think about it and write it down before leaving the room. Students work silently on filling out the forms. The facilitator asks students if they have any questions but only one student requires a clarification about whether they are required to work together and then the group disperses.

Maura has indicated on the form that she knows very little about any aspect of the topic and finds it only somewhat interesting. She has written that possible ways to find out answers to the questions in the task are:

1) use the Internet - a search engine such as Yahoo or the library website.

I use Academic Search through the CSU Chico library but I don't know if Sacramento [where this exercise is taking place] has a similar search.

2) use a library computer to find related books or articles on the topic although some books may not be as updated as the internet because of new resources available related to pesticides and health problems if there are any.

3) If I had an opportunity I would try to find someone to personally interview so I could see the firsthand effects and get an idea of how he/she feels about this problem, and anything they have tried to do to control this problem.

4) Look at statistics of repeating health problems in child farm workers.

It might be said that Maura has identified appropriate investigative methods (**Standard Two, 1a**) even though her list is not exhaustive. However, the Standards do not say whether the student needs to think of **all** appropriate investigative methods or how many would be enough to meet the Standard.

Maura next leaves the room with an ethnographer shadowing her and heads for her assigned computer. She goes to her own campus website (Chico) saying she knows that one and it will reduce the amount of time that would be required to learn this (Sacramento) library. This statement might indicate that Maura is able to select efficient approaches for accessing the information needed (**Standard Two, 1d**). But is this one statement enough to qualify her as competent in this regard? How many instances of efficient approaches should be required to say a student meets this Standard?

Maura explains to the ethnographer that she is beginning with an Academic Search and hopes to get two journal articles plus a couple of books and perhaps an observation or interview and she would consider that "good enough." When asked by what standards she would evaluate the material, she says it would be by her "ability to provide a useful, facts-based report that would give the audience confidence in the presentation." This answer seems to beg the question. While Maura "describes the criteria used to make information choices" (**Standard One, 4b**.) it doesn't seem like the best criteria for evaluating information. She makes no reference to the credibility, validity, bias or accuracy of the information or its source. (**Standard Three, 2a**.) How do we judge Maura's competence in regard to these two desired outcomes?

During the course of her online research Maura finds a list of organizations that "might supply specific data on the topic including statistics." She recognizes it as an opportunity to contact organizations with first-hand knowledge of the topic. She sees them as "excellent resources" and prints the page. Without knowing Maura's rationale, it is possible to observe the site she is on and judge it to be irrelevant to the task. But Maura intends to use the list to make contacts and seek further information. How then do we assess if Maura has determined "whether information satisfies the research or other information need" (**Standard Three, 4a**) or is selecting "information that provides evidence for the topic"(**Standard Three, 4g**) unless we ask her? Looking at the screen captures without her explanation can be misleading.

Maura conducts an Academic Search first and goes to the Internet using Yahoo only after exhausting her search of academic sources. Could this imply that Maura knows "how information is formally and informally produced?" (**Standard One, 2a.**) Does she regard academic or scholarly work as more credible and accurate than what may be found on a popular search engine? (**Standard Three, 2a.**) Or does she go to the library site first merely out of habit or because a professor has advised it?

The ethnographer observes that, unlike many of the students in this study, Maura is reading the articles she finds before making a decision to print or save them. It appears that Maura is reading "the text and selects the main ideas"(**Standard Three, 1a.**) Does she always do this? Perhaps so because she highlights paragraphs and saves them, telling

the ethnographer that this procedure is helpful when you find " a few pertinent, powerful lines or paragraphs."

Upon returning to the room at noon, Maura fills out a sheet asking what she found out to answer the question: "Do the businesses realize that using pesticides is a problem?" and also what she found to answer the question: "What alternatives do the corporations have while still earning a profit?" Her answers to these questions are the longest of any student in the study.(See **Appendix B**) She seems to have found out a great deal of good information yet she does not offer any citations for the information she provides. Does Maura know how to "record all pertinent citation information for future reference?"(**Standard Two, 5d**) Does she "demonstrate an understanding of ... copyright and copyrighted material?"(**Standard Five, 1d.**)

In the afternoon discussion groups, Maura is the first to describe her experience doing the task. Unlike many students Maura went first to her campus home page and library. She used several academic databases that she appears to be familiar with and that might be expected to yield results. Only after she thought she had exhausted the search of library databases did Maura move to the Internet using Yahoo. She said she had been looking for "alternatives to pesticide usage and also the effects on children. I found a lot of stuff on that and just how it affects children and how it affects adults, and how it, when they're young - cause they eat more and things like that, like it affects their cognitive processes in school... I looked up child farmworkers and, um, problems associated with pesticides."

The screen capture data confirm Maura's description of her process and the keywords she used. She got some results, even if not the best results, from using the same few keywords in various databases and on Yahoo. While the use of "alternatives to pesticides" in a search might seem more targeted to answering the questions in the task than the term "child farm workers", Maura, who knows little of farm workers, pesticides, effects of pesticides on children's health or agricultural businesses, seems to be seeking confirmation of what she has supposedly heard from the imaginary instructor in this task: that children of farm workers have serious health problems due to pesticide use. Thus, rather than her search terms being seen as less relevant than other keywords, they might show a critical attitude towards received information. Moreover, Maura is gaining contextual knowledge that will aid in her understanding of the issues. Thus she might be seen as "exploring general information sources to increase familiarity with the topic".

(Standard One, 1c.)

After talking about what she did online, Maura says:

"If I had more time I would have got, like, videos that you can order and also, like, organizations, like agricultural organizations, like pesticides and things like that - you know, other information about the organization that I would have known, and tried to find out more facts or something."

Maura says in the focus group that after going online, she usually will proceed to ask a librarian for help, though if a librarian tells her only that something "is on the third

floor", she will need further assistance because she has difficulty using the physical library as opposed to the virtual library. "Yeah, I get lost in libraries." she admits. Unfortunately the ACRL Standards do not differentiate between being competent in a virtual library vs. being competent in the actual physical library. There is no Standard that says: "Student can find their way to the location of a call number in the physical library." or "Student can use a floor plan to locate Special Collections." Yet a number of students reported having difficulties with negotiating the physical library to accomplish these sort of activities.

Working in groups is part of Maura's normal process but she has not used that strategy during the exercise. Her reasons for not doing so are mentioned in the afternoon group:

"because of the time and everything and I knew everybody else was doing their own searches and everything so we didn't really have time to share, but I think sharing information's great because you find out a lot more information, a lot more broad information..."

In fact, Maura's reason for working in a group, "finding out a lot more information", may be taken as evidence that she knows how to select "efficient and effective approaches for accessing the information needed from the investigative method or information retrieval system." (**Standard Two, 1d**)

While other students in the focus group reported that they preferred working at the Library because they lived in noisy dorms, Maura volunteered that she prefers to work at home because she has the technology available to do so and "I do my best work when there's, like, no people around and it's 2:00 in the morning or something like that. I do my best work in the middle of the night."

Maura approached the task seriously as if she were doing an actual school assignment. Her body language suggested only the normal, minimal anxiety most students had about being involved in the project. Her written answers to the questions were among the best given to us. She made a positive impression on the members of the research team and gave off every sign of being a "good student." But as discussion of her case shows, assessing student performance by attempting to map such performance onto the ACRL Standards or vice versa presents some dilemmas.

What critical threshold do students need to meet in order to be considered information competent? If judged only by the outcome she produced - her written work and oral statements - Maura might be seen as a competent student. Yet the data show some weaknesses in her process of seeking and using information: might these weaknesses be due to the time constraints Maura is working with? Given more time, would Maura have saved citation information and thought of better criteria for evaluating sources? Do students have knowledge of the best procedures as established in the ACRL Standards but not employ them when in a time crunch?

Determining what counts as evidence of competence is an enterprise fraught with puzzling questions. The case of Tracy illustrates this observation further.

Case #2: Tracy

Student #2, Tracy, is a 28 year old female from Humboldt State University. She is a Senior majoring in Biological Sciences and was assigned to Task #2. (See Appendix A) Task #2 was especially designed to induce students to narrow the topic or define a focus. This is the major skill we had hoped to assess through this task..

Interestingly, one group of students given Task #2 complained ad nauseam about how broad the topic was, never considering that part of their challenge was to define a focus. In a second group, one student instantly picked up on what the task was asking for and said to her group

"As far as what I understand the task to be, was to show this young neighbor the enormity of her task and that wasn't difficult to do because there is a lot of information out there about islands." (The rest of the group laughs as if they know exactly what she is talking about.)

However, Tracy is in a third group in which the facilitator explains the task quite differently from the explanation given in the three other groups doing this task. In the videotapes, Tracy's body language suggests uncertainty and a great deal of concern about the impression she is making as the day proceeds. After the facilitator introduces the task

and asks if there are questions, there is a brief pause before Tracy attempts to find out what the researcher wants.

From the transcript of the video:

FACILITATOR

(Reading the task) A young neighbor who's in middle school tells you she is going to create a web site on islands. You ask her what information about islands is going to be on the web site. She's rather vague and says she thinks islands are cool and she'll put everything about islands on the web site. You plan to do some investigating about islands because you suspect that "putting everything" may be a problem for her. So how will you go about your investigation?

So the work you're doing today will help you answer that question about how, for the next two hours, in how you will, eh, go about investigation of what, why putting everything may be a problem. Any questions you have? Think about it for a few seconds: any questions about this, the task, or any other questions?

TRACY

We're doing this individually not as a?

FACILITATOR. (speaking over her last word)

Um, it's up to you, you to decide, the only thing I can - again if you have a computer number and you're going to work as a group, then please work with that, that computer or one of those computers if you both have one, but other than that - I guess you're going to work with computers - other than that, umm, you can decide that on your own and after I get finished here, I'll go in the lab and if you want to take some time, you can decide when you want, how you want to proceed, and you can decide what you want to do along those lines. Any other questions about it? Is it clear to you? I'll try to answer any questions you might have.

TRACY

Are we coming back and, like, reporting to you on what we did?

FACILITATOR.

You can again, um you have your notebooks, you have, you can print, you can make copies, eh you can save to disk, eh, so anything you would typically do in trying to do something like this, eh you can use those resources. And at some point we would do, we will give you some questions again, another sheet of questions after the task before lunch and then again we'll do the discussion groups after lunch and have some final questions for you to fill out after that. Okay?

JAVIER

So right now, we're just in the research mode of gathering information that's good for..?

FACILITATOR (Speaking over last word)

Yes. Anybody else? Well, that's good. You can always ask other questions of any of us with blue tags later, uh, if they occur to you after we break here. I'll get out of here so you can talk about it and ask for help, or if you want to talk about it now, if you want to start. I can't give you any ideas about what you should do, so.. it's up to you. No questions? All right, then it's pretty straightforward. We will, you have the schedules, and we will end the tasks around noon and meet back here and then have you fill out some questions, short questions and then have lunch and I am going into the lab.

(Facilitator leaves.)

TRACY

Do you guys think we should do this as a group?

(unison talking)

TRACY

I mean break it up, everybody kind of do a little part of it for like an hour and then we get together?

The facilitator does not prompt the students to provide a written answer to the question: "How will you go about your investigation?" as was intended. This is inconsistent with other groups at other locations who did task #2 and who filled out this page. But in this group of six students only one student writes a single sentence below the question on the form. The rest leave the page blank. Thus, an opportunity to think through a plan is lost.

With her first question Tracy attempts to find out whether the students are expected to work collectively on this task or not. The facilitator's answer is ambiguous, leaving it open to the interpretation that students should work together. Phrases such as "if you're going to work as a group..." and "one of those computers if you both have one" imply group work. Also the statement: "I'll go in the Lab and you can take some time, you can take some time... to decide how to proceed etc." could be interpreted as meaning collaboration is expected. The listener could hear an implicit assumption that although the facilitator is leaving the room, the students will want to remain for some discussion. If taking this as an answer to her question, Tracy could have easily assumed the reason for students remaining in the room is to decide on a strategy for working collectively.

In trying to read "what we want her to do", Tracy also makes the suggestion that the group work collaboratively even though she normally does not work with others. Later in the day the ethnographer asks if she normally works in groups and records:

She tells me that she never works in a group and that if she has to she approaches it with a plan.

"What usually happens is that there is someone who doesn't do the work so I usually tell them that I will write the paper and give it to them for changes and revisions."

I ask her how she decided to initiate group work in the morning meeting. She tells me: "That's why I thought you brought us together. You put us in a room together. It seemed like what you wanted us to do... I thought that was the idea." She also refers to everyone being given the same topic as at least suggesting they would work together.

However later in the afternoon discussion Tracy does not mention her usual habit of not working with other students even though the facilitator asks a few times about whether students usually work together. Other students reply to this question but Tracy remains silent.

Returning to the transcript of the first morning meeting, we see that Tracy also asks a question about what is expected of them in the afternoon session: "Are we coming back and like, reporting to you on what we did?" The facilitator's answer does not address her question directly. Rather he talks about the resources students have available to record their findings and about filling out more forms with questions later on as well as the discussions. Tracy does not ask a follow-up question. Rather another student asks: "So right now we're just in the research mode of gathering information....?" The facilitator replies positively.

Tracy seems to have latched onto this answer as the goal for the morning: she is to amass information. In the afternoon session she talks about the conflict she felt between doing what she thought the researchers wanted and doing what she thought was necessary.

I thought it was, like, hard to focus on the fact that we were just researching it [emphasis is hers] instead of - keeping that as our task instead of focusing on: "okay, I need to be, like, narrowing this down and figuring out what I'm going to put in a paper." That really wasn't our task; our task was to be researching, like, amassing information for the girl and so, uh, it was - I kept getting sidetracked instead of just trying to bring that information in. It was almost like I thought we should be getting just as much as we could in two hours to give this girl and be like: "here it all is. You do what you want with it!"

Tracy focuses on what she thinks we want her to do just as some students focus on what they think the instructor wants to hear rather than what the assignment seems to be asking for. She doesn't narrow the topic because she thinks this is not what we are wanting her to do. Rather she believes from comments made by the group facilitator that the goal of the project is to collect as much information as possible on the broad topic of islands. Even though at a few different times she provides evidence of an understanding that this topic is too broad she does not develop a more manageable focus (Standard One, 1d.) because she does not think this is what we want her to do.

As self-appointed leader of the group, Tracy convinces them this is their goal, leaving other members of the group frustrated in their search as well. However, they too give indications that they see that the first thing that should be done is to narrow the topic. This dilemma is partly resolved when the group meets back together after an hour. They collectively decide that the topic has many aspects and in order to amass the required information, each of them should take one aspect and collect information they will share with the group. In this way they will have collectively amassed a great deal of information and not duplicated effort.

Students in this group give indications in their written work that they realize the topic must be narrowed though they also try to work with the perception that the task is to amass general information. In response to the question: "What did you find out about the topic of islands?" one student wrote:

The general topic of islands covers many different facts about islands. Some general things I found were that each island has its own specific detail about. [student's exact wording] With the vast amount of islands in the world, it is very difficult to generalize islands into one category.

Yet in response to the question: "Are there other things you would do if given more time?", the same student writes:

If I had more time I'd break down the web page into general ideas. From that point, break the main topics into subtopics. With the subtopics I'd

further my research into specific. The specific is what I would research.

(Standard One, 1d; Standard Two, 4b)

This ambivalence about the goal of the task is reflected in the answers of the other group members as well. Tracy herself writes:

First, I found it was difficult to gather information on general island information - I learned there are different types of islands:...oceanic....continental...Generally I was more concerned with gathering information about islands in the two hours - I didn't take the time to read the information which is something I would normally do.

(Standard Three, 1a)

Asked what she would do if given more time, Tracy writes:

I would have looked up maps, school textbooks and just amassed more information from which she could choose what she wanted.

Tracy resembles many students who are eager to do "what the professor wants" rather than trusting her own instincts about what needs to be done. Rather than reading the assignment over again she takes cues from the person in charge. Tracy has a legitimate concern that may be motivating her. The ethnographer notes:

T. tells me that she typically saves things to her disk or prints things out and takes them home or to a professor who can help her assess the value of the information to an assignment that she has been given. She says she

always reviews papers in steps with her professors because she nearly took a low grade on a paper one time and wants to avoid that in the future.

During the meeting the group has after the first hour, each student takes an aspect of islands on which to "amass information." Tracy is to do the chemical aspects of islands. This explains the type of journals she seeks to find in her final hour of work. She goes online once again and returns to the library databases and starts a search for "islands" on GeoRes. However, she quickly becomes frustrated, (a word she uses in the afternoon session to describe this specific search) stands up and says: "Oh, let's just go to the journals!"

The ethnographer trails along as she asks a librarian where she can find the journals. He tells her the floor and that they are arranged alphabetically. In the afternoon session Tracy describes this way of working as typical:

What I do a lot at home is I go and plant myself in the journal section and get out like, like Biology, go sit in front of the journals in Microbiology and go sit on the floor and I just pull those things down and start going through them. And that's what I did. I just went to the Geology and Geography sections, started pulling stuff down, looking in the index under islands, just going through the articles.

I really didn't have time. I was just trying to get stuff.... like the chemical stuff.

In her haste to find something to bring back to the afternoon session, Tracy copies 3 articles from journals having to do with islands. However, in so doing she seems not to consider the middle school student as her audience. **(Standard One, 2d.)** Nor has the ethnographer been able to discern a rationale for choosing the articles that she did. **(Standard One, 4b)** The articles Tracy xeroxes and brings back to the group are:

- 1) " Island-arc basalt alkali rations: Constraints from phengite-fluid partitioning experiments" **in** *Geology*, July 2000; v.28; no. 7: p.583-586.
- 2) "Active displacement partitioning and arc-parallel extension of the Aleutian volcanic arc based on Global Positioning System geodesy and kinematic analysis" **in** *Geology*, August 2000; v.28; no 8: p.739-742.
- 3) Geodigest, a section from *Geology Today*, July-August, 1999/137. (No author listed. Name might possibly be at the end but T. has not copied the entire article.)

In addition Tracy returned in the afternoon with several, single page photocopies apparently from books, and print outs of pages from Encyclopedia.com and Britannica.com One page from what might be a book contains some words highlighted in orange by the student: "In fact, islands originate in many ways. Often their formation stems from the workings of plate tectonics; the ponderous movement of tremen" (highlighting stops) One guess is that these single pages and websites offered keywords to help shape the search.

In the end I am left to wonder whether Tracy's search is representative of her skills. She seems to be constantly aware of the time passing as she does her search. The ethnographer notes: "She tells me she is sorry for wasting my time. T. also believes she is wasting her own time. T. reminds me more than once that she only has two hours and that she feels she is not getting very far with this task."

If this had been a class assignment that she had a month to work on, would Tracy have performed differently? Or does her anxiety have something to do with realizing she has only two hours to do a task that she has perceived as "amassing information" and that obviously requires much more time? Does she typify the performance of a student who is looking to decipher what the professor wants to see rather than proceeding with what she thinks ought to be done to complete an assignment?

Professors often encounter students who spend a great deal of time with them trying to "psyche out" what the professor wants. Older returning students who dropped out after not being very successful at their first try at college often return to the classroom with high anxiety about their performance. Tracy's anxiety became more apparent to me the longer I studied the data on her. For example, while the facilitator was speaking, the other students in the group looked at the task sheets or at the table. However, Tracy kept her gaze focused intently on the facilitator as if searching for additional nonverbal clues regarding what he wanted.

As he followed students at other campus sites, one perceptive ethnographer, in fact, wrote that "we must pay attention FIRST to how a person arrives at their perception of what they believe is expected of them in order to understand the process they follow."(Fieldnotes from Dale Deden)

How did some students perceive the challenge of Task #2 to be identifying a focus or narrowing the topic? How did other students decide Task #2 required meeting other objectives? Part of the answer is in the interaction that took place in the group during the introductory session. Both the facilitator and the students give off verbal and nonverbal clues to each other, helping students to align their expectations with the expectations of the authority giving the task. Some students are more sensitive to the authority's expectations than other students who are confident they understand the task and know how to go about it.

The other part of the answer may have to do with background knowledge students brought to the exercise. Past experience may lead students to focus on different elements of the group interaction that replicates similar experiences or echoes their past. We don't have enough information on this student to know exactly what she may be drawing on from her "stock of knowledge." One clue is her comment about a time when she did not get the grade she wanted because she had not correctly perceived the professor's expectations. This occasion and other similar experiences may have led her to focus on what the person in authority seems to want versus what she believes the written instructions are asking her to do.

Another result of trying to view Tracy's performance through the lens of the ACRL Standards is the confirmation that competencies are interrelated and it is difficult to isolate individual competencies and assess them without also assessing other competencies. Because Tracy incorrectly identifies the information need at the beginning she sets in motion a chain of frustrating experiences. This initial error keeps her from being able to display competence in a number of other Standards' outcomes that assume the student has correctly identified the information need in the first place.

Without this complete examination of Tracy's experience, we might simply dismiss her as an incompetent student. But with a full description of Tracy's experience we can see that situational factors, such as the interaction that takes place with the facilitator and other students, the desire to please the research team, and the short time available to make headway on a huge task impact Tracy's performance.

These two cases also establish that information competence involves a set of skills encompassing activities far beyond conducting an effective search on a computer. Determining the information need and conferring with others usually precedes going online; information is also sought through non-technological sources; and once information is found it needs to be analyzed and used in a variety of ways. Nor can performance on the computer be surgically removed from the constellation of information skills. Computer skills and conceptual skills are not only related but constitutive of each other. They do not follow sequentially from each other in a neat

linear progression. In addition, performance of information skills is embedded in social and institutional contexts which constrain and maximize their demonstration.

THE IMPORTANCE OF CONTEXT

Faculty sometimes encounter students who act as if they are on a quest for one particular fact, THE answer to the question or assignment. These students' papers are typically brief because they fail to set the scene or provide any background knowledge for the reader. During the course of this project we also encountered students who focused only on the question that came at the end of the task, not the information contained in the rest of the task. They searched for a resource that would contain that one piece of information they needed rather than by beginning with a search for more general resources that would give them an overview of a topic they knew little about. This left them with little or no understanding of the context of the topic.

However, more commonly students recognized that they must first get a general overview in order to understand the task.(**Standard One, 1c**) This is what Maura sought to do when she searched for information on "child farm workers" and saved a list of organizations whom she might contact for further information on pesticide use. These actions were part of a search to get a general overview. The data contain many other examples of students exhibiting this skill.

In fact, another student in the same focus group as Maura said that she purposely was looking at the information about "children and health problems" because she would

want to give an introduction leading into answering the questions. In other words, she would want to supply some context for the audience. She stated:

*I think I need to start somewhere else. I'm not just going to go into it:
"Yes, they realize it because blah, blah, blah, you know." That's why I
think I started that way: how does it affect children? What's going on?*

This student points out (in her own words) the importance of knowing background information on an issue. In order to discuss the role businesses play in pesticide use, some understanding of the harm done to children by pesticides is necessary to set the stage. It is important that the student read the entire task and keep it in mind before focusing on the questions which appear at the end of the task.

Students who believe they need only find the facts to answer the question at the end of the scenario, erroneously search for bits and pieces of information rather than striving for a contextual understanding of a topic. They run the risk of being like quiz show contestants who can answer trivia questions but would be unable to participate in a reasoned discussion of social problems where bits and pieces of information are analyzed in relation to each other and used to build conceptual frameworks and abstract arguments.

A third student explains:

"I spent my first half hour focusing on the children and the pesticides even though it wasn't really the question and I think the main reason I did that

was 'cause we read it in here, you read along and go: Wow! Children working on farms and pesticides. WOW! Is that true? Is it possible?"

Students who have never heard of, or considered, a topic may verify information or increase their own knowledge of the issues before proceeding to focus on a more narrow aspect.(**Standard One, 1c.**)

Students find it necessary to explore background information in order to understand their task. Understanding a question in context is central to accomplishing their research. A student involved in doing Task #4 who chose the topic "Maya, Aztec and Navajo Pottery" said:

There are Ceramics of the World, World Ceramics, History of Pottery, different background kind of stuff to find out because I don't know hardly anything about the cultures, or the pottery, or anything. So just for my own knowledge, to get some more... I mean I assume if I was really on this task force that I would probably have some background information, but yes, just to get acquainted with the subject and find out, you know, and somebody else may want to know that too, so that kind of stuff.

Another student commented:

If it's a class that's outside my major that I'm not used to, I end up doing a lot more general information search, just because otherwise I don't - can't - talk about specifics if I don't know the general overview.

Assigned to Task #1 another student was surprised to find how little his contextual understanding actually was. In a discussion concerning students' answers to the question how much they knew about the topic before doing the task, he remarked:

KIRK

Well, I didn't put "very little," and I didn't put that I knew "a lot" and if I would go back, if I had to do it again, I would put that I knew very little, cause there's a lot of organizations that I didn't know about. I mean, you know, I know basically the concept behind the greenhouse effect and global warming and that was it, and so, I spent most of the time just like going through these, like, high level sites you know, learning about these organizations and that sort of thing. So I didn't even get into a more detailed search, you know, like go to some of these other websites, like global warming and hoax and whatever, you know, so..

FACILITATOR

Let me see if I can paraphrase that, ?? ? So you basically are saying that when you saw how much was there, you realized that you didn't know enough to decide exactly how to, how to focus the search and what you wanted at this point - it was better getting an overall understanding of things first.

KIRK

Yes, I would say that.

Students may struggle with keywords because their lack of knowledge prevents them from generating even a few related terms. Students often mentioned their sources for keywords as websites or books that they went to first for general information. If one knows nothing about a topic, it would be nearly impossible to generate any search terms, let alone ones that might yield the best results.

Thus, one reason students may move from database to database or search engine to search engine using only the same few keywords on each one as the screen capture section mentions, is that they lack sufficient depth of knowledge on the topic. Another obstacle is not even understanding the words used in the assignment. For example, a student doing task #1 did not know what the word "hoax" meant. A student doing task #4 did not know what "improvisation in acting" meant while others interpreted "multi-disciplinary" to mean "multi-cultural."

Students need to be able to see how to unpack parts from a whole but even more importantly, they need to be able to see how to put parts together to get the big picture. They need to see how parts contribute to the whole and interact with one another. Pursuing THE answer to a narrow question cannot provide this holistic understanding.

PROCEDURAL AND CONCEPTUAL PROCESSES

Detailed analysis of the focus group data revealed that some groups talked more about the substantive content of what they had found and their reasoning in thinking about the topic while other groups talked more about the specific tools and procedural strategies that they employed. Further consideration of this difference between groups suggested two reasons for the difference: 1) the difference in the tasks and 2) the difference in the facilitators' lines of questioning.

Although the difference between facilitators might have been a contributing factor, the requirements of each task seemed to play an even greater part in the difference. It became clear that one cannot separate the procedures and tools one uses from the conceptual strategy and line of reasoning used in accomplishing the task. If a student does not have good reasoning and critical thinking skills, it will not matter how facile they are with manipulating computers, copy machines, books, journals, or any other resource.

In the following excerpt from the transcript, a group of students talk about what they did in response to an initial question from the facilitator asking them to describe their experience. The first two students emphasize their procedural process with tools while the other four students talk more about their conceptual process.

JOSH

And I spent all of my time basically at the computer out there next to the research station, and I found the web page, program, for finding books

within the library and music to be real easy. Real easy to use. I can't comment on actually going to find the books because I didn't think that was necessary. So I didn't go and do that, but as far as the resource list, I found stuff off of that. I did sort of cheat somewhat and go to my home school's library page because they have a listing of resources there and I've used that so many times and I know exactly what I am looking for.

FACILITATOR

That's not cheating. (Laughter) You can go anywhere you want.

MARK

This library is a bit bigger than the one I am used to at Chico and has a lot more books than I would have expected to find on Chico on the subject of Blues which was the subject I chose. It had a multitude of resources in the library itself, not counting what I found on the internet. So I was really happy with that.

FACILITATOR

Great.

KELLY

I also spent all of my time at the computer terminal. I, however, used the internet as my main form of locating information, and basically went

about it as I would a normal research project, as I do always, and just put in my topic. I chose Improvisational Acting. I put that topic in and got a whole bunch of websites and went through and chose the ones that kind of jumped out at me. I got some really good ones. I kind of was looking for the benefits of improv acting: the attributes attained by a student that would be involved in something like that in order to argue a point, I guess that would be. And found some really good information. As I sat there more and more, I came up with a few different ideas and ways to go about proving a point, or arguing a point, and in finding some of the attributes I found that what came would be confidence and better public speaking and stuff like that. And then I found a couple more websites on just the amount of people who have trouble public speaking, and actually went into the personals on Yahoo's personal ads and searched for the keyword "confidence" as an attribute people look for and on (?), and 846 people out of 1,000 ads had the word "confidence" in them which I thought was kind of (?). (Laughter). So just for my way of thinking that's how I kind of thought. I found some attributes and then went and looked why they were important to have in people around high school age.

FACILITATOR

Okay.

FRANCESCA

I pretty much right off the bat found what I wanted to find. I spent all my time on the computer also. I went to the California Department of Education website and went to their content standards for kindergarten through twelfth grade. I went through their high school standards and I chose improvisational acting and (??) content standards for performing arts. So I thought that would make a pretty strong argument. Other than that I just looked around on some websites about improvisational acting and checked out a couple of other things. Oh, printing. Oh that was kind of irritating. The system was easy and once I learned how to use it - I only had to be shown one time how to use it - but one time something wouldn't print, and I was trying to print two articles from the same website. The first article printed and the second article wouldn't print, so I went to the librarian and said "Can you help me print this?"

FACILITATOR

That was good. Okay, and Jake?

JAKE

I pretty much used the computers a lot. I went to the Google search. I did it on Pottery of Aztec Mayan and Navajo cultures. And the reason I did that is because I think that would be a good task to teach. And It's multi-disciplinary arts class because it covers a lot of ground. And that's mainly what I focused on. Is the ground that it covers and so I searched

each of those and found stuff it covers, like Geography, all sorts of stuff. Geology, Sociology, History - that was pretty much my technique. If I had had more time I probably would have called home and talked to some friends who are teachers and figured out how they go about it. And I also did some research looking for (???)

TINA

And I spent my whole time at the computer as well. I chose improvisational acting and I was happy with it because a lot of times when I go on the internet and the search engines I get so much stuff, and none of it really gives me what I want, and I sit there a long time clicking all these pages and pages and not getting any information. But I actually found the information I needed this time. I went to Google. I've never really used Google - I think at home I use Excite - but I've heard that Google is pretty good so I thought I'd try it and I just typed in "benefits of learning performance and visual arts", and "State Department of Education, Visual and Performing Arts contents", and it just listed a lot of things. It gave rationales for including arts in curriculums and the benefits that including arts in education gives kids, and things like increasing self esteem, increasing focus, thinking skills, problem solving skills. And so when I see that and then I saw something that said there were studies that improve SAT scores, and dropout rates are lowered, and attendance is higher because of having this type of thing in their education. So that

would lead me to look up maybe journal articles B which I didn't do, but I would probably try to find studies that actually proved that correlating having this curriculum would improve SATS keep dropout levels, and then I would probably speak to drama instructors and students and ask them how, outside the school having, careers in public speaking and communications, in my argument.

FACILITATOR

Okay.

CILLA

I choose the Blues and basically I just used the internet and bypassed our library, which I usually do.

FACILITATOR

Why's that?

CILLA

I don't know. ... For the Blues, what I did is that I chose this because there's a lot of aspects that (too faint) in direct response to the Y.(too faint) culture in America and so I thought that in terms of teaching it to children: they are getting music lessons, they are getting a cultural lesson, they are getting a history of America, which means a lot. So for the

materials I gathered I got the History of the Blues, the Origin of the Blues, lots of (inaudible) from different artists ranging from the 1930s to the 1990s, and then I got videos on the lifestyles of the musicians and the masters of the (inaudible).

The first two students, Josh and Mark, talk more about their searching process while Kelly, Francesca, Jake, Tina, and Cilla address the conceptual challenge in the task. In these excerpts we hear students talking about research tools and procedures at the same time that they are thinking through their conceptual strategies. Kelly proceeds from finding out what attributes students might acquire from improvisational acting to thinking about why high school students or their parents could be convinced they need those attributes. She goes to the Yahoo Personals and sees that the majority of people are seeking someone with confidence or else tell prospective dates or mates that they have confidence.

If one were only looking at screen capture results for this student, it might look like the student was "goofing off" or "not being efficient." But the logic this student follows in order to argue a point is quite reasonable. What high school student doesn't want to appear appealing to a prospective romantic interest?

Francesca is already aware that the Dept of Education has Standards for the arts in the curriculum so that she does not have to reinvent the wheel. She is looking to make "a pretty strong argument" but then becomes frustrated by the printer, distracted by the tool

she hopes to use to save evidence. Jake is thinking in terms of disciplines that would have information on pottery of indigenous peoples, a way in which information is organized, and also mentions talking to teachers he knows, a non-technological resource.

Tina thinks about looking at journal articles specifically to find studies which prove that studying improvisation leads to developing certain personal attributes. Using journals is not part of a pre-planned strategy but comes about because of information she has found on the Department of Education website. In other words, the content of what she finds on the site leads to identification of the next tool to use. She also thinks of using non-technological resources: gathering information from drama teachers and students in order to bolster her argument. These students are focused on their conceptual strategies with procedural processes remaining in the background unless or until tools become a problem.

In another discussion two students get involved in a fairly heated discussion about when it is fair to ask a librarian for help. The first student accuses the second student of wanting to get the librarian to narrow her search for her because of an ambiguous statement the second student has made. The second student clarifies it by saying:

I don't mind having to narrow my search down myself, but I think it was just the way she didn't explain to me really how to use the computer to even find stuff so I could narrow it down.

In other words, the student will do the conceptual work she only wants help in using the tools.

In the next example, the student's desire to get equal amounts of information on both sides of an issue guides his search. Whether one agrees with his logic or not, he has a conceptual strategy he pursues. However critical examination of information on the sites is slighted in favor of looking at what type of information each site contains: "figures and facts." He concludes sites claiming global warming is a hoax must be correct because they have more figures and facts.

I did the same thing, I just went on the Internet and ?? stuff with Gore's and Clinton's plan and you know, the whole computer thing (very faint), looked at that and all the stuff they had and I got an equal number of stuff on the pros and cons, that way I didn't have so much that global warming is true or global is a hoax, that it more on either one, I have like equal amounts, that way I could weigh them both and it looked like on the hoax ones it had a lot of more direct figures and then on the ones where it said, Oh no, global warming is true, but it was more around, they beat around the bush in talking about it, I thought that was interesting, you know, going and thinking that, you know, I believe in global warming when it seemed the hoax websites had more figures and facts than the other ones.

The next excerpt illustrates how one student could only find information on one side of an argument while a second student was able to use the same tool, the computer,

to find three different points of view. The second student was able to find these three points of view because he had a conceptual strategy before starting to use the tool for accessing information.

HENRY

..and the points of view that that web page had (talking very fast and hard to hear) then I tried on that web page to try, to try like to find the other side on, on the, I tried to find the pros and cons, but basically everything did favor that page, that web page so, that's what I found.

LEE

I found a lot of stuff, I took like a, like a 3 prong approach to it. I went you know, take the ultra conservative: you know, global warming's a hoax side, I take up that one side. I went to the government to get like, you know, kind of like the centrist approach, and then I went like to the environmentalist, you know, I read like some newspaper articles from the environmentalist, and it was interesting how they interpreted the data differently. The one, I think it was the Congressional, the eh Congressional eh page, I forget what it's called, the Congressional Research Service had like this, their numbers and they all come out pretty much in the middle whereas if you go like to the newspapers, they'd be, Yeah removing like 20% of our ?? in air (laugh) and fully ...??

In the following conversation about Task #4, Elliot offers his reasons for choosing the Blues as a topic he would advocate for before the local School Board. He tells about how he encountered a student working on Task #1 who gave him an idea. (In bold below.) He, in turn, related the suggestion to Charles. Although both students give other reasons to be used for arguing in favor of the Blues, they also consider the availability of information as indicated on the computer library database as a good reason. They will argue for the Blues being included in the curriculum partly because teachers will be able to find a lot of information on it as opposed to the other topics. In this way the tool constrains their thinking.

ELLIOT

Yes. Um I started out with just going into the library's catalog and seeing what I could find on the eh Blues. I chose the Blues, and so um I found it and then I went up to the 5th floor and the location of it and stuff and then realized um, you know this is really helping me out as far as how you can persuade other people about how we should teach blues versus uh the four other topics, and then, I happened to run into somebody else, I was in a different group, and I asked, eh we kind of like traded the tasks and I got to read her task and she got to read mine, and you know and I was like, Ah ha! that sounds cool.

So, then she gave me the idea of um, she told me the librarian showed her a really neat trick if you go on the website, this library, you could gather how many books are [emphasis added] on your topic, or how many entries there are, and so what I did was I went downstairs to the

computer thing and and I, I researched how many available things are there for the Blues and I compared it to, uh, how many things there are to the other four topics and it turns out there's more, more research available for the blues and sounds like that's a good persuasion argument, it's really easy access, [emphasis added] the teachers give to you whatever, you know, if they want to make a report, it's still here, you know, the children would be able to do whatever.

And then and then, I was thinking about the medical side of it and so I researched the medical side and then tried to find things um and there was a couple of articles I ran into about spatial, what was it? It's like spatial thinking or something like that, I don't know, and so I noted those and then, um, and then I noted some things about - well how else, what else, what else would be a good reason to teach the blues versus the others and I started thinking: well, it has a lot to do with American history and especially black history and so again, it would be the multi cultural thing like you were saying and you know, then I started thinking about other reasons like you know, if you start playing an instrument, you know, I started listing all kinds of things, like venues of music and stuff like that.

LARA

So when you said medical you mean, Oh I've got the blues, that kind of a thing?

ELLIOT

Oh no, I was thinking more of the concepts of of music, like this one's pretty cool, it's about uh, I don't have my book marks, but it's about spatial, spatial thinking and it talked about how, how children when they - there was this experiment they did and how children, when they practice music they grasp a bigger picture of how things are working together as a whole, and so and so if you keep on that path, you start learning things differently, you start um I don't know you start breaking things down differently, I guess and that's what this art, this little experiment showed and I thought that was pretty cool and I noted that down, so that's kind of like, I guess the cognitive side.

FACILITATOR

Um mm um mm. Okay, Charles.

CHARLES

Um I also chose the Blues topic and I, you know, went on the computer and, like, was checking out the library catalog and just typed in Blues and like a bunch of different books and stuff n the topic and then I also, um, clicked, like, on, like, the Big Plus button.

FEMALE

Oh.

CHARLES

*...so I could find more books at the surrounding libraries and on the same topic. And then I went down to the computer and **I talked to Elliot just to see kind of how he was doing and he talked about how he had talked to some other girl about forming an argument based on the availability of articles and books on the other um, the other topics [emphasis added], so ended up doing the same thing as he did and checked out how many resources were available on the other topics and like went on looking like for India dance - it just seemed like it was a really limited...***

ELLIOT

Yeah, there was maybe like two or something like that.

Students seem to be implicitly aware that substantive content and instrumental procedures are constitutive of each other, i.e., that procedures for using research tools cannot be considered apart from the specific topic and discipline one is investigating and the purpose of the research. This may be why students frequently mentioned that they prefer library instruction that is targeted to a specific assignment and in a certain discipline.

STUDENT SUGGESTIONS FOR BEST PRACTICES

Students prefer targeted learning sessions directed towards one task rather than a broad overview or tour of library facilities and resources. A number of students recounted their experience of a library tour and concluded that they didn't remember anything either because it was too long before they needed to use the library or information they had been given, or because they had been overwhelmed with too much information.

One student said she was a very visual learner and said of the librarian who spoke to them:

She was just talking to us and going over stuff on the screen but I was thinking it would have been really helpful.... I would have loved to have had something, a printout, and it's for psychology so it could have been very specific for our class and that would have been helpful, like go to get some good psych journals or go to these certain databases, so I know that'd be helpful.

Students also appreciated specific information about data bases. One student said:

I remember that she'd said, "Okay, EBSCOhost is really good for this and Jstore is really good for that" and so I made little notes when she was talking so then I'd take that wadded up piece of paper and go in the library and then I could more easily do - until you're just sort of used to it

- but I wasn't real thrilled about that, but it ended up being pretty useful to me.

Students appreciate faculty and librarians who work closely together. A number of students recounted experiences in classes where faculty and librarians had cooperated. In one class the faculty member had shared her assignment with a particular librarian, thus providing coordinated support for students. One student said:

She worked with the librarian, the librarian knew we were taking research methods. If we went in there - and we went in there at class time too as a class - and went through the database of PsychInfo, that's how I learned to access it. And every time we went in there, if you say you're from research methods she would know - the librarian would know - well, you need to do this or you need to go here. It was very... I wouldn't have made it that semester. It was crazy. I wouldn't have been able to do it. It was very helpful.

Some students would like help in negotiating the physical library. Some students report they cannot physically locate materials in the Library although they are proficient in locating call numbers for relevant materials in the online catalog, or in accessing full text journal articles on the WWW. As one student said:

I did everything on my own except I did ask the librarian to point me to call numbers because I get very frustrated trying to find the different call numbers and the library's so big and I just feel overwhelmed so I'll just

ask where three or four are at and she'll point me and once I find those, I'll find, like, somebody else to point me where the next call number sections are. You know, just tell me "the back right" or "in the middle left" because otherwise I feel like: where do I even begin? It's so big trying to find things...

On one occasion a researcher encountered two participants looking for a room. A floor plan was on a nearby wall. The students first asked the researcher where to find the room. Being unfamiliar with the library herself, she suggested they look at the nearby floor plan. "Oh, no." said one of the students, "We'll find someone else to ask." Other students in focus groups also mentioned the size of the library as overwhelming them, being unable to physically locate books or other materials, and feeling lost in their campus libraries.

Librarians who began using the virtual library mid-career are able to see many analogies between using the physical library and using the virtual library. Students who have never or seldom used a physical library but are familiar with the virtual library can't make these analogies. What seems like common knowledge to many librarians and faculty is intimidating to some students.

Some students would respond better to a friendlier library environment.

With the advent of bookstores with overstuffed chairs and cafes on the premises, and

public libraries with food kiosks outside the door, campus libraries seem comparatively less inviting. One student commented:

I don't know if this will happen but an idea I have - like, libraries could still continue to have all those books, but it should be a more comfortable place, for people to come to see it differently. Like Barnes and Noble, people go there and hang out and read books and like, you don't have to buy them, you can just kind of read them there. I mean, a library you can go and you can take it with you, you don't have to buy it but people don't really go to the library to hang out and read books and I don't know if it's just because it's so immense, so hard to find things or it's more structured so that it's hard to study. You know if there would be comfy chairs and like a relaxed environment, so I don't know but that may be a way to gear libraries towards staying popular while having people do...

Another student added:

I would go to the study rooms but that's really the only reason why I use the library is to go to the study room. You're not allowed to have food or drink, but I have to study with food - I have to have some food or drink up there, so I don't know, I don't think it should be so structured and I think it should have food and drink and stuff - I really only just use the library if I really have to go to the study rooms.

A participant in the same discussion summed it up by saying:.

I think librarians just might need some public relations 'cause when you think of librarians you just think of somebody saying : "Sh-h-h, quiet!", really strict, and that's how you always see them on TV and movies... Just some kind of public relations, you know, maybe a small ad in the newspaper saying, you know, a happy, smiling librarian saying: "Ask if you need help" Just change people's opinions about librarians...

ADDITIONAL FINDINGS FROM FOCUS GROUPS

In addition to what the students show us about their use of strategies listed in the Standards, there are additional findings with far reaching implications for libraries and librarians. These are:

- 1. Students do not often make distinctions between academic and popular literature whether this material is on the WWW or in the Library.** For example: a magazine is regarded to be as credible and sufficient as a scholarly journal. Bookstore sites are sometimes used in searches in lieu of libraries. Internet sources are used as frequently, or more so, than academic databases.
- 2. Many library resources such as microfiche or periodical indexes go unused because students are not familiar with them and can manage "to get by" without them.** They report they do not use certain sections of their libraries for the same reasons: Special Collections, the Media Center, or Government Documents are examples of places that students "fear to tread."

3. **Students rely on professors and other students more than on librarians for help in completing their research.** Students rely on professors more than librarians for help in where to go for resources for a particular assignment. They rely on friends and acquaintances more than librarians for help in using computers in the library.

RESEARCHERS' RECOMMENDATIONS

Following are suggestions based on the analysis of screen capture data by Nancy Oiye Hartwig and Barry Saferstein.

The data show that students find very little appropriate information using the web. Students could have gathered more, useful information with more efficient use of time had they used effective database searching skills promoted in the ACRL standards. Students develop a false sense of success in their information searching by generating large response lists on the web. Thus, they revert to the web rather than pursuing database searches. However, by doing so, students not only find less useful information, but also miss opportunities to learn about and practice effective information seeking practices.

- Discourage students from using the World Wide Web as a resource for completing course assignments that require valid and reliable analytical sources of information.
- Libraries can apply restrictive or prescriptive approaches to fostering database use. The restrictive approaches would involve, eliminating (to the extent possible) online access to web search engines on computers dedicated to library information seeking. The prescriptive approach would keep access to search engines, but discourage their use through the design of library web pages and guidance in the use of databases. Provide students with brief suggestion lists regarding the use of databases and catalogs. Such lists may be in the form of notes posted at workstations, online lists prominently displayed on library web pages, or posters in libraries. Compile and catalog by discipline or subject links to selected web sites.

- In order to encourage efficient, productive, and focused web searching practices that foster information competence, librarians might compile and organize, on library web pages, links to selected web sites. They might contact instructors for suggestions of useful sites as they do when they select and catalog books and journals. These lists of web sites could be organized by course and major. By using such sites, students would be able to develop the practices of thorough and systematic information searching, rather than the fishing approach that web search engines foster. Such skills would transfer to database searches.

Libraries can enhance students' information seeking skills by expanding their function as places for teaching and learning information competence.

As currently configured, the online environment provides students with information resources, but does not operate effectively as a resource for teaching and learning information seeking skills. Our libraries must adapt to the new information technologies, not only by increasing students access to a variety of information resources, but by providing guidance necessary for students to learn and practice information competencies appropriate to individuals receiving a university education. While faculty and many graduate students need libraries to function primarily as repositories for information resources, our data indicate that most undergraduates would benefit from libraries and library faculty taking a proactive approach to the teaching and learning of information competency. When undergraduate students visit a CSU library to work on course assignments, we should conceptualize their library activities, not only as fostering

the learning of academic subjects, but also as labs or practica for developing effective information seeking practices. We should provide support for such learning activities.

Below are other suggestions from Linda Shaw and Linda Pulliam:

- Information Competence needs to be seen as the province of both faculty and librarians. To begin to involve faculty, set up faculty - librarian dialogues about the findings of this report.
- Encourage coordination between faculty and librarians to develop orientations to specific library services and holdings applicable to a particular class or topic.
- Encourage students to use both technological sources and non-technological sources in the actual world and explain how various sources complement each other.
- In a time when lines between academic literature and popular press literature are being blurred, teach students to read critically and evaluate material using criteria other than what the source is.
- Encourage critical thinking and analytical and reasoning skills by increasing student awareness of the range of information available from "facts" to discussions of abstract ideas.
- Promote use of full library resources through "advertising" them as a time-saving device. (e.g., if students know they can go immediately to a special collection and be more efficient in finding information, they may take the trouble to learn its holdings.)
- Librarians need to be more proactive and approach students and faculty rather than waiting for them to come to librarians. Come up with a list of conversational openers

to use with students rather than saying: "Can I help?" This may require training some student workers to monitor library spaces.

- Reorient librarians to be attuned to the fact that students already have existing skills and ways of working, even if they do not match the ideal methods known to library professionals. Students are not blank slates but have their own logics and established strategies.
- Help students to feel comfortable in the physical library and to be able to find their way around it. Friendly, eye-catching signs posted in strategic places may help achieve this goal. Some students may require lessons in how to read a floor plan.

CONCLUDING REMARKS

In this report we have provided discussion and analysis of student information competence skills as evidenced in a one day exercise. We do not claim that our findings apply to all CSU students. Rather they are suggestive of the range of skills that may be found in the student population as well as the kinds of challenges students experience in conducting research for a specific paper or project

At times in this report, observations and findings by different authors of the above sections support or provide richer detail to each of the other sections. At other times we may have provided conflicting or contradictory explanations. Looking at the same phenomena from different perspectives leads us to different insights and understandings and we did not attempt to minimize or delete those differences.

After completing Phase II we are left with some questions for further research. If students were followed throughout a year, would we be able to see a fuller exhibition of

information skills as well as learn how they develop or improve those skills? Could library instruction along the lines suggested above be implemented in a way that would enhance student skills and make students more efficient and effective researchers and analysts? How can faculty and librarians best cooperate to benefit students? Are there some models of faculty-librarian collaboration that could be promoted and how?

Developing a tool for assessment requires data such as provided above to inform decision makers and practitioners. The use of scenarios as employed in the Phase I survey and the use of tasks as employed in Phase II lead us to a fuller and richer understanding of student practices and challenges. They approximate real world situations more than a paper and pen test that can only address abstract knowledge and hypothetical questions. A demonstration of knowledge in action ("knowledge of how") is more revealing and accurate than a demonstration of "knowledge of what" obtained through testing. This is what we have provided in this report.

APPENDICES

APPENDIX A: THE FOUR TASKS

APPENDIX B: EXAMPLES OF STUDENT WORK

APPENDIX C: PHOTOS OF SCREEN CAPTURE RESULTS

APPENDIX D: THE ACRL STANDARDS WITH OUTCOMES

