

First Workshop on Digital Libraries for K-12 Education

Dr. Miriam J. Masullo
IBM Thomas J. Watson Research Center
Yorktown Heights, New York

Ray Ramirez
North Central Regional Education Laboratory
Oak Brook, Illinois

Conference on Information and Knowledge Management

CIKM'93

First Workshop on Digital Libraries for K-12 Education

Washington, D.C.

November 1993

Introduction

By the end of this century large-scale digital libraries containing the collective legacy of human knowledge and information will be accessed in real-time, on-demand, over gigabit networks. The use of these technologies in education holds great promise for both students and educators. Digital libraries will provide access to information currently available in books, videos, and other traditional forms, while digital museums will provide access to content that is not currently available in these media, and that is generally limited in accessibility, particularly to students. The potential to be able to interact with limitless sources of educational content, in real-time on-demand, both from classrooms and homes will change the way in which our teaching and learning environments are organized. Curriculum, from the perspective of a methodology used to organize information in such a way that learning can be manageable, may have to be once more reformed to take advantage of these opportunities. Workshops and demonstration projects are extremely important because they give parents, educators, and decision makers the ability to explore and envision possibilities.

Workshop Overview

The 1993 Conference on Information and Knowledge Management, in Washington D.C. hosted a workshop on the *Digital Libraries for K-12 Education*. This workshop was organized in collaboration with NASA and the North Central Regional Education Laboratory (NCREL). Three panels were assembled to deal with the broad scope of issues relevant to this topic in the areas of technology, application, and policy. This section captures the collective thoughts and ideas of panelists as accurately possible.

Dr. Milt Halem of NASA Goddard Space Center set the stage for the work of the panels with an inspiring keynote address recognizing the difference between the currently evolving digital computing systems revolution and the forthcoming data revolution. Dr. Halem stressed that the technology for the first is the enabler for the other. Bringing these together is the grand challenge of our time. But, the impact of these revolutions is making little in-growth in our K-12 environments, and that has not yet been taken up as a challenge. Dr. Halem illustrated the meaning of this challenge by tracing one evolution of information turned into knowledge through a process that started in 1958, effectively pointing out that we are almost half a century into the Information Age. The impetus for the current initiatives revolving around the concept of digital libraries started with two decades of planning since 1958, followed by two major events associated with the history of NASA.

President Kennedy kicked off NASA's Global Atmospheric Research Program in 1961 in his address to the United Nations, where he proposed an international collaborative effort of all the nations to intensify analysis and measurement of the global atmosphere from space and earth. The launching of NIMBUS-7 in 1978 was part of this effort. And, the data collection that resulted has social implications having dramatically changed our policies and programs since then.

The data collected generated much knowledge that we now take for granted, but the data itself remains vastly unexplored revealing how little we know about worlds of information already in existence. Dr. Halem presented an array of formidable visual data, gathered from that program, representing: 14 years of monitoring the hole in the ozone layer over Antarctica, vegetation patterns on the ocean floor throughout the seasons, changes in snow fall accumulation over the North Pole, the relationship of warm water currents in the Pacific Ocean to weather patterns, the differences in the movement of clouds over the Northern Hemisphere and the Southern Hemisphere, and other examples.

The combinations of images and simulations that have been produced are not only of scientific value but also bring about an appreciation for the aesthetics of information. Such data is a dynamic source of information, a visual information system. And, it forces us to deal with a completely different domain of information outside that which is perceived by the senses, since it would be too difficult or impossible to understand these phenomena in any other way. But, we don't have a natural model or system to guide us in abstracting information from such data. The task of interpreting data, and deriving knowledge from data at this level of detail is extremely difficult, yet we now take the results for granted, because few who have understood the value of data and know how to deal with it have obtained them.

The role of digital libraries in education begins with understanding how to interpret information, and that was well put forth by Dr. Halem's presentation. The time is over for making our students computer literate; the future demands that we make our students data literate.

The following sub-sections contain a summary of discussions from each of the organized panel sessions during the workshop. These sections report not only on information presented by the panelists, but also on contributions by the audience. These reports do not constitute a complete and detailed account of the workshop, only an overview.

The Applications Panel (schools libraries, museums)

Students seem to learn in ways different from the way in which their teachers learned. Therefore, regarding the digital libraries issues, for librarians and teachers the focus is more on knowledge vs. learning than on knowledge vs. information. Questions of quality of information, not quantity or availability are the concern of this group. What kinds of information we have (good or bad) is relative to the intellectual problem that we want to solve, therefore there is an issue of relativity associated with the quality and value of information. Assessment of this relative value of information issue will be magnified in the digital library paradigm.

Another important issue is that of mission. The mission of a library or museum is to curate and cultivate content. In a way, the immense work that NASA has done to extract knowledge out of data is still the best model that we have for accomplishing that mission. In this new paradigm we may also find an amplification of the curatorial functions that so many organizations are now performing as a service to society.

Another thing to consider is that the classroom as a physical entity associated with learning, revolves in many ways around a concept of time, the time students spend with their teachers and other students. If this construct changes, then schools will require restructuring and it is unknown what will this mean for the teachers, it is likely to mean more work in terms of management of activities and preparation of materials. Preparation of materials for "classroom" use, however, might not change dramatically in concept. This task may in fact be facilitated by the digital media, as might the extraction of knowledge. Term textbooks may become the tools of the teachers. Traditionally teachers have prepared materials by selecting from available media and combining it to create learning experiences. This activity could become more efficient and teachers more productive.

Examples of interdisciplinary experiences like the San Francisco Cardboard Kayaking, where students are asked to build and sail a kayak, may become the norm. These kinds of projects may be the best way to prepare students for dealing with the wealth of information that will become available on-demand. Interdisciplinary approaches to knowledge acquisition may be the key to make sense of information.

As schools begin to connect with information servers, regional structures for organizing our education system may be considered. The concept of community information centers may start to make more sense, but this in turns may have profound implications to our national culture. Libraries for example, (in their role as community information centers) encourage the kinds of programs and activities that are relevant and meaningful to the communities and the schools. How will a digital library whose functions are driven by equipment and data take up that role? What will happen when we remove the human factor from the equation?

The Technology Panel

Issues regarding technology are typically driven by the identification of problems within specific application (of technology) domains. The identification of these problems, as they relate to digital libraries, turns out to be a daunting task in K-12 education. The technology panel could only begin to present the problems. Identification of the issues and isolation of the hurdles will take a long time.

In order to understand the situation we must consider that, as suggested by panel members, most of the technologies are being driven in their development by the larger more generic problems that apply to all domains. Applications drive the development of the technologies, and, in this case, applications are not exclusively coming from the education arena, although education is recognized as an important application area. Within the scope of the larger digital libraries activities, issues that have been identified by technologists are in the class of content volatility, that is, how often will data change in these environments, and information throughput, how many users will access the information, with what frequency, and at what level of concurrency.

These issues relate mostly to the communications platform and drive requirements in terms of representation and organization of information for interacting with it. How we represent and organize information for these environments is predicated on the mode of access. This is a significant consideration that will determine how to scale up the environments, and how they will integrate and interoperate. Dedicated test beds will be necessary for exploration. Results obtained in general purpose test beds are not likely to help with the K-12 problems.

Education test beds for digital libraries will differ from other test beds in some important ways. One specific goal here is to create networked environments where the users are also the providers of the information. But, with conceivably limitless sources of information and the incorporation of the larger population of users turned providers, how will educational choices be made? The concept of co-laboratories of information as opposed to repositories was presented as a possible solution. The problem is related to the relationship of information access to that of people access, and can be articulated as: how to include the vast source of educational resources associated with people access within a single infrastructure. Tools for managing these kinds of resources and collaborations across networked environments are needed, and must be developed with education in mind.

An example of the problem generated by networked environments where people become resources (in the same class with content), becomes evident when we think of how thousands of students will gain access to elite groups of very busy scientists. Information management issues (if we consider these scientists as sources of information) begin to gain complexity. That problem does not only drive requirements for tools to manage access to information of all sorts, but also indicates that there is a need to train our students to become inquiry literate as well. A structure of inquiry hierarchies merits consideration.

Also, the notion of working with ideas closer to environments that will work years from now is essential to successful implementation, if we are interested in building these to be of benefit to our students, this is, useful in the future. And, if we are to overcome the current perception that there is an implementation bottleneck where the educational community is concerned, then it becomes essential that we put these tools in the hands of the teachers as an integral part of the solution.

The Policy Panel

Two key policy issues that capture the concern of the communities at this time seem to be in the areas of subsidy for the schools, and standards for the technology providers. In a sense standards mediate between the digital library users, in this case the schools, and the information providers, in this case, not excluding the content providers, but more specifically the technology providers. The cost associated with providing digital technologies and the connectivity is an issue also related to standards. Therefore, it appears that the question of standards may have to be answered before any significant progress can be made.

However, the communities that will formulate and provide the technologies are divided in this issue. Universities and research laboratories prefer a process of chaos and natural selection in order to arrive at standards. Industry on the other hand, requires standards to help bring their products to market, particularly in this area where large investments are at stake.

The ownership of these digital libraries is likely to be in the hands of those who will develop them, and that is unlikely to be the government, or to be managed by the government. There is agreement in that government should not inhibit the development of infrastructure and digital libraries. Policies, however, are formulated at government levels and go through tedious government processes. With this in mind, and with education in mind, what can be done to facilitate policy development to support the goals of the schools? The imperative is 1) to be as informed as possible on the issues, and 2) to speak out to those who are in a position to make change.

Beyond that, criteria for good policies lies in what we as a nation wish to get out of these revolutions in communications and information. Equity in access is the prime hope that expresses the information needs of our students. In the current model access is free when we come to a library, but information is not free, the library has to buy information. In the model of the future access is unlikely to be free, and information will continue not to be free. So what will happen to those who have limited access now?

It is necessary to reach a consensus among technology providers, information providers, government, and the public, on where we want these imminent changes to take us. In the scope not only of democracy, but also of civilized society, information must be made available to anyone who can benefit from it. These things must be written into legislation, and legislation must play a key role in sorting out all the issues, in all of the areas. There cannot be shortcuts or omissions. In the many issues raised by this workshop, and the many more that need to be identified, lay the burden of building the future with technology.

Workshop Participants

Technology Panel:

John Clement, EduCom Networking
Luis Gomez, Northwestern University
Miriam Masullo, IBM T.J. Watson Research Center
Robbie McClintock, Columbia Teachers' College
Tam Nguyen, IBM T.J. Watson Research Center
John Richards, BBN
Doug Van Vliet, Unisource

Applications Panel:

George Brett, Clearing House for Information Discovery and Retrieval
Alice Calabrese, Chicago Library System
Linda Hunt, Librarian Fairfax County Public Schools
Beau Fly Jones, North Central Regional Education Laboratory
Albert Snow, The Discovery Museum
Lou Webb, San Francisco Unified School District

Policy Panel:

Glen Gallegher, NIST
Milt Halem, Goddard Space Center, NASA
Neal Kaske, OERI Library Programs
Rafael Ramirez, North Central Regional Educational Laboratory
Frank Withrow, Council of Chief State School Officers

Acknowledgements

The *First Workshop on Digital Libraries for K-12 Education* was made possible by the organizers of CIKM'93 who allowed this important event to exist within that conference. Dr. Yelena Yesha of NASA Goddard Space Center co-chaired and facilitated the workshop. Dr. Yesha was also responsible for inviting several distinguished panel members from NASA and NIST. This workshop would not have been possible without her gracious contributions.

Dr. Beau-Fly Jones and Ray Ramirez of NCREL were key organizers and participants. They devoted long hours and resources to every aspect of the event. The assistance of Rose Mary Bell, also from NCREL, without which the logistics of this event would not have been manageable, is gratefully acknowledged.

Dr. Steve Lavenberg, of the IBM Thomas J. Watson Research Center supported IBM's participation in this event, including the availability of many demonstrations and personnel. Special thanks is due to

Dr. Fred Mintzer, also of the IBM T.J. Watson Research Center, for presenting the Vatican Collection demonstration, as an example of a world class and pioneering digital library for education.

Many IBMers spent long hours helping to organize this event. The reward of success and many thanks goes to them.

Finally, the most important acknowledgement is due to panel members and panel moderators. These men and women put aside all other responsibilities to be present, on their own time and at their own expense. Their enthusiastic collaboration and interest in this cause is an inspiration to all professionals, in all fields of endeavor with something to contribute to the education of our young.