Summary of the Preliminary Findings: Needs of Potential SMETE Digital Library Users

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Summary

In October 1998 NEEDS received a one-year planning grant from the Digital Libraries Initiative – Phase 2, "Planning Test–beds and Applications for Undergraduate Education" to develop a test–bed SMETE digital library and to implement a user needs assessment. Parallel to the planning activities for the structure of the library, we implemented a study to better understand how the needs of users in the sciences and mathematics might differ from those in engineering and technology and to what extent they overlap. To do this, we conducted a series of ten focus groups (see Table 1) at five respected professional conferences associated with the sciences and mathematics. The focus group participants (primarily faculty members) were chosen because of their expertise in areas associated with innovation in teaching, technology, and pedagogy. These selection criteria enabled us to create homogenous groups of participants, which reflect the current users of digital libraries. In all, ten focus groups were held in the spring of 1999, and 69 faculty participated in the groups. (See Appendix A for a list of focus group participants.)

Table 1: Focus Group Location and Participants

Conference/Meeting	# of Participants & Description
American Math Society & Mathematical Association of America (Jan. 14 – 16)	33 Faculty from research and teaching universities
American Association of Physics Teachers (Jan. 11)	9 Faculty from research and teaching universities, community colleges, and high school teachers
American Association for the Advancement of Science (Jan. 23, 24)	12 Faculty from research and teaching universities, community colleges, and K – 12 teachers.
Modular Chemistry Consortium (March 18, 20)	9 Faculty from small, private teaching institutions and community colleges
Learning on the Internet (April 9)	6 Faculty from community colleges
Total focus groups = 10	Total Participants = 69

The focus group discussion topics (See Appendix B for the focus group protocol) centered on identifying and clarifying users' needs regarding:

- Desired content of the library
- Desired features and services of the library
- Ease of use and barriers to use of the library
- Value of computer enhanced education and the digital library
- Role of the user community in the digital library

This report outlines our preliminary findings from these focus groups. Each focus group session was audio taped and the transcribed. The responses from each group

were organized according to the question and analyzed for common themes. Themes were also read for across the entire transcript. The following summary is organized by theme and lists focus group responses by category. For example, when discussing the value of computers, digital libraries, and student learning, the comments reflected 18 different categories of responses. This preliminary report only describes the first steps in analyzing these responses. After this preliminary reading, further analysis will include re-analyzing and collapsing categories as appropriate, and examining the categories for differences among the disciplines.

For the purposes of this report, all of the categories are listed and the number of comments in that category noted in parenthesis. The number of comments is for sorting purposes only. It is important to note that an individual comment (and therefore category) may not reflect the importance the group may have given this comment. For example, one comment might reflect the opinion of all of the group members – this agreement being confirmed by body language or one-word agreements, rather than in-depth conversation.

Theme: Desired content of the digital library

Discussion regarding content was wide-ranging and often over-lapped with the kinds of features users would like, the quality of the content, as well as how best it could all be used.

Response Categories

- When users search for instructional materials (learning objects) they want to find "the right thing." It should be useful and meet needs of the searcher. (12)
- Users want to have access to and review:
  - successful labs, exercises, lecture notes, problems, and tests (10)
  - bibliographies, books, book/journal reviews, software reviews, and discipline-based research journals (9)
  - successful courses and learning experiences (6)
  - data sets and research in the discipline (6)
  - subject matter aids, illustrations, demonstrations, and visualizations (4)
  - instructor tutorials and manuals, and developer notes. (4)
- Users want to be able to view a wide variety of materials including those that are not refereed, works in progress, or an idea section. (4)
- The library should include multi- and cross-disciplinary information. (3)
- Users want information about the learning objects "up-front", e.g., courseware quality, size, and platform. (4)
- Film and multi-media items should be included in the content. (2)
- The content should be re-usable. (2)
- A national organizing syllabus might be a useful organizer. (1)
- Content should support good pedagogical use (1)

Theme: Desired features and services of the digital library

The features and services the respondents felt were most important centered on the need for an easy way to identify, search for, and find the information they seek.

Response categories also reflect differences within the actual features, such as a good index and the design of those features, or more specifically: the search engine should be fast. Differences also seem to be based on whom the discussants viewed as the end user, i.e., students or faculty.

Response Categories - Faculty

- Issues associated with need for a good index, glossary, and thesaurus, to ease the retrieval of items. (15)
- There should be an easy to see, up front, sorting or coding method highlighting the cost, software edition, and student level. (12)
- There should be a selection process for the instructional materials. The library's contents should have a referee, editor, or peer/expert review process. Referees should also have knowledge or background in education. (11)
- User notes and information from users would be helpful. (10)
- There should be a way to create or connect with a community of like-minded educators(7)
- There should be ways to network or contact with others such as discussion groups. (6)
- The services and materials within the library should be free. (6)
- There needs to be a rating system so that the quality of the materials is readily apparent. (5)
- Users will need training and workshops on how to use the library and its content. (4)
- Users would like to be able to set up a user profile to streamline the search process; weekly updates based on the profile would be a useful timesaving device. (4)
- Users will need to be able to demo computer materials. (4)
- Since the library will be encompass more than just one discipline, there needs to be a way to assess the quality of reviews from disciplines outside of your own. (3)
- Assessment information that shows the efffectiveness of materials should be included. (3)
- A top ten list would help users focus searching and keep up-to-date with new materials. (3)
- There should be a place for “about” a topic; this might include articles, books, and links to related information. (2)
- There should be standards for authors. (1)

Response Categories – Students

- Students will want the library to be a resource for papers or research and for course information.
- It should be a good cross-reference for information that cuts across the disciplines.
- Students need stable references, like books. The digital library should be stable. It should be a good reference for life long learners.
- Students use discussion groups.
- Students with disabilities need to be able to try out materials – access is an important issue.
- Students want to have access to lots of problems and their solutions.

Response Categories– Design and Interface

- The search function must be easy to use, have a good interface and be fast. There needs to be one place users can go to quickly get to the search function.
- The library must be well maintained and materials constantly updated. The library must be stable, materials archived well, and there needs to be a good way of dealing with changes, i.e., with links, new or updated software, etc.
- Changes in software need to be controlled for, or identified so users know – at a glance – whether a learning object matches their system.
- The quality of the staff of the library is very important – there needs to be a full time "librarian."
- The type / version of software used to create the learning objects is an issue; people with older versions will want access without having to update their software.
- Users want to be able to try out materials; the sites shouldn't be just commercial.
- The library should work across all platforms.

Theme: Ease of use, and barriers to use of the library

Respondents reported that the main reason they believe their colleagues do not use instructional technology is the time it requires to learn how to use it, and to revise or create new courses that incorporate it. Other barriers to use center around the perceived impact the technology may have on the culture of the institution.

Response Categories

- It takes too much time and effort to learn technology, revise courses, and create new course materials. (45)
- Students resist change; they want to learn in traditional ways. Computer instructional materials rely on students' reading abilities, many student prefer oral communication. Students are so different (many are under-prepared) they aren't able to learn with these methods. Students say they don't like the technology, so why use it? (13)
- Faculty fear that trying technical or teaching innovation will have a negative impact on their teaching ability and evaluation of their teaching. Adding technology has to be worth the effort. (11)
- Many faculty see no reason to use technology – how they teach works fine, so why should they change? (11)
- Faculty are overwhelmed by the amount of computer instructional materials, they find it difficult to find exactly what why want. Materials are hard to find. (9)
- The quality of the materials varies widely – faculty don't know what to expect or how to find high quality materials. (9)
- The reward structure of academe doesn't support or give credit to faculty who apply technology and innovative teaching practices. (8)
- Faculty view the administration as promoting the use of technology in teaching for the wrong reasons, e.g., it's a cheaper way to reach more students. (7)
- Technology challenges traditional belief systems about teaching – this is threatening to the faculty and their academic culture. (7)
- There is a lack of access and many technical problems associated with using technology in the classroom, e.g., bandwidth can make it impossible for all students to work on one project at a time. (7)

- Innovation is idiosyncratic, attached to only one person – faculty need supporting documents and other assistance to use another's course materials. (6)
- Rapid change in technology makes it difficult to keep up with new things, difficult to sort out the "best," and people don't change their [software] to meet changing standards, technology, and so forth. (6)
- Faculty don't want to learn about technology by themselves, they prefer to learn from and with other faculty. (3)
- Faculty simply aren't interested in, or don't see a need to add technology to their teaching. (2)
- Small schools and community colleges don't have the financial resources to cover the costs of software, instructional materials, and so on. (2)

Theme: Value of computer enhanced education and the digital library

The value of the SMETE digital library is revealed in respondents' discussion of computer enhanced education. The respondents' observations focused on the positive impact of computers on student learning.

Response Categories

- Computer instruction increases students' responsibility for their own learning; they take control of their actions and interactions. This pedagogy involves active learning; they organize their own time for learning. (38)
- It frees the instructor to give students more individual attention. Faculty can focus more on learning strategies, the level of the work, and assignments can be more sophisticated. (11)
- Student attitudes towards learning improve and student motivation increases. (10)
- Group interactions, peer teaching and learning are enhanced. (10)
- Computers allow for visualization, which helps students create mental constructs and pictures of concepts. (9)
- Technology helps students build self-confidence. (8)
- Computer enhanced education (CEE) improves students ability to describe phenomena, content, etc. (7)
- CEE strengthens and creates communication links between students and instructors; allows for more direct and timely feedback re: teaching and learning. (7)
- Even though it's not the focus of the course, students learn life skills, e.g., word processing, email, spread sheets. (7)
- CEE encourages continuing education outside the classroom, encourages students to explore things on their own. (6)
- Student access to information increases; the power of the computer allows them to do things that can't be done with a pencil and paper. (6)
- The technology allows faculty to assess teaching and leaning more rapidly. (6)
- It's a tool that leads students to a better understanding of a discipline; they can talk and do science, math, physics, etc. (4)
- In general, CEE enhances communication among students and teachers. (3)
- It makes things easier. (3)
- The instant nature of access to information and feedback makes a big difference in the way things are taught and the way students and faculty interact. (3)
- Use of the same instrumentation leads to integration of subject knowledge. (1)

- Students learn more. (1)

Theme: Role of the user community in the digital library

Respondents discussed how a sense of community is essential for the success of the library. Many of the features they identified as essential to a library are features that encourage discussion and dialogue among and between the users and authors. In addition to these features, respondents also discussed the need for establishing a personal connection to the space and those colleagues associated with it.

Categories of Responses

- People learn from a community that is developed and maintained by face to face inter action, e.g., workshops, meetings, and conferences – people want to know one another. (15)
- The differences in the needs and interests of the different disciplines affect how communities develop. (5)
- Personal contacts are what drive involvement and learning about innovation. People need to communicate with other users, developers and so on. Networking is important; what will be the impact of all this networking? (5)
- Technology is important to connect to the community; it encourages communication and dialogue about shared concerns. (4)
- A digital library has to be more than just content - it means developing a group of users. The users, depending on their expertise will want support services. (4)
- Personal and professional contacts are the way people get involved in the community. People have to bring others to the project to involve them. (4)
- People who use or might use a digital library are select; they are a small group. Other larger groups will have to support the idea. (3)

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Appendix A: Focus Group Participants

American Math Society and Mathematical Association of America

Name	School/College
Don Allen	Texas A&M University
Marcelle Bessman	Jacksonville University
Ed Dubinsky	Georgia State University
Al Hibbard	Central College
Ken Levasseur	University of Massachusetss - Lowell
Jonathan Lewin	Kennesaw State University
Paul Patten	North Georgia College & State University
David Smith	Duke University
Annie Selden	Tennessee Tech
John Selden	Tennessee Tech
Joan H. McCarter	Arizona State University
Bill Bogley	Oregon State
William Hammack	Nova Southeastern University
Mike Hvidsten	Gustavus Adolphus College
Charlie Jacobson	Elmira State University
Carole Lacampagne	US Dept of Education
Jean Marie McDill	California Polytechnic University - San Luis Obispo
Gerald Porter	University of Pennsylvania.
Dorothy Wallace	Dartmouth College
Darren Wick	Millsaps College
Lang Moore	Duke University
Jean J. McGehee	University of Central Arkansas
Agnes M. Rash	St. Joseph's University
Doug Ensley	Schippensburg State University
Thomas Judson	University of Portland
Gene Klotz	Swarthmore - Math Forum
Betty Mayfield	Hood College
Anita Salem	Rockhurst
Dick Schori	Oregon State University
Sue Schou	Idaho State University
Philip Yasskin	Texas A&M University
Robby Robsin	Oregon State University
Lee Zia	National Science Foundation

American Association of Physics Teachers

Name	School/College
Scott Bonham	North Carolina State University
Marianne Breinig	University of Tennessee
Pat Conney	Millersville University
Bob Fuller	University of Nebraska - Lincoln
Priscilla Laws	Dickinson
Larry Martin	Northpark University
Peter Signell	Michigan State University
Francine Wald	Nightingale-Bamford School
Dean Zollman	Kansas State University

American Association for the Advancement of Science

Name	School/College
Gordon Wood Anderson	Dept. of Defense, Threat Reduction Agency
Stephen Berry	University of Chicago
Beth Cole	University of Wisconsin - Madison
Elaine Johnson	Community College of San Francisco
David Kerger	MIT
Neil Kestner	Louisiana State University
Glenda Lappan	Michigan State University
Joseph Ledbetter	Contra Costa College - CA community college
Mary Linquist	Columbus State University
Richard Mankin	AAAS - COOS
Tom Romberg	University of Wisconsin - Madison
Virginia Stern	AAAS - COOS

Modular Chemistry Consortium

Name	School/College
Morris Waugh	Moorehouse College
Maria Dean	Coe College
Bill Trogler	University of California at San Diego
Steve Singleton	Coe College
Jack Bell	Contra Costa Community College
Curt Fromke	Napa Valley College
Karen Harding	Pierce College
Raymond Chamberlain	Merritt College

Learning on the Internet

Name	School/College
Susan Meacham	Shasta Community College
Nancy Jacobsen	Kankakee Community College
Deborah S. Podwika	Kankakee Community College
George Pisching	Fresno City Community College
Nina Morberg	Southern Alberta Institute of Technology
Denis Beaulieu	Southern Alberta Institute of Technology

Appendix B: Focus Group Protocol

Welcome to this discussion of developing a digital library of courseware for math and sciences. As I explained in your invitation these discussions are being sponsored and run by the National Engineering Education Delivery System – NEEDS. NEEDS is itself a digital library of computer based educational materials focused on engineering education. We have been funded by NSF to explore if NEEDS is a useful prototype that could provide the basis for expansion into the larger SMETE community.

You have all been identified as interested in technology, student learning, teaching, or educational innovation. As potential users of such a system, we would like to learn from you your opinions regarding the utility and feasibility of it, what features you feel would be necessary for it to be successful, and how you would most likely use it, to name a few topics. We are attempting to learn what the needs of users are from the different disciplines; thus discussions like these will be conducted at a variety of professional conferences including ACS, APS, AAPT, etc.

1. Lets begin the discussion by doing a round of introductions. Please tell us your name, where you are from, and your discipline.
2. What does computer enhanced education mean to you?
3. How are you currently using courseware in your classes / teaching – please tell us how you use it, and more specifically, how students and TAs use it for your classes / in your setting: is it the same, different, how so?
   - How do your students use it?
4. Describe 1 or 2 ways what you are using enhances teaching / learning.
5. Think over how you go about using courseware in your profession, what are the critical issues, barriers, or other problems that get in the way of people using or developing courseware?
6. What things come up for you that make it difficult or easy to find courseware that meets your instructional needs? Where do you find it? What would make it easier to find?
7. Focusing more specifically on digital libraries, what content areas, topics, or types of materials are important to you?
8. What features do you think would be important for users?
9. We've been talking a lot about faculty, let's open the discussion to learners – e.g., college students, life long learners, high school students – would add or delete anything from this list? What?
10. What resources (e.g., digital library or example from each discipline) do you use currently? What does or would make you go back (i.e., become a regular user)?
11. Are there any other services or programs that you would like to see offered to instructors or faculty regarding the development or use of courseware in your discipline?
12. Our goal was to learn more about what you think about the value of a digital library of instructional materials for SMETE education. Have we missed anything?
13. What advice do you have for us in how to develop such a library?