**Evaluating the NSF National Science Digital Library Collections:
Categories and Themes from MERLOT and DLESE**

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After more than a decade in construction, and nearly as many years in use, the National Science Foundation has begun a process of summatively evaluating the national science digital libraries' collections. Although there has been formative evaluation going on throughout the digital library projects' lifespan, there has not been a large-scale evaluation effort until now. The Association for Research Libraries and Texas A&M are collaborating to create a Web-based instrument which might provide information on who is utilizing the digital libraries (preliminary data indicate that the digital libraries, for example, are being widely utilized by overseas users, including teams of research scientists); how and for what purposes the digital libraries are being used; how the information and scientific data within them are being deployed; and what users find to be the strengths and weaknesses of the various libraries, their meta-data, and/or their accessibility. These questions are in addition to regrounding LibQUAL+™, although they are complementary. It is the hope of the evaluation team that these questions will provide additional substantive data to NSF for assessing the value (worth) of the national science digital libraries.

User Survey

The evaluation form to be utilized, tentatively called e-QUAL, is a successor survey to LibQUAL+™ (Cook, 2001; Cook, Heath, Thompson and Thompson, 2001), an instrument developed to measure perceptions of service quality in research libraries by patrons, users and researchers. LibQUAL+™ was developed originally from SERVQUAL™ (Parasuraman, Berry and Zeithaml,

1988; 1991), created to assess customer perceptions of service quality in the for-profit, corporate sector. Its emphasis on customer and user perceptions of quality in service meant the original SERVQUAL instrument might be highly adaptable to the service components of research libraries, and the Association for Research Libraries joined with researchers at Texas A&M to reground and retrofit SERVQUAL to the research library service environment.

The re-grounding was accomplished through more than 70 extensive interviews with research library users at all levels throughout the university environment at ARL-members libraries in the U.S. and Canada. Supported through a grant from the U.S. Department of Education, Fund for the Improvement of Post-Secondary Education (FIPSE), LibQUAL+™ was expanded and applied at settings beyond the ARL community of libraries. As of 2004, the LibQUAL+™ evaluation protocol has been applied at more than 500 libraries and collected data on more than 300,000 users since its inception in 2000. It has also expanded internationally to Canada, Australia, Egypt, England, France, Ireland, Scotland, Sweden, the Netherlands, and the United Arab Emirates. The current survey instrument is available in eight language variations.[1].

Once a major data base was established in the familiar library environment and sparked by findings of the increasing importance of self-sufficiency in navigating the information universe, the research team undertook to evaluate a subset of the National Science Foundation's national science digital libraries' collections. Reformulating and regrounding the LibQUAL+™ instrument for digital libraries was accomplished with focus group interview data from both DLESE and MERLOT participants. The categories, themes and

issues were identified utilizing data collected at Annual Meetings of the DLESE and MERLOT groups, with users, developers, reviewers, and system administrators.

Subjected to a formal content analysis, the data began to cluster around a dozen or more themes. Those themes, with samples of the data which prompted their identification, are presented below.

Categories and Themes from the Focus Group Data

The first several categories relate to what we have termed, broadly, "design features"—that is, the design of the Website, its initial attractiveness to users, its ease of navigation, and the critical question for its teaching potential, its interoperability.

Web Attractiveness; Design Features

Sample items –especially those which seem the most focused, follow the category titles:

"I think the homepage is too cluttered" (ME)
"I would want a site that is truly simplistic; there's a lot of initial information on the homepage" (ME)"
"I don't think about [aesthetics] much. Yeah, I like the newer version; I think it's prettier." (DE)
"The graphics (in version #1, DLESE] wasn't anything moving around; nowhere to go. But it's okay [now]"
"I really appreciate no pop-ups" [DE]
"I don't like the [MERLOT] Webpage. There's so much stuff going on, but there is a problem in the way it is listed."
"And then the other way I think about it is the theory or concept behind MERLOT, which is very attractive, more so than is the actual physical site."

Accessibility; Navigability

"…we see some problems with the initial accessibility." (ME)

"Actually, the former version of DLESE I had a pretty easy time using"

"I think it's fairly accessible once you are accustomed to the site." (ME)

"…there's a lot of links, you know, like that [unusable without a username]" (ME)

"On the other hand, I do like to have an advanced search where I can specify the format and that only things with peer review [come up], so those are features that are also very important to me." (ME)

"In terms of accessibility, I think one thing that I also find good is they open the gateway to other digital libraries." (ME)

"Use and experience count for a lot" (ME)

"Actually, one of the thing (and this is coming from the librarians's point of view. In the Version I…you could do a lot of limiting, but to do so, you had to go to 'Advance Search' " (DE)

"Vocabulary is an issue" (DE)

"…You can select a group, like age groups, and I think with finding information as with in traditional libraries and graphic data bases on the vocabulary, and the vocabulary isn't clear in this library." (DE)

"I think with anything, if you use it over and over again, it's easier to navigate." (ME)

"But I think another step is that the interfacing needs to be designed in such a way that the data is taken advantage of in simple, easy-to-use, and intuitive [form]." [DL]

"The more fields the person has to complete each time, the more awesome the task is to the user." (ME)

Other Technical Aspects of the Sites

This is a slim category which pertains directly to the reformulation and redesign of the DLESE Website, which occurred in 2002-2003. This comment should likely be added to other technical aspects in the previous

categories, or additional, follow-up data should be collected on the design

and navigability of the new and more sophisticated Website.

> "Well, I reviewed a site yesterday, because I was in one of the workshops, and I actually did ask questions about the technical aspects of the site. I don't know if that referred more to whether or not you could go to the links, or it meant that the actual texts, the content material, were correct or not." (DE)

Interoperability of the Sites

> "I've had mixed results in terms of either use [around interoperability]. I had an easy time using it, but when I let them loose to go do certain things, I had to do a lot of explaining [to the teachers with whom I was working]; I had to kind of get them into the groove, so the speak, in order to be able to use those types of things." (DE)

> "I think that the major complaint that I had...we do what we call a learning log. It's a little activity we do with teachers...and I ask specific questions about how they did some of the things, and they...it's not so much that the content is beyond them, but just some of the ways of going about using [interoperable functions]." (DE)

> "I think there's a large group of educators out there that are certainly capable, knowing content, but actually using the computer, using things in that domain—it's very difficult for them. Again, it's something new to them; not that they're stupid or something like that." (DE)

> "Yes and no. [Interoperability] depends on the learning object that you access." (ME)

> "As part of the review process, you have to indicate whether or not the learning object is or is not inter-operable when you review the Web site." (ME)

Social and Psychosocial Aspects of the Digital Libraries

These concepts of community and culture in the online environment may

map to the "Library as Place" dimension measured by the LibQUAL+™ survey

instrument. With minor modifications, many of the questions used to measure

that dimension may resonate with the online community and provide a valid

means of measuring the concept of virtual community and online space. For

example, the item, "A getaway for study, learning, or research" may be changed

to "A gateway for study, learning, or research" in order to better suit the online

environment.

Library/Digital Library as "Community"

      A. Users
      B. Developers
      C. Reviewers

We have grouped these without reference to whether the responses were from

users, developers or reviewers, but we believe it's fairly easy to see who's

contributing when you read the comments, since they are frequently self-

identifying in terms of their usage or involvement.

> "I think it [community] brings to mind two very important things: 1) the notion of community within and between MERLOT.. and 2) I was just kind of blown away by the fact that they (physicists) would completely ignore any kind of 'knowledge' that we obviously have in the library community on how things should be done, and they built this thing along the lines of how they actually *think*." (MER)

> "[In building the physics part of the digital library], it's the community base, because it's the way they thing, because now you get to CINDY and you realize CINDY is not concept-based. Bingo, it's time, space and matter! It's really cool..."

> "I'm beginning to understand now that this whole notion of community is incredibly important—probably far more important than us coming up with any 'grand schema' if you will." (MER)
> **[NB: This probably also relates to the issue of meta-data, so that meta-data and community are clearly interrelated.   This relationship is shown in Figure 1.]**

> "At my college, we have an undergraduate library and lots of other libraries. It is busy there. It is a place that people can [use to] study and come together."

"But notice what we're saying: That the library as a resource area where you went for stored knowledge has shifted suddenly now to a place where we look at community and social community which many librarians would say, "Sure, it's always been that way." But perhaps not to the extent that we're talking about now."

"There's a certain…what I kind of noticed is that DLESE has its own certain language and sort of approach to all sorts of things, and I'm wondering how an 'outsider' would approach it…"

"It's a multi-step process. I would say there's—you've got researchers producing the data; you've got the digital library developers producing tools, portals and stuff like that, maybe the meta-data material; You've got educational material developers who are going ahead and building these lesson plans, along with teachers who may be building these lesson plans and the materials around it. And it may wrap all the way around…"

"And that's a perfect example of something that DLESE should be, a circle where it goes around. Now, students have produced data that teachers have mentored the students into producing data…[And that addresses] also the issue of community, because you know that you are collecting data in California and someone in New York is using the same protocols and collecting data there, and you compare your points."

"Offers a wonderful sense of community."

"One of the big advantages, or the benefits, I get from MERLOT is the community and the collaborative nature of the organization as a whole."

"But we need them [feedback forms on sites], because we are a community-driven resource." (DL)

"And if we are a community-driven resource, we need to hear from the community loud and often." (DL)

"That's why it's called a community, because you're contributing to the community" (DL)

One of the issues to be addressed here at some later point is the larger issue of "community" and what counts for a community. We already know that the term "community" no longer means the same as it did 50, or even 25, years ago. But the meaning of community here is far different from its original meaning. It

is intimately wrapped up in a project which creates a common "product" or service (the blurring of product and service aspects is another interesting aspect of the digital libraries)—a digital library and its archives—but its "members", particularly its users, may be unknown to each other, and indeed, many of them will never meet. Nor will some of them ever even "chat" with each other. They provide input, learning objects, materials, data, and they withdraw, from this common source, materials, data or learning objects which they themselves might need. But some of this activity is done relatively anonymously, and with no contact other than the common resource which is being both built and drawn from. The idea of "community" is therefore related to the process of building and using a common project (or service, perhaps?). Contributors and users alike see themselves as drawing from a project which has meaning larger than themselves. This entire issue may be related to more symbolic meanings and roles of the or a library, and its metamorphosis through the ages.

Collection-building: How It's Done, How It Should Be Done in the Future

There is great concern about how the collections in the digital libraries are built and maintained, that is, updated, renewed, and new scientific findings (as well as teaching units) included and integrated. There is no small amount of concern about ongoing funding, as well as simple manpower to update, vet, referee, and manage submissions, as well. While thousands of users appreciate having the digital libraries as resources, it is quite clear that far fewer are willing to be involved in the time intensive labor necessary to build and maintain them.

Role of "Federation"

"So I did a search in MERLOT, and I found a few things that I think might be useful for developing the content that we're putting together; but, for the most part, I'm hoping that our institution will be a provider of information."

"…but there's a lot of null searches that should be avoided, because we need to populate the library…" (DL)

"I'm on the editorial board and spend a lot of my time on MERLOT building the archive."

"[Populating] means identifying areas that are being asked for that we're not able to come up with."

"That populating means also identifying an individual or set of individuals who can make it richer and richer in terms of the material that are there…"   )DL)

"So, people that have been or were already on board are thinking 'contribute!' So…if "oceans" are weak, you call NOAA or somebody to get them on board."

"In a similar situation, I'm on the editorial board of History and spend a lot of time just cruising history sites to fill in the gaps…"

"One of the things is to populate the library. Right now, we can tell you what resources are in the library, and we have someone who is doing collection assessment so that we can--. And so we're identifying that these resources should be increased in the library before asking for them." (DL)

"Collection building…we will forever be in a collection-building phase as far as I can tell." (DL)

"It was previously in its rapid growth stage and trying to figure out who we are and how to tell it to people. And now we're into what don't we have and why can't people find what they want." (DL)

"So, the collection is uneven, and it's not clear to begin with to the user that it's uneven." (DL)

"Collections can come into the library with a reviewed status if they choose to. In order to do that, they have to—like DWEL did—they created this very rigorous review program that they have to outline and adopt, and they came forth with their collection and review document. And they have to say how they reviewed all the resources

in their library for scientific accuracy, for use in a classroom, for standards…"

"That's why we have to start looking at the collection and say, "Ok, guys, we need to go out and to collect in these [low-density collections] areas"—and that's happened. (DL)

Federation's possibilities:

"We heard this morning at the general session about a federated search, and I really resonated with that because as good as MERLOT is, it's not going to be able to solve it on its own. It's got to be part of a federation…But that could help, if the digital libraries framework could in some way support a federated search so that you could have the same good feelings in a federated search that you have in the search that you do with MERLOT, it would be wonderful."

"And you can tell they're starting to fuse and they're mingling. It's, like, my collection is already in two of the digital libraries. I'm sure that there are others that are in more than one. And so the issue is that they can federate between them. The more they can interchange what they have inside them, the more it will become like one digital library." (DL)

With respect to this last comment, it is becoming clear that that there are many, many digital libraries out there, slowly becoming integrated (federated) such that it is difficult to tell just how many digital libraries actually exist, or how they might be accessed. As better and more comprehensive meta-data are created, the possibilities for federation seem likelier.

Problems Particular to Libraries and Digital Libraries

Librarians everywhere struggle with the question of meta-data. Even as new meta-data archives are being built, knowledge is expanding so rapidly that even the newest meta-data databases are struggling to keep up.

Meta-data: Their Role (This may be a subset of the category above. Many of the items here relate to the use of meta-data across collections, for instance, which apparently becomes a problem when collections and libraries are being/becoming "federated".)

"So, we've actually felt the need for a discipline-specific page that introduces information for the first time about how things are structured, why we've made certain choices, how they might find things within history." (MER)

"The way around meta-data issues, it is 'cross-walking'". (DL)

"Basically, if I've got a meta-data standard, and someone elsle has a meta-data standard, you can map onto them. It may not be perfect mapping, but [cross-walking means, for example, that you can move one collection into the format of another collection]....And so, the question then is, how to federal all these digital libraries so material usually can be discovered through all of them." (DL)
NB: Please notice the whole idea of meta-data just transposed itself into the federation issue here.

"My impression is that users want to have resources described in a way that anticipated the things that they want in that resources, whether it is a Website or a learning object, how granular it is [that is, is it an image, or is it an entire Website]."

"I think that it is worth the investment of putting educational descriptors on the resources and getting educational description of the resources that help end users find and use the learning objects or resources." (MER)

"I want the user in a seamless sort of way to be able to find [what he needs], and in order for them to find that, that resource has to be described on the back end with those kinds of things [descriptors]." (MER)

"A lot of collections are using very minimal meta-data—contributor, date and that's it. And if you have richer meta-data, richer than the double-core meta-data. And it will be much easier, for example, if you're using the learning object meta-data for end users to find what they want quickly. And so those would be in the catelogue records, not attached to the actual resources."

"...and the critical thing is we're still developing a control vocabulary, a vocabulary for the library." (DL)

Copyright Issues; Ownership of Materials

    D. Plagiarism and the Digital Libraries
    E. Issues with Submissions to Digital Libraries (especially of "learning objects") and how faculty members get credit in the promotion and tenure process

"Who owns the content? Who owns what's up on MERLOT? Ans: People who created their pages."

"The people who create it...have the ownership." (MER)

"Very early on, people said MERLOT wouldn't work because of the copyright issue, and MERLOT said, we're not even going to deal with it; we're just going to refer to it, we're never going to have it ourselves."

"Just like the Smithsonian, we own it, it's ours, belongs to the— users." (DL)

"I think in terms of ownership, I think it's very difficult. Certainly, if there are copyright statements available, there is clear ownership. But oftentimes, there is not any copyright statement. Then we have things like images from NASA that are public domain. So, I don't think that we should assume that it belongs to the authors. I think those things are out there to access and use." (MER)

"But it [the copyright/ownership issue] does suggest something about ownership and about the way we now view knowledge as a multi-person constructed set of instructions." (MER)

This issue seems important to us. We perhaps should especially look at users'

views of what knowledge is, given the "community" nature of knowledge-

building that is going on, and the multi-site construction of that knowledge.

"Who owns the content? You own your own content, but we own the meta-data. I mean, we can have the meta-data...The meta-data can be harvested by NSF." (DL)

"...let's say you have a TT plan, you have to provide us the meta-data for that resource." (DL)

"Or you can provide a resource and ask DLESE to do the meta-data link to a single resource."

"[Or] you can create your own meta-data record, a cataloging tool." (DL)

How Digital Library Resources Are Used

(It is worthwhile here to note that this section of cards is the second largest in the analyses. While sheer numbers do not "count" in the same way as they might in more experimental inquiry, nevertheless, card count is one rough measure of salience in interviewing and other kinds of data collection which lead to content analyses. There are, of course, analytic and conceptual problems with this significance estimate; one might be, for instance, inadequate or inept analysis. Another might be unsophisticated questioning. But we feel relatively confident when the transcripts are compared with notes which were taken in the various focus group sessions by professional librarians who are ARL staff.)

"It's also an easy way for me to send people to those sites without my having to remember what the URL is." (MER)

"I may not use a particular site the way it was constructed as an assignment in class; but I get ideas of how I might work an assignment on a topic…"

"And what I found is that they [teachers] really sought the animations, the quick things that they could take into the classrooms 10 minutes before class."

"Their [the teachers] feedback—and I can identify with this—was the quick and easy—the search engines helped them find information they could use." (MER)

"I have the most cluttered desk that you can imagine, and this is a hell of a good way to keep it organized and simply in one spot [putting the URLs and materials on MERLOT] so that I can do exactly the same thing…"

"…if a faculty member realizes that stuff is going to come down and they still want to have it, they can negotiate to have that put somewhere else to have some permanency." (MER)

"So I use both a search and a harvest. I have to tell you that I also harvest stuff. There are tools out there—some of them very specialized, some of them not so specialized….And I must tell you

that I shamelessly harvest stuff, and I'm sure I'm committing all kinds of copyright violations on a daily basis—I'll confess to doing that! But I do that because I'm fearful that the stuff will sometimes disappear and go away, and so I harvest that. So I'm both a searcher and a harvester. And that's how I use MERLOT."

"It has some levels of cumbersomeness in getting to the subject matter." (MER)

"Rabbit trails are easy with MERLOT."

"I don't think MERLOT ever thought it was their responsibility to create and develop the learning objects. It simply wanted to make available the learning objects and to give credit—scholarly and academic credit—to the developers, the authors."

"But my point is that's why we're so often looking for those delightful learning objects that are—and you heard me say it before we started—the 'sweet spot.'…The shorter ones that you pick to plug in? Yeah, the 'sweet spot'." (MER)

"My collection has 75 different countries…and, 11,000 users over the last year. And I'd say a good 15% of them are foreign users, at least." (DL)

"Like, I know the San Diego super computer has 20% of our users, and I have no clue what they're using it for yet." (DL)

"I use MERLOT basically to show all my faculty how to find online course objects that they can use in conjunction with their regular classroom instruction."

"I have used, searched it for information." (DL)

As readers can see, the digital libraries are used for all the purposes originally planned for them, and more. Some appear to contain quite active, dynamic data bases which are being created daily (daily atmospheric data, for instance, as a cumulative record), other things are mobile but not dynamic (simulations), and still others are fairly static, but nevertheless, terribly useful to some groups (e.g., middle school teachers).

Evaluating the Digital Library Collections.

This is a set of suggestions from the focus groups members (both DLESE and MERLOT) about what should be evaluated, who should evaluate, how it should be evaluated, how and who should be vetting the collection, and the like. Below are a set of representative comments. This was by far the largest subset of categories, although in the analysis, we have the set divided into this one (front of the stack), and what seemed to us to be a subset, "Intellectual Issues with Digital Libraries {Teaching}".

> "If you're wanting general advice about evaluating, I'd say, first is, what's your policies and all that stuff. 'Cause there's a lot of policy issues that go into this." (DL)

Some comment needs to be made about the comment above, because it has become clear that each of the NSDL digital libraries is governed by its own set of user- and developer-created policies. The policies for usage, contributions, refereeing and other matters will clearly affect the manner in which the individual libraries are evaluated. This may be less true when the evaluating individual was a contributor to policy development, but more true when the end user had no role in developing policies which now govern the individual library.

> Issue of "dead links", "link rot", or "site decay"—who's responsible for cleaning that up?
>
> "...If I'm translating you right, there are really two levels at which stuff gets reviewed. One is for the accuracy of the data that are on there, for the actual scientific information. The other [level at which materials on DLESE get reviewed] is pedagogical utility and facility."
>
> "You figure that in a peer-reviewed process, if the image were bad science, that the image wouldn't get up there. So that, I think the

values of being able to see the review is that you can have things that can be useful but that still do have some imitations. I mean, you may be more aware of what those limitations are." (MER)

"But there are things where people have put a page and they haven't touched that page in 3 or 4 years to review it, and it just sits there. Some decision about when do you revisit these thing to see how current they are …" (MER)

"We don't have enough in some areas." (MER)

"From users, you would want to go ahead and ask—user testing, what kind of user testing do they do." (DL)

"How do they gain their quality of material, the pedagogical quality." (DL)

Problems

"Mainly, the broken links are the problem for me…"

"These teachers are desperate for this….not just [high quality] teaching material, they want data—scientific data. They way, they say it's more exciting if it's real time…"

"The one thing I've discovered with mine, just having real-time data isn't enough….It's not just the data, you have to have the documentation; and it doesn't have to be a full lesson plan. It's just enough so they can know the lesson plan." (DL)

"I guess because there's so much information there, it wasn't as intuitive as a lot of Web sites that I've been to before, and I went to a lot…"   (DL)

"I went to a lot of Websites looking for things to engage the students, and I guess I had a problem just figuring out how to narrow and search it." (DL)

"But I have a frustration with the Website. Giving feedback is limited; it's limited to the front page." (DL)

"But honestly that is an issue with me. I think it's a quality issue within the library…when you like put up your list and you think you are getting all the right stuff and it puts you on a bad site, you want to be able to say, 'I really question this site. Could you check it out and make sure that it meets the criteria for DLESE?' ".

Sustainability of Digital Libraries; Issues of Whether or Not They Will Continue to be Funded, and related Concerns.

Users, developers, contributors, and other interested parties are deeply concerned regarding whether or not NSF will continue to fund the national science digital libraries. The tone in which focus group members spoke of this issue suggests it is a grave one for them. Indeed, many have apparently come to believe the digital libraries are a critical national resource in the information age, and can not imagine what their scientific life would be like without them. Other members of the focus groups point to the knowledge that a portion of usage comes from international parties, and they construct this usage as a critical effort at scientific sharing within the international scientific communities that are utilizing the resources, especially the real-time data.

Members of the focus groups were quite intense on querying whether or not members of the research and evaluation team would learn of the National Science Foundation's strategy for sustaining and maintaining these libraries over the long haul, and many expressed concerned that there might be no other agency, corporation or body which could or would assume responsibility if the Federal government were to cease its funding. Although none of our interviewees said so directly, they want NSF to understand that these critical resources must remain a priority if the nation is to remain scientifically competitive, and retain its scientific leadership in the larger international community.

> "I would ask [NSF] for the strategy of sustainability…because when it comes down to it, if it can't be sustained, then it really doesn't matter." (DL)

"When you talk about sustainability, Chris, are you talking about how are we going to keep the federal government funding it? Or are you talking about how do we keep growing the collection and the community?" "Both." (DL)

"And so, it was part of the proposal process you write in, what's your sustainability path? We get enough users, DOE wants to fund it then. We have probably 8 to 10 times the number of users that DOE has for its data, and we are having trouble getting funded by it." (DL)

"...There's a reason...it's partially because of good will, good financial politics. If people know about it, people like it, they're interested, it's more likely you'll get money from Congress." [DL]

"What about leisure use? What about wanting just to know something— instead of being the Monday *New York Times*, you go to DLESE to find out something cool and new about what's going on. So, I really—I mean, it may link to sustainability as you mentioned—but really make it a tool that every person..." "And that would help in sustainability..."

"...and, you know, I'm not so sure how long MERLOT is going to be able to sustain itself." (MER)

Other themes which emerged, which appeared to possess less salience for interviewees, included: 1) student experiences with and in libraries and digital libraries; and 2) textbooks and textbook usages versus using digital libraries. Two other categories also emerged in the categorization process: "Scientific literacy", which refers to the role of the digital libraries in creating scientific literary, and in creating a "market" for scientific data, and "The Nature of MERLOT: Referatory rather than Repository." The first of the two might be "recognizable" as something which should be included in the new Web LibQUAL for digital libraries; but we are not certain the second will.

Scientific literacy as a category seemed powerful to some interviewees. As some of the foregoing data points indicated, some users and developers seem

to feel that having the digital libraries open to anyone with curiosity meant that individuals might find their appetites whetted for more scientific information—genuine data from scientific findings. Several participants commented that creating scientific literacy in ordinary people was a way of increasing general sophistication and desire for more scientific exploration; in other words, the digital libraries might help to create a more powerful market for scientific work itself.

The research and evaluation team took a first shot at "mapping" the concepts to try understanding how the topical and category areas related to each other. Doing so, we felt, would create a more integrated sense of what concerns we should focus on in the evaluation effort for NSF. The category map, in slightly different terms, appears below, showing some of the implied relationships between categories in respondents' minds.

[Figure 1 about here]

Clearly, while we believe we received valid and robust data from focus group respondents, we will be attempting to refine, clarify and augment those data as we build e-QUAL, for the online survey of users, developers, contributors and reviewers for the digital libraries, [2] and thus we also seek input from audiences in venues in addition to the focus groups. Attendees at presentation sessions, readers of this paper, and other interested parties who have substantive comments to make on categories, potential items for the Web-based survey, and/or issues and concerns surrounding the services which

digital libraries offer are invited to submit comments, suggestions, or other helpful inputs to paper authors.[3]

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[1] Users were defined to include full, associate and assistant professors, graduate students, and upperclassmen and freshman-sophomore cohorts, particularly Honors students. These groups were assumed to be the major users and research patrons of the original ARL institutions. Those same groups were included for all other Carnegie category institutions, including community colleges, requesting the LibQUAL+™ service assessment evaluation since that time.

[2] The actual evaluation will begin with three of the digital libraries, identified as "mature digital collections with identified user communities, providing suitable environments", where access is guaranteed, and where members of the team have been working with library managers. These include: Math Forum, the Digital Library for Earth Systems Education (DLESE), and the Multimedia Educational Resources for Learning and Online Teaching (MERLOT). Regrounding of LibQUAL+™ into e-QUAL or DigiQUAL will occur with these collections.

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