Library Access, Search and Retrieval (LASR) Pilot (Final Report)

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Abstract: The Global Change Data and Information System (GCDIS) is a cooperative effort among eight United States government agencies and other organizations to provide public Internet access to their global change resources. The Library Access, Search and Retrieval (LASR) pilot project focused on in-library use of these resources, testing the GCDIS with the public from September, 1994 - December, 1995 in order to solicit information about the system's usefulness in its current state and suggestions which might be employed in the continued evolution and revision of it. This document is the final report of the LASR project.

LASR - A project of the Data Management Working Group (DMWG) of the U.S. Global Change Research Program. The DMWG includes representatives from the following agencies: Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Department of the Interior, Environmental Protection Agency, National Aeronautics and Space Administration, and the National Science Foundation. This work was funded by NASA grant no. NAGW-4096.

Introduction

The Global Change Data and Information System (GCDIS) is a cooperative effort among eight United States government agencies and other organizations to provide public Internet access to their global change resources. The Library Access, Search and Retrieval (LASR) pilot project focused on in-library use of these resources, testing the GCDIS with the public from September, 1994 - December, 1995 in order to solicit information about the system's usefulness in its current state and suggestions which might be employed in the continued evolution and revision of it. Questions[1] of particular interest were:

- What are the resources of the GCDIS and how well will they function in a user environment?
- Is the current state-of-the-art in libraries adequate to access the data and information from the GCDIS and make them available to users? And how will the libraries know what is available?
- What will happen when the community of users tries the GCDIS?
- How will we provide mechanisms for obtaining user input and feedback in order to respond to user needs?
- How will we provide links to a diversified community of users?

To answer these questions, the LASR project set up several sites in two Virginia communities: Charlottesville, a city of 40,341 in the center of the state[2], and Williamsburg, a city of 11,530 in the southeast[3]. The two areas enjoy comparable standards of living with median family incomes in keeping with the national average ($33,729 and $36,693 versus $34,018)[4] [5] [6]and unemployment rates well below it (3.6% and 3.8% for Albemarle and James City counties versus 5.5% for the United States as a whole)[7] [8] [9]. Both communities are home to state-supported coeducational universities that serve as major area employers, necessarily attracting well-educated citizens for the LASR sample. Approximately 22% of Charlottesville residents 25 years of age and older and 28% of the same demographic in Williamsburg have an Associate or Bachelor's degree while 17% and 20% of others in the two cities have additional graduate or professional degrees[4] [5].

The particular sites that were arranged within these communities included:

- A public library system with 8 branches, serving 4 counties and the city of Charlottesville.
- A science and engineering library at the University of Virginia (UVa), the larger of the two universities with its combined undergraduate and graduate enrollment of approximately 18,000.
- A multidisciplinary library at the smaller university, the College of William and Mary, with its combined enrollment of 7500.
- A state-supported community college with an enrollment of 4,000.
- A county lower elementary public school (K-5) with approximately 250 students.

- A city upper elementary public school (grades 5 & 6) with approximately 700 students.
- An environmental education center associated with a private, predominantly male military school (grades 5-postgraduate). Enrollment: 94 students.
- A small commercial consulting firm involved in the development of products that monitor the environment. 10 or more employees.

Six other sites were designated but never fully developed. Two of the proposed locations were four-year colleges in other cities, Virginia State University[*] in Petersburg and Randolph-Macon Women's College[†] in Lynchburg. Since it would have been extremely difficult to set up their access technology from a distance and the higher education target group as well as the problem of user diversity should have been satisfied by the two universities already fully functioning, it was decided that it would be preferable to consolidate effort in the immediate areas over which project managers had some control. A third proposed site was a children's museum, The Virginia Discovery Museum[‡], which would have to have been tied by their computing needs to the facilities of the public library during the study period and therefore, might have represented duplication of information for those groups as well. A Geographic Information System (GIS) Laboratory[§] in the central library of UVa, a medical library at that same school[**] and an Albemarle County high school were also considered but showed no enthusiasm for being sites after initial contact. No reason was given in the first and last instance. In the case of the medical library, the Library Director felt the project was too far removed from its core mission, even though global change could be demonstrated as having an effect on health and the health sciences by association.

Site Descriptions and Subjects

Jefferson-Madison Regional Library System[††]

The Jefferson-Madison Regional Library System (JMRL) was meant to be the hub of LASR activity in the extended community of Charlottesville outside UVa.

Anticipated User Community

The anticipated user community at the JMRL consisted of 8 reference librarians and the public service staff. Others who might have benefited were non-service staff, branch librarians, patrons among the general public and early adopters of Monticello Avenue, the community information server whose computer lab is located on the mezzanine of the Central Library branch.

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[*] http://www.vsu.edu
[†] http://www.rmwc.edu
[‡] http://www.comet.net/vdm
[§] http://www.lib.virginia.edu/gic/
[**] http://www.med.virginia.edu/hs-library/HSLIBHome.html
[††] http://monticello.avenue.gen.va.us/Library/JMRL/home.html

Description of Hardware

The hardware at the library site was all added as a result of cooperation between the LASR project and the joint effort between the city of Charlottesville, Albemarle County, UVa and the library to establish Monticello Avenue. That hardware included one Macintosh PowerPC in the Reference Office (which was connected via modem to the University) as well as 6 Macintosh PowerPCs, 1 Macintosh 840 AV, 2 Dells, 2 scanners and 1 printer in the public lab, all connected by a direct ethernet line.

Preparation for Use

1. An IBM RS6000 computer was provided on loan from another project to stand in for the server at UVa which would eventually be moved to the library to drive Monticello Avenue.

2. A second Apple workstation with modem was lent anonymously through UVa Medical School to be used until the Reference Office PowerPC arrived. Although it was not a PowerPC itself, the second machine was provided to help Central Branch Reference librarians and staff become familiar with the basic platform differences between Apple and DOS-based systems with which they were more familiar and to practice their Internet skills using lynx.

3. The LASR project Field Manager volunteered to be one of two Training Coordinators for Monticello Avenue (not to be confused with the person responsible for internal staff training which was a paid position in the library. This position was assumed by the then-Systems Manager of Monticello Avenue). The Training Coordinators conducted 14 trainer-training sessions with approximately 30 volunteer participants, several of whom took multiple classes and ultimately taught their own trainer-training classes. The 8 Reference Librarians were among those in attendance. These training sessions were held under the Monticello Avenue banner. The librarians were included so that they would be able to provide on-site support for the library users of GCDIS.

4. The Field Manager gave one-on-one assistance to the librarians outside of formal classes when it was not perceived as encroaching on the Monticello Avenue Systems Manager' s duties.These sessions were for librarians only and the Site Manager determined what was taught, given her prior knowledge of the skills of her co-workers. Again, the aim was to help the librarians become more comfortable with the Macintosh hardware, the Netscape Web browser and the Web resources (including GCDIS) that they would need to troubleshoot in order to help patrons. Only three librarians took advantage of the one-on-one training.

Science and Engineering Library

Anticipated User Community

The Science and Engineering Library at UVa is open to all university faculty and students. Yet, because of its specialty focus, faculty and students in the graduate and undergraduate schools of Arts and Sciences and Engineering were the principal anticipated users at this site. Many should have been faculty and students of

Environmental Science[*] in as much as the Library is physically housed in Clark Hall, the home of that particular department.

Description of hardware

One LASR-dedicated Dell 486 was placed on the main floor of the Library.

Preparation for Use

The Dell was acquired through the LASR project and set up as a specialty kiosk with signs and literature about the GCDIS at the workstation.

Earl Gregg Swem Library

Earl Gregg Swem Library[†] is the central library of the College of William and Mary in Williamsburg.

Anticipated user community

The primary users at William and Mary were thought to be faculty and students in the science and social science fields. Those who might benefit secondarily from intermittent promotional activities included members of the Student Environment Action Coalition at the university, employees of the Virginia Institute of Marine Sciences, and employees, local teachers, students, and business-persons at NASA Langley.

Description of Hardware

One WIN 486 in the Technical Services area of the library was made available for the dedicated use of the Site Manager. Public access to the World Wide Web was available from two other WIN 486s in the Reference Department. One demonstration and eight hands-on WINs were set up in the library's classroom as well.

Preparation for Use

To prepare for use, funds to hire a part-time site manager in fall 1994 were acquired from the LASR project.

Piedmont Virginia Community College[‡]

Piedmont Virginia Community College in Charlottesville is a two-year school made up of non-traditional students, typically in-state females over age 25 who are seeking an Associate degree or transfer credit. However, Piedmont (or PVCC) is also the physical site of Mary Baldwin College's Adult Degree Program and the satellite delivery site for Old Dominion University' s TeleTechNet, both of which offer additional third and fourth year BA degrees. Bachelor's degree applicants through Piedmont differ from those at UVa and William and Mary in that most are employed full-time.

Anticipated User Community

Primary users were intended to be faculty and students in computer and applied sciences. Secondary users might be library patrons or students in the electronic classroom who were simply curious about the site.

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[*] http://atlantic.evsc.virginia.edu/EVSC/evsc.html

[†] http://swem.wm.edu

[‡] http://onyx.pvcc.cc.va.us

Description of Hardware

6 WIN 486s were available in the PVCC Library with Netscape browsers on each as well as 35 286/386 computers in a classroom lab, some of which could be set up for Internet browsing through lynx. All were connected via a 56kbps network.

Help given to prepare for use

None was requested.

Virginia L. Murray Elementary School[*]

Virginia L. Murray Elementary School in Ivy, Virginia is 15 minutes outside Charlottesville. It is classified as a modern suburban school in an area of Albemarle County where children tend to be racially homogeneous and from moderately well-to-do families.

Anticipated User Community

The anticipated user community at Murray were primarily fourth and fifth grade teachers whose curricula included environmentally-related units. It was hoped that other teachers and students might also be given direct exposure to the GCDIS through activities planned by those teachers.

Description of Hardware

From spring-summer of 1995, six grade 3-5 classrooms had Macintosh LCs with external ethernet box connections. Four Macintosh LCs, also with ethernet boxes, were located in the library. By October of 1995, the Albemarle County School System, of which Murray is a part, had had a fiber-optic line installed and the school received new equipment, including 6 Macintosh 5300AVs, 2 Macintosh 5200s, and 10 Macintosh LC580s. They have since been placed in each of the classrooms in the school, the library, the resource teacher's room and the science room.

Preparation for Use

To prepare for use, Murray received financial, technical and training assistance. Over a period of several months between the start of the pilot project and such time as the site had to be shut down for fiber-optic installation, Murray's principal was given sufficient funds to cover the $465/month leasing fee for a 57K line. The school also obtained the computer and telecommunications support services of three Instructional Technology (IT) students through the Curry School of Education' s Technology Infusion Program and three additional UVa student interns through a social sciences program. While the individual teachers were being given instruction on-site by the IT students, the principal was given Internet and Web training through Monticello Avenue. Both site managers had had previous training.

[*] http://pen1.pen.k12.va.us:80/Anthology/Div/Albemarle/Schools/MurrayElem

Walker Upper Elementary School[*]

Unlike Murray, Walker Upper Elementary School is part of the Charlottesville City School System where children tend to be from homes of more diverse ethnicity and lower income levels.

Anticipated User Community

Fifth and sixth grade science teachers were the direct anticipated user community at Walker; their students, the indirect users.

Description of Hardware

Walker has a central computer lab which houses 27 Macintosh 575s. 23 other Macintosh 575s are on mobile carts in various locations around the school building. They are not permanently installed in any of those locations so that they can be marshaled together to form a "mini-lab" whenever such a need arises. Work is in progress to wire every room with access to the Internet.

Preparation for Use

To prepare for use, the Instructional Technology Coordinator of City Schools was given funds to match city funds for installing a router, CSU, port on HUB and 56kbps line at Walker as well as maintaining continuing costs of the school's link to the Internet through VERNET, Virginia's Educational and Research Network. Temporary use of a UVa SLIP account was made available at no cost until a direct connection was established. The loan of a UVa-owned router was made while Walker awaited arrival of its own purchased router and the technical assistance of the Information Technology and Communications Division at UVa was provided at no cost during all installations.

Environmental Education Center[†]

The Environmental Education Center was founded to provide locally-oriented programming and leadership "that encourages informed participation in the issues, decisions and projects that shape our environment". The Center is currently located at Miller School in Crozet, Virginia (Albemarle County).

Anticipated User Community

The Environmental Education group encompasses multiple activist organizations, the makeup of which roughly represents the Charlottesville-Albemarle community at large. The Center has a mailing list of over 1000, all of whom might have been GCDIS users.

Description of Hardware

The Center has no computing facilities of its own apart from a dedicated computer for the current site manager to use in planning and implementing outreach activities. While Miller School has a computer lab that has recently been set up, it was not available during the project.

[*] http://pen.k12.va.us/Anthology/Div/Charlottesville/SCHOOLS/WALKER/Walker.HTML
[†] http://monticello.avenue.gen.va.us/Community/Environ/EnvironEdCenter

Preparation for Use

Because there was no computing facility available, the original site manager initially tried using his own office computer with lynx. The Project Manager set up a lynx account for VT100-compatible text browsing to accommodate his difficulties in getting access. The Field Manager then arranged for him to use the Reference Librarians' Office PowerPC at the Jefferson-Madison Regional Library (which was publicly-inaccessible) when graphics capability became important. The Project Manager also set up an unrestricted authenticated account to the Web via SLIP for all non-UVa affiliated sites, most notably the Environmental Education Group and the JMRL staff.

For a summer 1995 workshop of high school science teachers which the Environmental Education Center was hosting, a computer lab in the Curry School of Education at UVa was set up with Netscape for Web viewing and participant parking was paid for by the LASR project. A second workshop was held in the fall in which the facilities at Walker Elementary School were made available through association with LASR. Between the two events, 35 teachers were trained on navigating the World Wide Web and using the GCDIS to get global change information.

Simpson Weather Associates[*]

Simpson Weather Associates is a consulting firm specializing in two areas: the development and prototyping of optical remote sensing concepts employing laser technology and the development of technologies and strategies for reducing fugitive dust emissions from coal handling facilities. Work in remote sensing frequently involves simulating the propagation of light through the atmosphere from data such as cloud climatologies, moisture profiles, model wind estimates, or detailed topographic maps; therefore, access to the GCDIS was seen as an important factor in their operation.

Anticipated User Community

The anticipated user community at SWA includes 4 Ph.D. and 5 Masters level scientists with additional support staff.

Description of hardware

Apart from a Cray C98 system and assorted workstations, the specifics of which computers were configured with World Wide Web browsers is unknown.

Help given to prepare for use

None was requested.

Methods

Support System

The GCDIS testing process was predicated on a belief that successful use of public data is affected by network access, network interface, and integration and use[10]. While the tendency in many past projects has been to focus on the access and interface

[*] http://faraday.clas.virginia.edu/~osse/old/was.public_html/

aspects, the LASR project placed its emphasis on establishing an active support system of site managers and activities to encourage participation.

Site Managers

Site managers were chosen by participating organizations or through association with either the project managers or Monticello Avenue, the community information server. In most cases, a single individual was designated as site manager but where he or she lacked authority to make decisions regarding such issues as technology installation, purchases or facilities use, a second person served as a supplemental contact. One such person was a school principal; another the Instructional Technology Coordinator of schools. Most site managers remained constant throughout the year-and-a-half test period; however, two were replaced in the hope that a newly identified support person could generate greater use of the GCDIS. Project and field managers regularly maintained contact with site managers through electronic mail, telephone calls and meetings.

Activities

Activities took a variety of forms. The project and field managers repeatedly communicated the intrinsic benefits of participation (i.e., access to information for personal and professional enrichment, aid to building and enhancing course curricula, collaboration in building the community network and civic responsibility). As described above, they provided hardware, software, connection and training assistance to schools, libraries and organizations. Financial incentives were given to defray line costs or to purchase special needs equipment. Grant support for other networking projects was provided. Articles were written for target group newsletters, flyers created for distribution to student mailboxes, and messages posted to newsgroups and bulletin boards. Project managers also devised a new, shorter evaluation form that was distributed in hardcopy, in response to complaints about the on-line form. Both individual site managers and the project administration participated in events such as Earth Day, NASA Langley' s Internet Fair 2, and UVa' s InfoFair. They conducted a series of classes, seminars and workshops for specialized interest groups: two Computer Science image processing classes, two Environmental Science classes, one Atmospheric Science class, one Environmental Law class, one Economics and the Environment class, one Fisheries Climatology class, one Education class, Information Retrieval and Marine Sciences seminars, and two Environmental Science Teachers Workshops. Individual site managers offered to present GCDIS material at faculty meetings (both school whole staff and team meetings) or directly to teachers covering GCDIS topics. They provided links to the GCDIS on the respective webpages of Murray and Walker schools, PVCC, the Jefferson-Madison Regional Library and Swem Library. One principal even offered to pay $250 to each teacher who sent in an evaluation from one of the elementary schools. Only one actually took up the offer.

On two occasions, site managers also met with the Executive Secretariat and the Head of LIS for the Interagency Working Group on Data Management for Global Change (IWGDMGC) from Washington, the administrative and development body of the LASR pilot project. The purpose of these “site visits” was open discussion of issues that could not be conveyed through the system evaluation. The first such visit (in February, 1995) consisted of an overview of each site' s operational status, plans for bringing

GCDIS to the attention of each site' s community of users, and recommendations regarding future directions. Among those new direction ideas generated in the discussion were:

1. to create a shorter open-ended fill-in form which would be less overwhelming than the online version for teachers and others pushed for time;

2. to provide the ability to review the form first in hard copy or in a second display (as in a split screen window or dual monitor system);

3. to release an HTML version user interface which the developers had been working on;

4. to make data accessible to project administrators from Washington;

5. to produce a video of site managers as documentation and a means for further conveyance of ideas; and

6. to create demos of good sites that would be useful to specific user audiences (such as the K-12 school population).

The second visit (in September, 1995) reviewed the evaluation feedback for both the gopher and HTML version, the status of sites, the use of the system to date, and observations on the reality of responses. That discussion centered on the problems of technology that was faulty or not in place, the investment of time which site managers were unable to meet (in most cases), poor timing of the project in terms of problems at the sites, and the temperament of individuals uncomfortable with the self-directed learning style.

Feedback System

LASR pilot test performance required that users submit their impressions of the GCDIS on-line, via email, or in hardcopy form. The on-line form consisted of 9 sets of 46 embedded questions designed to elicit general status information (e.g., occupation, client site, type of browser, user information interest, intended use of the information, number of times used); quality assessment research on such elements as the interface design (e.g., introduction and system directions, menus, sorting topics, navigation), data set access and usefulness, the help system, overall system performance and the form itself. Two simpler, single-page hardcopy forms were also provided for those who did not have time to fill out the on-line form, those interested in the types of questions to be asked in advance of filling out the on-line form, those subject to technology problems and those with more generic information to supply. One form queried the user about his or her expectations, level of interest, the type of site and access method used, his/her topic of interest or purpose for use, comments about access and content, and the number of times the GCDIS was accessed. The second form was a simpler version still, with only five questions. Individual gopher and web addresses were set up for each site so that survey submissions could be properly attributed to their particular client in the network of sites and automatic counters were added to the data collection directory on juliet.cs, a UVa server in the Computer Science Department. An additional mechanism was put into place that made feedback directories on juliet.cs accessible to project monitors in Washington.

Experience with Sites

In all but one instance, the sites experienced difficulties with performance compliance that were only marginally related to the GCDIS itself. Because there were so many, they are recounted below by site and problem category (i.e., logistical, political, technical and other).

Jefferson-Madison Regional Library.

Logistical

The Monticello Avenue lab was not ready to debut until November 3, 1995, three months after the original LASR pilot project completion date. Its Program Manager was hired in July, 1995 but because the project was so far behind, he had no time to plan for training the public on the GCDIS use. In fact, the first open training workshops for the public to learn to use any feature of the Internet and the World Wide Web, much less the GCDIS specifically, only began in February, 1996 which was itself two months after the expiration of the LASR project's no-cost three month extension.

Political

Progress was hampered by a totally uncooperative Monticello Avenue Systems Administrator who, through inactivity, delayed the move of the central server from UVa to the library. Staff Internet access could only be achieved, therefore, through a single machine and modem for almost a year. That machine also locked up fairly consistently, enough to severely discourage any new users. A second lower-end machine which had been lent to the library for internal training was rarely used because it remained locked in the Systems Administrator's office to which he had the only key. As he was not often in the office and refused to relinquish the key, access to that computer was limited. Furthermore, his absence kept librarians from learning how to use the PowerPC hardware when it arrived and from getting technical help when there were normal system problems. Because he had been hired with the expectation of at least a year's contract with the library and because there was no one to immediately replace him, he was retained throughout most of the GCDIS initial evaluation period after which his contract was not renewed. There continues to be no replacement for him.

While the Monticello Avenue lab was under construction, one of its PowerPCs was to have been made publicly-accessible via a leased line near the Reference Desk. The line had previously been used to connect a Virginia Tech kiosk; however, it had since been deactivated. The library administration chose not to reactivate it because it was expensive and they preferred to wait for the fiber-optic installation. Given that a SLIP connection from the Reference Office a few feet away proved unreliable, the workstation was never put out for public consumption.

Technical

A great many difficulties resulted from the need to upgrade the old Central Library building's wiring. For example,

1. There were inadequate electrical outlets in public reference areas that might have permitted computers to be installed while waiting for Monticello Avenue's lab to be completed.

2. The Ethernet line for the building did not get installed until summer, 1995 due to Sprint/Centel's scheduling and it was not activated until the fall.

3. Half the number of connections that were requested were actually installed.

Other

1. The JMRL was given a machine for its Reference Office, the platform of which was unfamiliar to librarians. Even if the Library' s technical problems had been resolved and Monticello Avenue's lab opening had occurred before the virtual end of the study, the platform of the lab machines would have been the same as that in the Reference Office. (The 2 Dells which would have been the familiar platform were not working.)

2. The carpeting for the Library had to be replaced due to water damage. The Library was closed for most of August and September, 1995 for new carpet installation.

Science and Engineering Library (UVa)

Logistical

Library patrons figured out ways to bypass the GCDIS menu which had been set up as the opening screen in order that they might use the computer to open other locations or for purposes other than browsing the World Wide Web.

Other

Minimal site support was given because the Site Manager has been and continues to be on long-term sick leave.

Earl Gregg Swem Library ***(College of William and Mary)***

Logistical

A subcontract problem caused delay in getting the site manager hired and the library underway until spring semester of 1995. The reason for the delay was the slow pace at which anything financial and/or legal moves through two different university bureaucracies.

Piedmont Virginia Community College

Political

1. Administrative concerns that have yet to be resolved have kept the classroom lab and library from being fully accessible to the public as had been hoped.

2. The Site Manager, who was on the Engineering faculty, was recruited through his volunteer training association with Monticello Avenue. He did not feel in a position of authority to make decisions about how the GCDIS was to be promoted there. The Dean of Instruction for Piedmont, who did have that authority, and was to have put together a team from the library, computing center and academic departments to promote it, never implemented his plan.

Virginia L. Murray Elementary School

Political

The desire to be showcased as the technological leader among county schools could not offset a corresponding lack of institutional support for creating and protecting "free time" to devote to instructional technology peer-teaching. Teachers were expected to use planning time for administrative concerns to make the building run smoothly or for dealing with problem student behavior. As the second site manager put it: "I don't know of any teacher at Murray now who only works 'contract' hours. Any teacher who teaches in a more than perfunctory manner probably would have a hard time fitting all their planning into the 2 'late' days we are slotted. So, given that we are all working over what is budgeted, just to keep our classes up to our vision, it's hard for me to try to organize anything on top of that which would further eat into teacher planning time....Coming from outside the elementary school setting, I am amazed at how people often take for granted that teachers will work way beyond their compensation, and how much of their lives good teachers invest in their teaching. A more supportive framework [within the school and school system] would provide a more productive situation, I believe."

Technical

During the period prior to installation of the county's fiber line, it was difficult to connect to the Internet during the school day. Installation of the fiber line disrupted service for several weeks as well. Add to these the problems of repeated "denied access" barriers to information after considerable navigation within the GCDIS system, which were encountered during the beginning of the evaluation period. These problems made use of the system infeasible for in-class or independent student activities.

Other

There was a much more difficult job situation at Murray during the study period than had been the case in the past. For example,

1. The current 4th grade had a higher percentage of at-risk and special needs students than ever before.

2. A high teacher turnover brought in 4 new first-year teachers during the study who "generally need to get settled in before venturing far in their use of instructional technology".

3. Loss of the Curry School's Instructional Technology students through graduation, the initial LASR project site manager through transfer to a different school and the three UVa social sciences/psychology interns through moving to the new school with him (as part of their ongoing project) was another obstacle. Although the interns were not directly part of the GCDIS pilot test, the site manager had intended to use them in locating classroom-relevant resources through the system. He wanted the children to be able to bring change data from those resources into a spreadsheet and create graphs that would illustrate some subtopic within the weather and oceans units. He hoped to then put the graphs into a global homepage for weather on the Murray homepage, to show parents the progress their children were making in computer skills; to demonstrate to administrators that the cost of the connection serves some viable educational purpose;

and to illustrate Murray's technological achievements. None of these plans were ever implemented.

Walker Upper Elementary School

Logistical

The direct connection to Walker was delayed past the start of the spring 1995 semester. The Instructional Technology Coordinators of the school itself and the city school system were to look through the GCDIS for sites of interest that they might point out to three science teachers and two enrichment teachers. Their intention of then applying what was found to activities of the Spring Science Fair could not be met in time. The coordinator from the city schools was constrained in what he could do to live up to that intention as he was unable to get an operational SLIP connection to work from work. The coordinator from the school could dial in from home via Apple Remote Access simulating a SLIP but she was also constrained in the amount of GCDIS exploration she could do in that, for most of that time period, she only had access to one-hour allotments of time on the Internet through Virginia's Public Education Network (PEN). Getting a connection during the evening was difficult at best; once she was forced off the system after an hour, dialing in and re-establishing contact was unlikely.

Political

The City School Superintendent was concerned that putting a direct connection at Walker might be ill-advised because of the age of Walker students. She felt older students would make better use of the technology and therefore, preferred a middle school or high school location. Her reticence may have contributed to the fact that the Walker lab was never opened to the public during the test period as had been hoped, although the reasons given had more to do with how to provide after-hours janitorial services. Now that testing is over, the lab is open on Tuesday nights for public exploration of the World Wide Web.

Technical

The direct connection was not installed until mid-March, 1995. The school server had been sent for repairs and was out of commission for several months during the project. Until it was fixed and their direct connection was in place, VERNET would only allow them ten concurrent users. Although they had 50 computers, the GCDIS could not be used for in-class activities here either, as class size could be larger than the imposed limit.

Environmental Education Center

Logistical

The Center is not a computing facility so much as an organizational space. During the early months of the LASR project, that space was shifted from Tandem School (south of Charlottesville) to Miller School (in the western portion of Albemarle County). While the transition took place, the original site manager used the facilities of the Central Library branch near his professional offices in downtown Charlottesville. Consequently, he suffered under the same set of problems as did the JMRL librarians. Had the Center been permanently established and the Miller School lab been set up, the

situation might not have been much improved. It would not have been easily accessible to other than the school's small resident student body of "under-achievers"[11], given that Miller is physically located in a rural area 15 miles outside the city limits. The larger community of environmental activists for whom the Center operates would have found it difficult to commute to use that facility on a regular basis.

Political

The LASR Project Manager offered to install software for the Miller Lab but the offer was never accepted. Articles about the GCDIS were written by the Field Manager and Site Manager for the Center' s quarterly newsletter but publication was delayed until late in the project because they were edited out to make space for more immediate concerns.

Summary of Feedback and Reactions

A record of accesses to the LASR server on juliet.cs was maintained during the life of the project. Analysis of these access logs reveals a number of interesting statistics.

As seen in Figure 1, accesses to the server occurred primarily during business hours of the eastern United States, then trailed off during the evening. All sites were in the eastern U.S. and as Figures 2 and 3 show, most accesses were from that area.

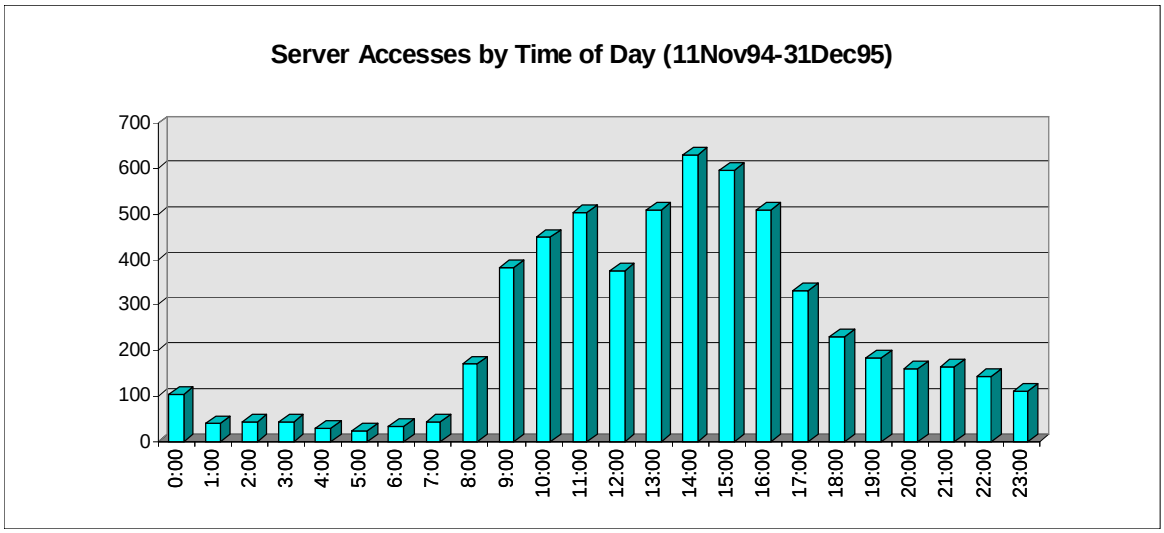

Figure 1. Server Accesses by Time of Day

Most server accesses from within the United States came from the virginia.edu domain. This is to be expected since there were several sites affiliated with UVa and many Charlottesville sites received their access via UVa servers. Most of the accesses labeled "United States" are from Piedmont Virginia Community College. Note that not all accesses are from designated LASR sites. During the extent of the evaluation project, the server registered many hits from other universities and commercial sites in the United States and abroad (see Figure 3). Very few (if any) of those persons browsing the sites submitted evaluations.

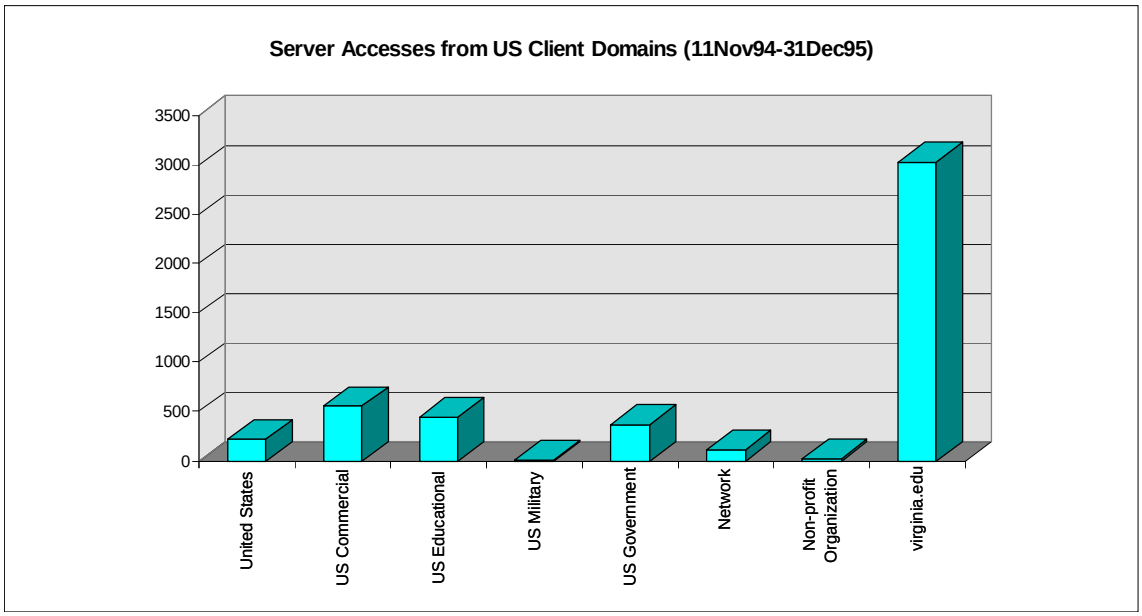

Figure 2. Accesses from U.S. Client Domains

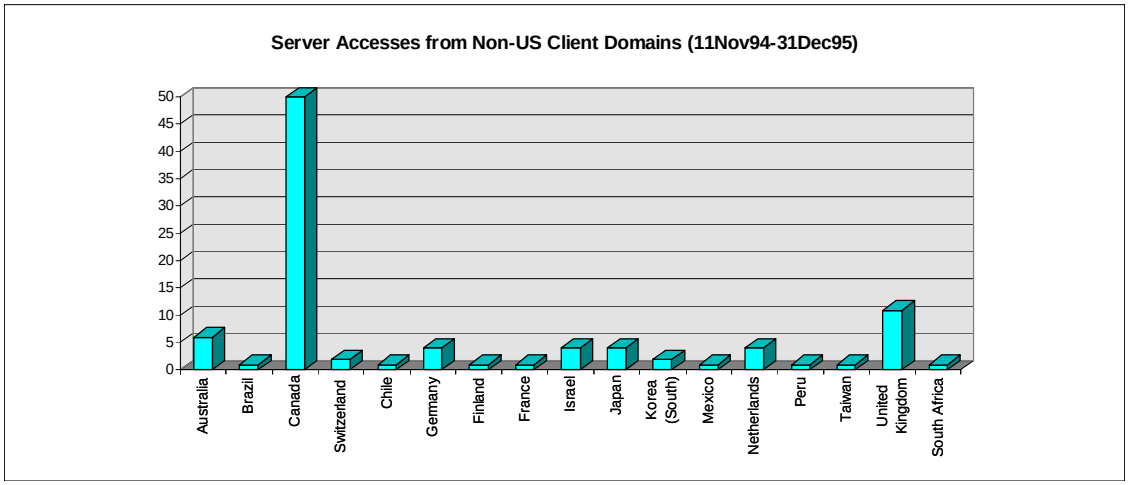

Figure 3. Accesses from Non-U.S. Client Domains

Figure 4[*] displays the number of accesses to the homepage, number of hits to the evaluation and mail form pages and the number of evaluations for each site. The sites are labeled by the abbreviations assigned to them.

- anywhere - the generic homepage. Most general accesses, as well as the accesses for the 1994 CS682 graduate computer science class at UVa were to this page (see

[*] This is a color figure. If you have a black and white version of this document, please note that there are four data points for each site. They occur in the order in which they are listed in the legend.

Sample Data from Universities section below). The CS682 accesses were to this page because they occurred early in the evaluation process and no specific page was created for them.

- AHS - Albemarle High School.
- AldermanGIS - Geographic Information System Laboratory.
- CS682 (1994) - UVa Computer Science Digital Picture Processing class. Evaluated the gopher version of the GCDIS. The bulk of the evaluations were submitted using electronic mail or hardcopy because we only had a prototype of the online form at that time.
- CS682 (1995) - UVa Computer Science Digital Picture Processing class. Evaluated the WWW version of the GCDIS.
- EDES766 - UVa Education School class on computer interfaces in education.
- EVSC493 & EVSC795 - UVa Graduate and Undergraduate Environmental Science special topics classes.
- EEG - Environmental Education Center.
- JMRL - Jefferson-Madison Regional Library System.
- Murray - Virginia L. Murray Elementary School.
- ORNL - Oak Ridge National Laboratory.
- PVCC - Piedmont Virginia Community College.
- RMWC - Randolph Macon Women's College.
- SEL - UVa Science and Engineering Library.
- SWA - Simpson Weather Associates.
- WM - Swem Library at the College of William and Mary. (Note: most evaluations were submitted using personal e-mail, not the evaluation pages provided.)
- Walker - Walker Upper Elementary School.

The pattern most evident in Figure 4 is that most sites generated many accesses to the GCDIS page but produced few, if any, evaluations. The exception is classroom activities which required an evaluation.

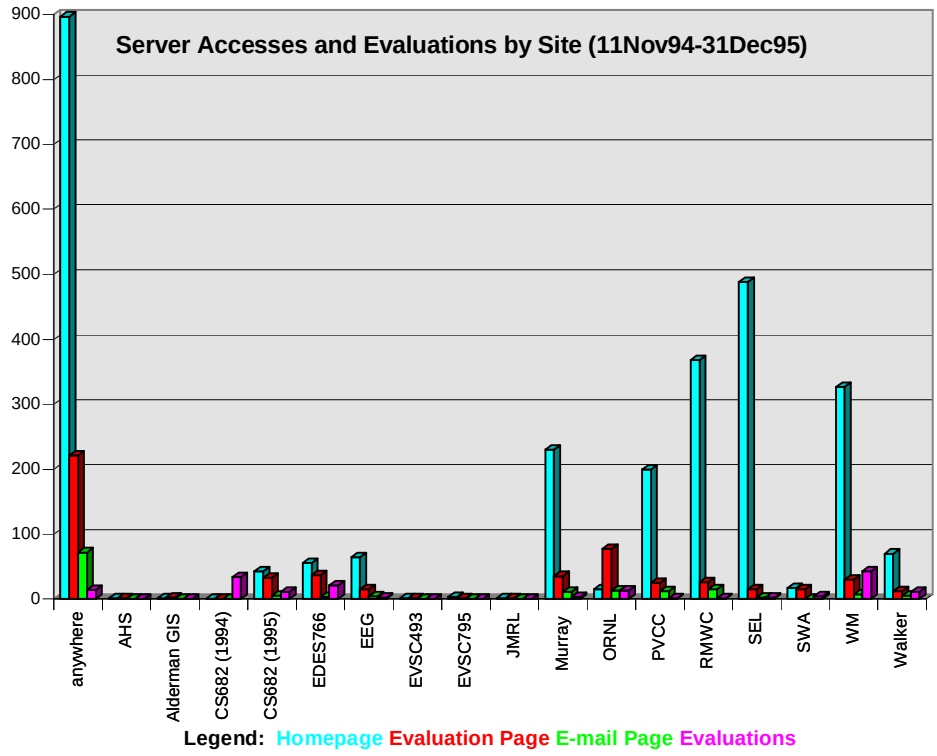

Figure 4. Server Accesses and Evaluations by Site

Number of Response Impressions

The highest percentage of feedback submissions came as a direct result of classes and promotional activities at the two universities. University students and faculty - whatever their motivation - also volunteered more usable information than any other designated target group. Conversely, "citizens" from outside the universities volunteered the least amount of information and their submissions were more likely to be minimally informative or altogether unusable. Among several reasons that might account for these disparities are the following:

1. In the current economy, universities are places of intense competition. Students compete for grades in order to get the best postgraduate jobs and faculty researchers compete for limited funding opportunities. Competition intensifies the need to take advantage of available information resources at the universities and to participate in studies which contribute to the pool of information - needs that may not exist to the same extent in the world of the general public where moneys are not so closely tied to research.

2. University students and faculty may have a higher tolerance than other citizens for the time it takes to search through information resources and fill out evaluations since both activities are natural extensions of their educational and professional processes. Perhaps more importantly, their tolerance may be tempered by the knowledge that they

are not being charged for time-on-task as are many of those accessing the system from home without university accounts.

3. University students and faculty may be more sophisticated computer users, have more ready access to reliable networking technology and be more accustomed to using the Internet to find information, in as much as universities were among the first non-governmental establishments to be wired into it.

4. University students and faculty may be more sophisticated information consumers than the general public. The disparity may exist simply as a result of different reading comprehension levels, different levels of interest in esoteric topics and/or different levels of ability to interpret highly technical data.

Sample Data from Universities

An example of the type of feedback drawn from University classes came from two successive fall sessions of a graduate-level UVa computer science course (Digital Image Processing, CS682) that were assigned to review the GCDIS. The first session assignment resulted in 34 submissions; the second, 12. The number of evaluations is roughly equal to the class enrollment for each semester. (Note: The second was not a subset of the first but rather, an entirely new sample of students). Because the Web version was not available for use until the spring of 1995, the first group from fall 1994 had no alternative but to use gopher access while all but one of the second group from fall 1995 used the Web. The second group submitted feedback through the on-line survey form and e-mail replications of the same while the first generated more free-form comments framed around five assigned criteria. Those criteria were organization, ease of use, availability, robustness and value of information.

Like the 1994 class, the majority of the 1995 group found the GCDIS to be useful and its organization to be adequate but not optimal. Most felt there was enough information to understand what the system was and how to use it. The Web version seemed easier to use than the gopher version with navigation that was "not simple but... straightforward". On a scale of 1 to 5, the system was judged by the 1995 group to be readily available (mean=4.7) and the agency datasets were only slightly less so (mean=4.3). While response time was only x=3.7 in comparison, there were no reports of timed out connections or dead ends troubling the 1995 group as had been the case in 1994. Most 1995 students found the text information and the information from agency datasets to be more useful or interesting than their earlier counterparts as well. However, complaints again surfaced (as they had in the previous year's class) about not providing (1) descriptions of agencies or the type of information available at a dataset level prior to moving into it and (2) a simple, friendly search mechanism such as Yahoo or Lycos since finding information was "by pure chance" and keyword searching is preferable to navigation through a series of pointers and hierarchies. Some mentioned that the system was too research oriented, that information tended to be too complicated for novice understanding and that it could result in information overload. Suggestions for improvement ranged from needing less ornate but more uniform screens ("a common look"); more visual cues but with pictures in different places to speed up the system; and

a design appropriate for smaller, less sophisticated monitors in that some users object to scrolling.

Sample Data from Outside Universities

A common theme among all types of feedback respondents (as seen above) was that the GCDIS is "good for research, not casual users". One public librarian's experience seemed to mirror that of several others in this respect and provided insight into the problems the general public might have with the same system. She described the gopher version as very user unfriendly. It was not easy for her to locate information through it and when found, that information was in a format "not suitable for use by public library patrons". The Web version was more acceptable in that "...tremendous improvements have been made in the ease of searching and in the usableness [sic] of the information. GCDIS however is still a long way from being really helpful to the average citizen who generally wants short, simple answers to rather practical questions". There needs to be revision of (1) the opening screens which are not enticing, (2) the logic by which topics were linked to subject headings, (3) the links themselves and (4) the entire GCDIS organization. As is, "[s]tudents working on science projects -- or the librarians assisting them -- would not find GCDIS very helpful".

Main Lessons Learned/Discussion

Neither enthusiasm, increased availability of resources nor amount of usage guarantees results.

Study participants in general exhibited a strong disinterest in supplying feedback data, as evidenced by a low response rate despite an inversely high number of logins across all sites (see Figure 4). The only incentive that proved fruitful was filling out evaluations in a class setting as a course requirement or in an inservice activity as a job requirement (the "cage 'em, feed 'em and get it before they leave" approach). Otherwise, assessment performance could only be characterized as poor, even among target groups that were thought to have been intrinsically most interested in the information the GCDIS had to offer and among site managers that were thought to have assumed leadership roles within their respective target groups. We feel this was true in part because there was no prior public user analysis or needs assessment (i.e., objective B2 of the Library Information Subgroup Implementation Plan should have been done before, not after, the design of the prototype system[12]).

Engineering good performance begins with understanding the performer as well as the task.

Gilbert's Behavior Engineering Model states that "[f]or any given accomplishment, a deficiency in performance has as its immediate cause a deficiency in a behavior repertory (P), or in the environment that supports the repertory (E), or in both"[13]. In retrospect, poor performance on the GCDIS evaluation could have been attributable to behaviors that were brought to the study as unrecognized characteristics of participants. One example that was observed was lower than anticipated skill levels (P1)

coupled with problems of temperament in disclosing or seeking remediation for them (P2). Skill deficiencies can result from never having used the skill in the past (P1.1), not using the skill often (P1.2), or not having the capacity to perform the skill to a prescribed standard (P1.3)[14]. As has been demonstrated, the regional librarians were at a disadvantage in having to use equipment to which they had never before been exposed (P1.1); yet, they were reluctant to ask for training or accept it when offered if that training came from outside the library bureaucracy. The principal and initial site manager of one of the schools proved to be only intermittent Internet and Web users (P1.2) but because they were attempting to build a reputation for their school as the technological leader in the county, they did not want to acknowledge their personal disinclinations to engage in hands-on activities so much a part of that technology. The Environmental Education Group sponsored two workshops for teachers, one at UVa's Curry School of Education in summer 1995, and the other at Walker Upper Elementary School in fall 1995. Participants in these one-time-only environmental workshops could not be prescreened for needed performance competencies (P1.3) nor did they come forward at the time of either workshop to suggest that they were not competent to perform. Although they were shown on site how to go to the GCDIS entry point, it is conceivable that those with only minimal knowledge of computer technology and the Web would not be able to replicate the process off site in order to fill out the survey form. (It bears noting here that of the two surveys that were submitted from the workshops, one was unusable and the other came through the mail as a hardcopy).

"People learn to avoid the things they are hit with"[15].

Environmental circumstances might also have affected the outcome, if the desired performance was perceived by participants as punishing (E1) or unimportant (E2)[16]. Cited obstacles such as increased demands on limited time, difficulties in technological installation or maintenance, inability to make connection during the day, etc. may have made study tasks seem stressful to those responsible for results (E1). Participants complained that that stress was compounded

1. when responsibility was imposed by their employers rather than being made voluntary,

2. when despite the vagaries of the technology - electronic submission was the preferred method of getting feedback, and

3. when a secondary goal of finding ways to support GCDIS use with target audiences assumed that participants would be more able to use the system and its information than the rest of the real-world user environment.

Although most participants saw the applicability of GCDIS information, the quality of their feedback as well as the number of their responses were below the level that was expected, leading us to believe that the vast majority did not attach sufficient importance to the system' s usefulness in the context of their jobs, classes or lives to counteract the pressures of having to perform (E2).

Begging the question is no way to get feedback.

It must also be observed that through premature design of the entry system and false assumptions about users, we (as management) failed to provide the best methods of access and assessment. We never inquired what information, if any, the expanded community wanted before setting up information categories that dovetailed with pre-existing resources; we never determined the expanded community's understanding of the Internet and gophers prior to adopting the original gopher structure, although admittedly gopher technology was the only solution at the time; and while the design was revised to include a more "user-friendly" Web version as the result of initial feedback, we never established a community baseline of skills status or the relationship between skills, attitude and behavior to see if study participants really were users and, perhaps more importantly, if they wanted to be users. We assumed that librarians, for example, would embrace computerized information retrieval when, in fact, branch librarians of the Jefferson-Madison Regional Library System were such computer novices that they had to be taught how to save to disk and Central librarians, who were more computer literate, had to be taught or teach themselves an unfamiliar platform. As a group, they could hardly have been expected to readily adopt the additional cognitive burden of - what for them was - a new technology together with - what for everyone have been - the new concepts of hypermedia, document fragmentation, non-linear navigation, recursion, etc. inherent in the Web. In short, as a result of not doing a prior public user needs analysis, we assumed as fact exactly the sorts of things we should have been testing.

A support system is only as good as the network access and network interface.

Finally, whereas the starting premise of the GCDIS/LASR pilot test placed emphasis on a support system for users because too often they can become overwhelmed by technical aspects of network access and interface, site support cannot make up for technical or system design inadequacies where they exist. If the hardware is not in place to insure that system delivery is reliable, if platform choices do not match what the user is accustomed to, if the entry point is not effective for most users and if the system itself is not fast and easy, a community of site managers is powerless to encourage successful use of public data. The question posed by the Environmental Education site manager bears consideration in this context. Why should the public use the GCDIS when there are other, friendlier indexing systems already on the Web and the benefit of using the GCDIS (which is not simple) over Yahoo, for example, (which is) has never been established?

Recommendations

Although it is not clear what their role might be, we would advise that the only libraries given a role in GCDIS dissemination at this stage of development should be those at major research universities - not those in the community at large - because

- neither the network access nor the network interface are yet ready for general public use;

- public librarians, who would be the default troubleshooters when the technology fails or patrons have problems with the system, may not yet be ready to assume that role; and
- in terms of computer skills and sophistication, the general public may not yet be ready for such a resource.

If dissemination through community libraries to the general public is of particular importance, however, we would suspend any further effort to develop topic menus for currently unspecified audiences with currently unspecified needs. Instead, we would encourage further development of approaches such as GC-ASK[17], which has promise as the type of help tool this community of users most advocated, and we would recommend that an extensive two-pronged market survey should be undertaken: one prong to assess the minimum requirements for consistent reliable delivery versus the state of the delivery system already in place at public library facilities; the other, to establish the needs and wants of community library patrons.

The state of the delivery system might be easily assessed by scrutinizing the research of organizations intimately involved with library automation, such as the Council for Library Resources, or by requesting information from members of national library automation associations, such as the Library and Information Technology Association[*]. The more difficult task would be to establish the needs and wants of general public users. In this instance, a market survey should be based on a graduated diffusion model conducted only with volunteers among the expanded community the LASR project was meant to serve. The volunteers who have jobs in crucial target group areas should be given release time to participate and employers should be made to understand that that release time ought not to carry with it the burden of adding to their work load. Further, the survey should not directly involve the use of technology, which may or may not be reliable at this time and may or may not make participants uncomfortable. That is to say, feedback should not be solicited via the on-line survey. Neither should it involve reaction to the available GCDIS resources as they are currently presented, which may or may not be in appropriate form. It should be exploratory, with the goal of designing a parallel but very different "public service" system.

1. Phase 1 should consist of focus groups among proven seekers of global change information in each target group. (Note: The choice of proven seekers should not be based on self-selection or association with researchers but on some quantitative measure of use). Research in Phase 1 might involve status questions about current information seekers, their attitudes, and the relationship between their attitudes and their behavior (which may not be consistent). This differs slightly from the Library Information Subgroup' s Implementation Plan in that it would be face-to-face sessions similar to the LASR site visits in which the entire spectrum of participants shared much more information than they offered on-line about their experiences with the technology and the GCDIS system. In addition, there would be no direct discussion of the GCDIS but rather, abstract concepts to which the GCDIS should be addressing itself. Some suggested questions might be:

[*] http://www.ala.org/lita.html

1.1. What global change information have proven seekers needed in the past? Have they always found what they need? What information have they looked for but not found?

1.2. How much information have they typically needed on any given global change subject? What information don't they need?

1.3. From what sources have they gotten their information in the past? How were those sources structured? What about the sources' structure, if anything, appealed to information seekers?

1.4. What media do they use to get their information now? Are they satisfied with the media through which they get their information? If satisfied and if other means were available, would they be inclined to use those other means in addition to what they use now? If not satisfied, how would they prefer to get their information?

1.5. What is the extent of their computer experience? What is their Internet/Web experience? Do they use computers in their work? Do they use the Internet/Web in their work? What work-related sites do they use most frequently? What about the most frequently used work-related sites appeals to them?

1.6. Do they have a computer at home? Does it have a modem? Do they use the computer at home? Do they use the modem? If not, why not?

1.7. What is the extent of their self-assessed computer comfort? Would they use a computer to retrieve information they need if there were other ways to get it (e.g., hardcopy volumes, videotapes, slide sets, etc.)?

1.8. If they use the Web to get information about global change now, what locations and/or search systems do they use? Which sites are most popular and why?

2. The output of the first set of focus groups would be used to conduct secondary (Phase 2) research on the ability of the participating federal agencies and other organizations that contribute data to meet the needs and preferences of information seekers.

2.1. Do the federal agencies' data contain the information that is needed by information seekers? Do they contain the additional information sought but not found? If not, would public access to them be useful or merely duplication of effort?

2.2. Do the federal agencies' data mirror currently used sources in structure? Do their respective structures contain any of the identified elements that appeal to information seekers? If not, could their structures be changed and how?

3. Research in Phase 3 might involve soliciting the expanded community of non-seekers/non-users. It might require developing a "teaser" mailing in which it is explained

that system developers have been working with early adopters to create a user-friendly approach to the data, that their ideas have been incorporated into the development process and that those early adopters have benefited by the changes made in some material way. It might request volunteers and from them, draw a sample for a second set of focus groups to determine their status and attitudes. For example:

3.1. What would it take to get them to use a computer to get global change information if they needed it?

3.2. How much training and support would they need to feel comfortable in using a computer to get global change information if computer use were free and readily available to them?

3.3. Would they be willing to go to a local public library setting to receive training and use a computer to get global change information?

3.4. Understanding that training might involve hiring new personnel, would they be willing to financially support an initiative to establish computer training and dedicated support services at the public library?

Concluding Remarks

The GCDIS lacks an identity separate from its constituent data systems. The approach of federating disparate data systems exacerbates the situation. Each separately maintained data system has a unique look and feel prescribed by local considerations. When aggregated the systems present a disjointed feel. For example, each page often has a "return to home page" button, but there are in fact many home pages. And very few pages have a "return to GCDIS home page". To achieve a separate identity the GCDIS must provide some added value. Judging by the feedback from the LASR pilot, the most desirable added-value is a global search facility such as is being demonstrated with the GC-ASK project. Respondents repeatedly mentioned how easy it was to get lost and how necessary a search function was to navigate the vast data resources of the GCDIS.

Another device that can facilitate navigation is carefully constructed pages containing resources of special interest to various communities such as educational software, maps, and other resources. However, the maintenance of such pages would present an ongoing burden to the GCDIS project. If a global search function were available, it would be possible to strike a middle ground where professionals generated queries that were used to synthesize special interest pages. This strategy would lead to resource rich pages that maintain themselves, indeed, because they are regenerated on each access, new information would be incorporated at each access. This is another form of added-value that increases the utility and identity of the system.

We learned a great deal from the LASR project and the GCDIS was enhanced as a result of the feedback generated by the project. We also learned that this kind of undertaking is incredibly labor intensive, that online feedback is logistically difficult, and that events outside the control of the project were impossible to control at each site. Nevertheless, this was a valuable exercise. It showed how difficult it is to deliver information electronically to communities of individuals thought to be very receptive to

the medium. Enthusiasm does not imply success and the LASR project helped us understand why.

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