

An Exploration of K-12 User Needs for Digital Primary Source Materials

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Abstract

With the rapid development of the global information infrastructure and networked multimedia systems, is it possible to make access to archival materials and their descriptions truly virtual, to make their use more diverse, and user interaction more effective? Part I of this article examines trends in K-12 pedagogical and curricular innovation that are leading to increased integration of primary sources, facilitated by new learning technologies, into the classroom. In Part II, the author argues that what is required is a conscious approach to the selection, representation, and presentation of digitized and digital archival materials, informed by sound empirical knowledge of the needs of targeted user groups. In Part III of this article, the author reports on research underway at UCLA exploring the needs of K-12 teachers and students, both for locating and using primary source materials, and for incorporating those materials into learning systems design. The author also speculates on the potential of Encoded Archival Description to provide the descriptive infrastructure for a multimedia archival information system that would address some of the needs identified for K-12 users.

Introduction

This article falls into three major parts. Part I examines trends in K-12 pedagogical and curricular innovation that are leading to increased integration of primary sources, facilitated by new learning technologies, into the classroom. Part II examines the state of the current archival knowledge base with regard to issues of access to, and use of, digital primary source material. This part articulates the need for a conscious approach to the selection, representation, and presentation of digitized and digital archi-

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val materials informed by sound empirical knowledge of the needs of targeted user groups. Following through on this argument, Part III reports on research underway at the University of California, Los Angeles, exploring the needs of K-12 teachers and students for primary sources, and the potential of Encoded Archival Description to address ways in which those needs might be met through the descriptive infrastructure of a multimedia archival information system (such as a digital archives or digital library).

Part I: The Changing World of K-12—Curricular Innovation

Many federal, state, and local historical repositories have worked closely with schools for several years to introduce teachers and students to primary sources through repository tours, classroom presentations, publications, and other packaged materials. The needs of K-12 users remain poorly understood by the greater archival community, however. Children, in particular, are often excluded from archival programming because they are perceived as lacking the cognitive and educational tools to comprehend or work effectively with primary sources or finding aids, and sometimes because they might even pose a physical threat to collections. The opportunity now exists to address such issues and to greatly expand the use of primary sources by K-12 teachers and students through the delivery of these sources, or at least their descriptions, over the Internet or through their incorporation into learning systems for the classroom or educational multimedia for the home.

Addressing the educational needs of K-12 communities represents an unparalleled opportunity for archivists to a) expand the relevance of archival repositories within society; b) begin to grow a “records literate” as well as “information literate” audience that is aware of the importance, relevance, and complexities of records as bureaucratic, social, political, and cultural evidence; c) promote the role of archivists as active participants in the communication of cultural heritage; d) take advantage of the technological and financial resources that are being allocated nationally for the application of information technology in the classroom and for educational reform; and even e) promote archival education as a possible college choice. This paper, therefore, explores what might motivate K-12 users to integrate primary sources into their activities, and how archivists might design systems that accommodate K-12 needs, and maybe even make teachers and students active participants in archival description and system development.

Political, educational, and technological rhetoric abounds about how multimedia and network technology will revolutionize schools and educational processes, particularly when employed to bring innovative curricular content such as primary sources directly into the classroom and even the home. Mendrinós writes that:

The dynamic world scene of dramatic social changes, environmental challenges, scientific discoveries, and research necessitates a learning process that no longer focuses strictly on the pages of a textbook The resource-based learning environment provides the means for students, teachers, administrators, and community members to use diverse formats to satisfy their information quests These are not supplemental resources but necessary elements integrated within the curriculum to stimulate different literacies (i.e., visual, auditory, textual, information) to increase the learning achievement of the student.¹

Schools are also increasingly aware of the need to make their teachers and students literate in the ways Mendrinós indicates—not only learning how to locate content, but also how to select and employ it critically in a much less mediated environment. At the same time, however, schools are struggling with the realities of insufficient availability of equipment; inequity of access, even between students in individual classes; and teachers who are lacking in technological skills.

Pedagogically, two increasingly intertwined strands appear in the K-12 education literature: 1) how multimedia technology can be used in the classroom to encourage the development of so-called “learning environments,” and 2) how additional source material can be used in project-oriented activities to enrich that learning. In other words, these strands are looking at the technology and the content, and the interaction between them. For example, Toomey and Ketterer report on how three elementary school teachers in the United States and Australia used multimedia to enhance students’ cognitive skills, in particular, how to “construct and compile knowledge for themselves.” The authors felt this was important in a world where knowledge is growing so fast that teachers are unable to mediate or synthesize it for the students, and, therefore, the students need to acquire the ability to do this for themselves and also to learn not to accept what is presented to them uncritically. In discussing computer-enhanced learning (CEL), Toomey and Ketterer state that “CEL is sometimes envisaged as a form of the learner-centered, but teacher-guided, approach to teaching and learning advocated by Dewey....Support for the concept is drawn from the notion of constructionism (Papert, 1987) which claims that knowledge is not transmitted but constructed by individuals with the help of other people and the support of a material environment, of a culture, of a society. On this view, the introduction of multimedia to the classroom makes the material environment more supportive of knowledge construction.”²

¹ Roxanne Mendrinós, *Building Information Literacy Using High Technology: A Guide for Schools and Libraries* (Englewood, Colo.: Libraries Unlimited, 1994), 2.

² Ron Toomey and Kim Ketterer, “Using Multimedia as a Cognitive Tool,” *Journal of Research on Computing in Education* 27 (Summer 1995): 474.

Fisher, Wilmore, and Howell conducted a study known as the Knowledge Express Project, where they introduced an innovative curriculum into a fourth grade classroom, and then used technology to facilitate the pedagogical changes. They describe this new pedagogy as follows: "The new, compared with traditional, pedagogy places much greater importance on the roles of prior knowledge, social interaction, and relevance of learning context in determining what and how much will be learned. In addition, the new pedagogy emphasizes explicit consideration of both learning processes and the subject matter to be learned while traditional pedagogy focuses on the latter."³ One of the rounds of projects conducted by these students was health projects. Students could work individually or in teams, and their projects could be an oral presentation with visual aids, written and oral reports with guest speakers from the community, or a dramatic production. The information used was acquired not only from textbooks, but also from films, multimedia sources, computer networks, and local experts such as a dentist. The results of the study included less artificiality in classroom activities, and a shifting in social control in the classrooms to where the students "took more responsibility for themselves and their actions in the classroom and...for their own learning." Students also took more risks in their learning.⁴ One of the benefits found by the teachers was that the technology allowed students to create, express, or otherwise represent knowledge and ideas in multiple ways to each other, and outside the classroom.

One of the ways that new pedagogies and technologies appear to have potential to work together is through the development by students of portfolios, or their digital equivalent. Stating that "the involvement of students in the collaborative authoring process creates an active learning environment for students to learn more effectively," activities of which included exploring, organizing, and encoding, Rada, Michailidis, and Wang developed a collaborative hypermedia authoring environment called MUCH (Multiple Users Creating Hypermedia). The major finding of the MUCH study was the extent to which student authors benefited from peer feedback that was facilitated by the hypermedia environment. In other words, students learned by commenting on others' work as well as having their work commented upon.⁵

Roe and Vukelich discuss the benefits and disadvantages of portfolio development as part of a literacy project. They report that how portfolios are used is highly dependent upon individual teachers. Various data-gathering

³ Charles Fisher, Faye Wilmore, and Robert Howell, "The Knowledge Express Project: Using Technology to Support Changes in Pedagogy," *Journal of Computing in Childhood Education* 5, no. 2 (1994): 132.

⁴ Fisher, et al., "The Knowledge Express Project," 146.

⁵ Roy Rada, Antonios Michailidis, and Weigang Wang, "Collaborative Hypermedia in a Classroom Setting," *Journal of Educational Multimedia and Hypermedia* 3, no. 1 (1994): 12-36.

mechanisms are employed in a variety of contexts. Portfolios tend to be broad rather than discrete in scope; they are time-consuming to develop, assess, and modify, but they allow teachers to focus on individual students and what they can, rather than what they cannot, achieve. Portfolio content included photographs, examples of children's work, tapes of children reading, teachers' anecdotal annotations, goals and indicators, writing samples, and lists of works consulted. The authors found that the "gap between what is espoused and what was done by teachers seems to stem from sociocultural influences on their document creation. Although theorists write about portfolios in a focused way, teachers create them in a cultural context. This context, either directly or indirectly, places constraints or presents challenges for portfolio development."⁶

A project called "We Connect" at Flint Lake Elementary School in Valparaiso, Indiana, provides a good example of integrating technology into the classroom in ways that would help develop a learning environment guided by a "philosophy of connections." These connections are not only network connections, but those between academic areas, between what students learned today and yesterday, between what they learn in school and in other aspects of their lives, and connections with the future. Students work collaboratively, directing much of their own learning, and employ network technology to interact with others, conduct research, and scan and incorporate images, text, graphics, and music.⁷

If these are internally developed research initiatives, external motivating factors also exist in the form of new national and state standards in a variety of subject areas. For example, new standards for science education, issued by the National Research Council, emphasize the need for students to become active participants in their educational process, and that this should be undertaken in part by deep exposure to certain topics, rather than a broad approach. Digital library developers such as Eliot Soloway feel that such technology could play a vital part in delivering a range of information resources such as primary sources, multimedia, and data in targeted areas necessary to support this kind of learning, as well as providing ways for students to collaborate and publish their own results or provide other forms of feedback.⁸ New state frameworks for history and geography in states such as California and Hawaii also place a large emphasis on the incorporation of primary sources into the curriculum. At the same time, the national history curriculum standards, initiated by President Bush as one way to enhance K-12 education, and developed by a team led by Gary Nash in UCLA's Department of History,

⁶ Mary Roe and Carol Vukelich, "Portfolio Implementation: What About R for Realistic?" *Journal of Research in Childhood Education* 9 (Fall/Winter 1994): 10.

⁷ Jane Foley, "We Connect," *The Executive Educator* (October 1995): 18-19.

⁸ Eliot Soloway, "Digital Libraries in the Classroom," *D-Lib Magazine* (March 1996).

have proven to be extremely controversial. A considerable number of primary sources were incorporated through this effort into 2,500 illustrative teaching examples supporting thirty-one basic standards. Due to intense political criticism, however, all these examples had to be eliminated. This incident underscores how important it is that educators and archivists articulate and follow proven criteria for the selection of exemplary teaching materials if their selection is to withstand criticisms of bias or partisanship in terms of the viewpoints expressed or any notable omissions.

Part II: The Archival Knowledge Base

Background

In responding to a rapidly developing world of electronic recordkeeping, networked hypermedia, and on-line bibliographic information systems, the United States archival profession has developed three movements that, while they present themselves in many respects as distinct and divergent, are increasingly converging around key issues related to the preservation and authentication of context and content in the digital environment.

The first of these movements is concerned with electronic recordkeeping issues, particularly with concerns of evidence and accountability in the creation and management of the institutional record. This movement has been evolving since the rise of data processing in the 1950s and has strong ties to the milieu of government archives, corporate recordkeeping, and recordkeeping systems design. The particular conceptual and practical contributions of this movement for digital systems design lie in the areas of appraisal, preservation of context, and validation of both data and metadata.

The second movement is that concerned with transforming historical collections into digital formats. This movement has its roots in the early 1980s activities of the library and archives preservation community, which tested the potential of various emerging digital technologies for preservation reformatting of traditional holdings. By the late 1980s, however, as demand for access to digital materials on-line began to grow and preservation budgets continued to shrink, there was a growing realization that such digitization activities might serve the additional purpose of expanding access to the rich cultural holdings of historical repositories through the development of digital archives and digital library projects. The major conceptual and practical contributions of this movement lie in the standardized approaches to digital preservation and preservation of digital media, concerns for enhancing secondary use of archival materials, the provision of on-line, cross-repository access to digitized and digital historical materials, and the development of economic models for digital access and preservation efforts.

The third of these movements is engaged in the continued development and standardization of digital description, most topically through the development of the nascent Encoded Archival Description (EAD) data structure. EAD uses Standard Generalized Markup Language (SGML) to describe and communicate not only the content, but also a) the context and structure of collections as a whole, b) individual components of those collections, and c) files that contain digital facsimiles of items within those collections linked to collection descriptions. The conceptual and practical contributions of this movement lie in the emphasis on the development of standardized approaches to description, concerns for enhancing secondary use of archival materials, description of records context, validation of descriptive metadata, and the provision of on-line, cross-repository access to that metadata.

Through the experience of almost a century of preserving organizational records and cultural heritage, and particularly out of the recent work with technology described above, U.S. archivists have developed a unique and impressive armament of paradigms, practices, skills, and experience that address how to manage, distill, document, authenticate, describe, preserve, and inter-relate exactly the types of non-bibliographic materials and media that many digital access initiatives seek to encompass. In the current World Wide Web-driven approach to digital access, however, archivists have yet to address how to apply this archival knowledge base effectively in access systems design. Instead they are developing individual digital access initiatives that are rarely fully articulated, systematized across repositories, nor designed based on an analysis of users and their needs. Most importantly, perhaps, given the potential of the World Wide Web, archival applications show little evidence that their developers have considered the needs of the diverse new audiences that might now access their materials.

Several key issues arise from this situation, some that are germane to possible new users, and some that are important to consider for all users. The first issue is how to ensure that, by digitizing and developing network access to its collections, a repository will enhance its access environment at least in proportion to the resources it will need to expend on its digital efforts. A second issue pertains to reaching an understanding, within the parameters of the mission of the repository, as to the extent to which the repository might wish a) to reach out to potential new users who are not currently coming into the repository to use its holdings; b) to design systems where at least some users will be able to satisfy their needs through unmediated access to what is made available; c) to help make users become more "records literate" so they can better understand what they are accessing; and d) to make users aware of the steps that have been taken to validate and contextualize the materials they are accessing. A third issue arises from the last point, which is how to ensure that the evidential value of materials is not

diminished because those materials have been taken out of context, have been transformed into new data or metadata structures, or have been delivered without any validation mechanisms.

In order for issues such as these to be addressed, great thought must to be put into both the selection and the representation processes for digital access to metadata about materials (i.e., the documentation and descriptions that are developed by the creating agent and/or the archivist for the materials); and to digitized and digital archival holdings (i.e., archival holdings that have been transferred into digital formats, and those electronic records and other artifacts that were created in digital form in the first place). In terms of selection, archivists need to consider which materials are prioritized for inclusion in a digital access system, why they are prioritized, and what the cultural, informational, educational, even legal implications of that selection are. In terms of representation, archivists need to consider how materials are structured for on-line access, how they are described within those structures, how both digital descriptions and digital facsimiles are validated, how existing context and evidence are retained and the development of augmented contexts facilitated, which search and navigation processes are facilitated, and how the materials are rendered on screen.

The State of Archival Knowledge About Users

The thought that goes into the selection and representation processes also needs to be informed by much more knowledge of potential user communities than the archival profession currently has. In the mid-1980s, some of the paucity of concern for users began, for the first time, to be addressed overtly in archival literature and at professional meetings. In 1986 a thematic issue of the *Midwestern Archivist* was dedicated to the exploration of “the implications of analyzing the use of archives and applying the information to archival administration.” The issue included studies by Maher, Turnbaugh, Goggin, and Conway which were to become the core of subsequent discussions of archival use and users. While library and information science literature on user studies, information seeking practices, and factoring user needs into interface design is rich,⁹ archival literature on the same aspects remains scant.

Although archivists can learn much from the research and experience of the library and information science community, several activities and definitions related to use and access in archival currency are perhaps more complex—at least somewhat different—from those used by librarians, and thus need to be examined in the context of archival research into use and user needs. Most notably, these differences lie in the archival practice of heavily mediated access to their holdings; the emphasis that archivists place on serv-

⁹ See, for example, the work of Marcia Bates, Christine Borgman, Carol Kuhlthau, and Brenda Dervin.

ing not only immediate consumers but being agents of *überlieferungsbildung*—the handing down of culture and civilization from generation to generation;¹⁰ and the development of access tools such as archival finding aids that are heavily predicated on the methods of certain types of historical research. The argument in favor of mediated access derives its strength in part from what many archivists still perceive as a fundamental tension between the archival function of preservation, and that of making materials available to users. This argument is also supported by the importance which archivists place on archival materials being presented to, and interpreted by users, within a valid evidential and historical context. In each of these cases, however, research and development in digital access, platform independence, and enhanced finding aids may facilitate new forms of resolution to these concerns.

A fundamental rationale for archives and archival use over the years relates to scholarship in history. This rationale can be narrowly and exclusively interpreted to refer to scholarly research by historians and the use of institutional records by administrators, or so broadly that it can mean that every use of an archives is really a historical one.¹¹ Indeed, the latter interpretation was echoed by Conway when he stated that “users of archives are ...all beneficiaries of historical information,” and more recently by Ham, Boles, Hunter, and O’Toole when they wrote that “Other user groups (administrators, lawyers, genealogists, etc.) may frame questions different from those of historians, but the reasons for asking questions of archival collections will be essentially the same....they are all ‘historical’ in that they deal with information from the past.”¹²

The problem with such broad definitions of use is that they are difficult to operationalize when trying to design access services that are tailored to the

¹⁰ Paul Conway offers the following definitions of use: “Use of archival materials is comprised of two distinct activities. Use occurs in a physical sense when researchers scan collections, series, folders, or individual items in search of information relevant to their needs....A second kind of use is more difficult to explain but as important to document—usefulness, or the use made of archival information to benefit individuals, groups, or society as a whole.” See, Conway, “Facts and Frameworks: An Approach to Studying the Users of Archives,” *American Archivist* 49 (Fall 1986): 396. Larry Dowler expands upon this notion of a wider sense of use and users: “The definition of use should not be limited to actual use, and the definition of users must include future users and all those who could use, might use, perhaps even should use, the information in archives.” Dowler also notes that “Several implicit assumptions in a research agenda need to be made explicit, including the notion of a community of users, the meaning of outreach, the concept of mediation, and the idea of archives as information....All uses of archives, even research uses, are not the same, and archival policies and procedures ideally should recognize these differences.” See Lawrence Dowler, “The Role of Use in Defining Archival Practice and Principles: A Research Agenda for the Availability and Use of Records,” *American Archivist* 51 (Winter/Spring 1988): 78, 75. For further discussion of this aspect, see Maynard Brichford, “Academic Archives: *Überlieferungsbildung*,” *American Archivist* 43 (Fall 1980): 449.

¹¹ See, for example, Margaret F. Stieg, “The Information of [sic] Needs of Historians,” *College and Research Libraries* 42 (November 1981): 449–60.

¹² F. Gerald Ham, Frank Boles, Gregory S. Hunter, and James M. O’Toole, “Is the Past Still Prologue?: History and Archival Education,” *American Archivist* 56 (Fall 1993): 723.

needs of specific user communities or types of uses. On the whole, the provision and structure of archival reference services have been developed to a large extent with the needs and research methodologies of historians in mind. User studies have demonstrated that academic historians, the users most favored and sought after by archivists, while probably the users of the highest volume of archival records due to the in-depth nature of much of their research, are not by any count the largest user group of archives. In fact, Freeman, Dowler, Turnbaugh, Oberly, and Goggin all found from their studies that scholarly use of archives is either low or not as prevalent as archivists believe.¹³ The major categories of users of archives in recent decades have been genealogists, administrators, public policy makers, lawyers, students, amateur historians, and archivists themselves. However, no studies indicate the level or nature of any use of archival materials by K-12 teachers or their students, probably because this user group does not generally represent a constituency of the academic archivists and educators who are the authors of most of the published studies.

A key question involved in any discussion of who does and who does not use archives is that of how users and user groups find out about archival collections. Maher, Conway, and Stieg all found that users did not use standard published reference tools such as the *National Union Catalog of Manuscripts Collections* and *American Literary Manuscripts*. Therefore, Oberly advocated the development of customized finding aids aimed at specific user communities to increase the numbers of groups of users. Studies by Stevens and Maher both found that word-of-mouth and citations were primary sources for finding out about collections.¹⁴ Maher found that referral accounted for the highest source of how users found out about archives (based on a 1983-84 study of 159 reference letters to the University of Illinois Archives). Paul Conway, in his 1986 user study conducted at four presidential libraries, found that a scholarly "grapevine," rather than any published source, was the most important way in which academic researchers found out about archival holdings.¹⁵ The work of Avra Michelson and Jeff Rothenberg which examined the impact of technology on the research process, has con-

¹³ Elsie T. Freeman, "In the Eye of the Beholder: Archives Administration from the User's Point of View," *American Archivist* 47 (Spring 1984): 111-23; Dowler, "The Role of Use," 74-86; Roy C. Turnbaugh, "Archival Mission and User Studies," *Midwestern Archivist* 11, no. 1 (1986): 27-33; James Oberly, "The Value of Finding Aids in the Archives: A Quantitative Analysis," paper delivered at the MidAtlantic Archives Regional Archives Conference Meeting, Spring 1983; Jacqueline Goggin, "The Indirect Approach: A Study of Scholarly Users of Black and Women's Organizational Records in the Library of Congress Manuscript Division," *Midwestern Archivist* 11, no. 1 (1986): 57-67.

¹⁴ Michael E. Stevens, "The Historian and Archival Finding Aids," *Georgia Archives* 5 (Winter 1977): 64-74; and William J. Maher, "The Use of User Studies," *Midwestern Archivist* 11, no. 1 (1986): 15-26.

¹⁵ Paul Conway, "Research in Presidential Libraries: A User Survey," *Midwestern Archivist* 11, no. 1 (1986): 33-56.

vinced those authors that network technology is now fostering and facilitating invisible college activity among humanities researchers in the electronic environment.¹⁶ In his 1988 article, Dowler asked if the archivist could capitalize on the importance of this scholarly “grapevine,” and how archival finding aids could be used more effectively. He also suggested the possibility of educating university students on how to do research: “What are the implications of this fact for developing methods for promoting use? Do archivists need to plug into the ‘grapevine,’ publish scholarly articles with lots of footnotes, or perhaps initiate programs to educate student and scholarly users on how to do research? How effective are repository guides, subject guides, and other methods of providing access to materials, and what role, if any, can they play in a strategy to promote use?”¹⁷

Part III: Exploring K-12 Needs for Primary Sources and Archival Systems Design

Methodology

In 1986 Paul Conway explicated a five-stage methodological model for the study of users of archives. Conway described this model as a comprehensive framework “built on definitions of users, information needs, and use” that brought together both quantitative and qualitative methods to assess use and users.¹⁸ The first three stages of this model related to studying actual users of archives during their research process, and most extant archival use studies fall into these stages. The fourth stage related to user satisfaction with archival services and also the impact factor of archival collections as measured through citation analysis conducted on users’ publications—a few archivists have conducted citation studies that fit into this category.¹⁹ The fifth methodological stage of this model was to use what Conway termed “experimental research” that would examine aspects of archival use and nonuse such as integrity of service measured in terms of linkages between information creators, technology, and additional information resources; or the value of historical information in society assessed through community network analysis.

Ten years after the publication of Conway’s model, this fifth stage remains almost completely unaddressed by archival research into use and users.

¹⁶ Avra Michelson and Jeff Rothenberg, “Scholarly Communication and Information Technology: Exploring the Impact of Changes in the Research Process on Archives,” *American Archivist* 55 (Spring 1992): 236–315.

¹⁷ Dowler, “The Role of Use,” 81.

¹⁸ Paul Conway, “Facts and Frameworks,” 394.

¹⁹ See, for example, Clark A. Elliott, “Citation Patterns and Documentation for the History of Science: Some Methodological Considerations,” *American Archivist* 44 (Spring 1981): 143–50; Frederic Miller, “Use, Appraisal, and Research: A Case Study in Social History,” ca. 1981, n.p.; Jacqueline Goggin, “A Study of Scholarly Users of Black and Women’s Organizational Records.”

This part of the article discusses research underway at the University of California, Los Angeles (UCLA) that falls into Conway's fifth stage. This research is building archival knowledge of the potential value and use of archival materials by one specific user community, K-12 teachers and students, and factoring this into the design of prototype digital access systems for archival materials.

Since almost no previous work existed upon which to build this research, the researcher took an exploratory approach based on five activities:

1. *A survey of historical repositories* with collections relating to the history of the health sciences and historical repositories in the Los Angeles Basin covering a wider range of collections. This survey inquired about the criteria which repositories currently, or might potentially use to select materials for digitization and inclusion in digital access systems.
2. *A review of recent education research literature* in the areas of educational technology, early childhood education, and educational methods. The review identified common themes, findings, and observations relating to innovative pedagogies, technology use, and content needs.
3. *Observation of, and interviews with teachers* from a range of grades and schools in Southern California who have been participating in an ongoing initiative to encourage the integration of primary sources into innovative curricular content. This initiative includes a UCLA summer Primary Sources Institute which has been sponsored for the past four years by UCLA's University Research Library's Department of Special Collections and UCLA's laboratory elementary school—the Corinne A. Seeds University Elementary School (UES).
4. *Mapping identified teacher content needs against materials prioritized for selection by archivists* to ascertain the extent to which K-12 teachers' needs might reasonably be addressed during the selection for digital access process.
5. *Mapping identified teachers' structural and presentation needs against archival systems design.*

Study Results

Activity 1. A brief survey on the state of archival and library digitization was funded in 1995 by the Council on Library Resources-Commission on Preservation and Access (CLR-CPA).²⁰ The resulting report states "Clearly, there is not yet a straightforward, logical mechanism for finding out what collections are available in electronic form (and where and how). Further, there is very little ability to filter or assess the resources that are there—and they

²⁰ Patricia A. McClung, *Digital Collections Inventory Report* (Washington, D.C.: Council on Library Resources and the Commission on Preservation and Access, February 1996).

range from the ridiculous to the sublime.”²¹ As a result, the report called for an on-line finding tool that would bridge all these diverse developments and serve as a unified information resource.

In order to probe issues relating to the digitization of archival resources further, the researcher conducted a more detailed survey in 1996. An identical survey instrument was distributed to two mutually exclusive groups. Group I (LA repositories) comprised historical repositories with diverse collections located in academic, research, and cultural institutions in the Los Angeles Basin. These local institutions were chosen by the researcher because they were likely to be in a position to become involved in the sorts of digital activities under consideration, and potentially might be interested in programming for K-12 users. Group II (health science repositories) comprised historical repositories across the United States whose collections are based in the history of the health sciences. The researcher chose to survey this group because 1) significantly differing responses to the questions from those of Group I might be an indication of differences in digitization issues due to the nature of the collections and primary user groups being addressed; 2) health and science education represent significant K-12 areas where funding sources such as the National Science Foundation have been encouraging the incorporation of primary sources into the classroom; and 3) several science and health K-12 education initiatives are already underway at UCLA. No attempt was made by the researcher to identify only those repositories already involved or experienced with digitization, since the survey was also designed to elicit information about possible barriers to digitization.

The researcher advised each participating repository that she was interested in investigating practices and attitudes of archivists and curators with regard to digitization selection criteria and heuristics, as well as an examination of how such selection might have an impact on K-12 use. Based on the responses received, each aspect proved enticing to some repositories and undesirable to others. Fifteen Group I and twelve Group II repositories agreed to complete the survey. Several respondents indicated, however, that they do not sufficiently understand the issues surrounding digitization to be able to give informed answers, although their overall responses point to the transferability of their archival experience, knowledge, and intuition as sound starting points for beginning to consider digitization issues. This lack of clarity is evident in some of the survey results and points to a lack of proven and consistent selection, digitization, description, design, and economic models, as well as knowledge of user communities which can be integrated with the existing archival knowledge and experiential bases. While the compiled results which are discussed below should be considered preliminary since there is a considerable level of follow-up inquiry still to be conducted, there was,

²¹ McClung, *Digital Collections Inventory Report*, 4–5.

overall, a considerable degree of consistency in responses between the two groups.

The first set of questions was designed to elicit some background against which to assess responses. These questions addressed the scope of the repository's collections, the major user groups (now and prospectively), and information about any digitization that had already taken place, was underway, or was in the planning stages. In both groups, historians and students (especially graduate students), were seen to be the major current user groups for collections. Repositories in the Los Angeles area held collections ranging across many subject areas, including organizational records, manuscripts, three-dimensional artifacts, films, works of art, music, and oral histories. The health sciences repositories obviously held collections within a much more restricted scope, but again they covered organizational records, manuscripts, artifacts and instrumentation, as well as rare books and clinical and scientific research data. When asked which user groups they would like to see using their collections more often, most repositories indicated that they wished to increase use by the above-mentioned groups, especially those directly involved in scholarly research in the subject area of the collections, such as art history, theater, or history of medicine. No one user group stood out, many respondents chose not to answer this question at all, and K-12 users were never mentioned by respondents in either group.

Respondents were next asked about digitization activities that they were either contemplating or in which they were already engaged. As had been the case with the CLR-CPA study, respondents were unsure how to define what might be considered digitization. Was putting selected photographs on the World Wide Web, or was marking up finding aids in EAD to be considered "digitization"? Three (20%) Group I respondents and two (18%) Group II respondents indicated they were not considering digitization at this point (this number is probably artificially low, since several repositories were not interested in completing a survey on digitization since they were not currently involved). Nine (60%) Group I and five (45%) Group II respondents indicated that they were exploring digitization as a possibility. Five (33%) Group I and one (9%) Group II respondents had a project in the planning stage (sometimes a repository had multiple projects at different stages). Five (33%) Group I and five (45%) Group II respondents had projects currently underway. No respondents in either group had completed a project, and only one respondent (in the Los Angeles group), indicated that digitization was a routine archival activity.

Two additional questions asked those involved in digitization about where the digitization was taking place, and what were the strongest factors influencing the decision to digitize. Five Group I and four Group II projects were taking place within the repository's own facilities. Four Group I and two

Group II projects were taking place elsewhere within the same institution. Group I repositories indicated one instance of digitization being conducted by a vendor, and one of digitization of materials by another organization.

All respondents felt that digitization was only one of a number of options that could be taken for either preservation or enhancing access, and many respondents felt that it was appropriate, feasible, or desirable to digitize finding aids only and not collections. Respondents cited all of the following as important considerations supporting digitization:

- the availability of special funding,
- the opportunity to publicize collections,
- preservation,
- user demand, and
- development of a special exhibit or the celebration of a special event.

It was difficult to discern from the survey data whether any one of these was an especially important consideration, but their weight appears to depend more upon individual situations. On the whole, respondents felt that the considerations laid out in Table 1 would either work in favor of, or against digitization. It is likely that a follow-up survey sent to a broader cross-section of historical repositories would yield clearer data on this aspect.

The survey data were relatively consistent in an additional aspect: the existing knowledge base among administrators of the repositories surveyed. While there was a wide range of exposure to digitization among the respondents, ranging from having conducted one or more substantive digitization projects to never having been involved in any digitization, there was an overall lack of confidence about providing informed opinions on the questions asked in the survey because respondents felt they lacked conceptual clarity about the nature and potential of digital preservation and access technologies. This is probably also reflected in Table 1 through the large and rather diverse number of considerations in favor of digitizing, versus the smaller number of considerations against digitizing. Table 1 may well reflect more of a lack of clarity about digitization and its implications than a lack of enthusiasm for the process.

Activities 2 and 3. Several themes emerged from a review of recent education technology literature and these were reinforced by the comments and an examination of the types of curricular units created by teachers participating in the UES-URL project. The emergent themes can be broken down into the following categories: a) learning objectives; b) cognitive objectives; c) nature of student activities that might address learning and cognitive objectives; d) characteristics of resources that can be used to achieve learning and cognitive objectives; and e) barriers teachers experience to the use of both digital and primary resources (Tables 2 and 3). Overall, innovative educators seek to encourage the active involvement of students in collaborative

Table 1. Considerations that might factor into a digitization decision, as identified by archival repositories

Considerations in favor of digitization	Considerations against digitization
<i>Physical characteristics of the materials</i>	
Materials are high volume	
Materials are broken, torn, faded, or stained, but could be digitally "restored"	
Materials contain 3-dimensional objects	
Materials contain photographic or other visual media	
Materials can be repackaged in new ways (e.g., multiversioning, development of educational, informational, or entertainment products)	
<i>Intellectual characteristics of the materials</i>	
Materials have widespread significance and merit widespread dissemination	
Materials contain documentation of procedures or processes which cannot be replicated today (e.g., medical or educational experiments)	
Materials contain primary documentation of notable "firsts," and "advances," events, figures, movements, functions, institutions, or geographical regions	
Materials represent the best available source of documentation on the subject (e.g., most complete, densest, most physically or intellectually accessible)	
Materials contain unpublished materials and/or data that might lead to new knowledge about, or insight into, the past or present	
Materials have intrinsic value (e.g., rare, unusual, or exemplary)	Materials have commodity or other entrepreneurial value
Existence of other material relating to the same theme or subject	
<i>Technical characteristics of the materials</i>	
Materials contain handwritten documents or annotations	
Materials contain writing in pencil or faded ink	
Requirement for high-level resolution	
Requirement for faithful color rendering	
<i>Level of intellectual control over the materials</i>	
Materials have MARC records	
Materials have folder- or item-level control	
Materials have a specialized index or database	
Materials are undergoing processing	Materials are in an unprocessed state

Table 1. (continued) Considerations that might factor into a digitization decision, as identified by archival repositories

Considerations in favor of digitization	Considerations against digitization
<i>Use of the materials</i>	
Reliable and/or detailed use information is available for the material	Use of the material is restricted owing to privacy concerns
Use of materials has increased over the past five years	Use of the material is restricted owing to security concerns
Copies of some or all of the materials are frequently requested	
Copies of some or all of the materials are occasionally requested	
Reliable and detailed information about which user groups would like to use this material in digital form is currently available	
Special event/anniversary for which the materials might be used is approaching	
Materials might be used by those who otherwise would/could never come in in person	
Repository owns the rights to materials	Some party other than the repository owns the rights to the materials
<i>Funding considerations</i>	
Special project funds available for digitization	Lack of funding outside base budget
Other units in the same institution are interested in cost-sharing	
Possible interest by external funding agency	

processes, knowledge creation, and other forms of creativity, and for these activities, it appears that primary sources can provide a gold mine of opportunity when they can be made available in the classroom. In particular, the issues of evidence and context that are raised by historical materials appear to match closely with teachers' learning and cognitive objectives for students. However, teachers also seek to balance the benefits of being able to access primary sources without travelling to a repository against the value of students being able to "touch history" by actually viewing the original object.

Activities 4 and 5. Given the preliminary data indicated in Tables 1-3, is it possible to select, describe, and digitize historical materials and maintain their context through the design of a multimedia archival information system to be made available on-line? Could such an access system be tested in actual K-12 settings and then further refined based on feedback from teachers and students? Mapping the identified teacher and pedagogical needs against selection considerations identified by the Group I and Group II respondents, it appears that the immediate content of archival access systems that might give the widest applicability or utility for inclusion in an experimental system are the following:

Table 2. K-12 learning and cognitive objectives, and sample student activities using primary sources that might address those objectives

Learning objectives	Cognitive objectives	Related student activities
Trace cultural, social, and scientific developments and put curricular knowledge requirements into those contexts	Ability to examine and interpret evidence of the past	Interpreting Explaining Role playing Restoring
Understand which knowledge development processes are incremental and which are non-linear	Ability to construct new knowledge on a foundation of the already known	Commenting upon Annotating Creating Augmenting
Examine values and value systems and how they develop and change in different periods, and in different cultural, social, professional, and scientific environments	Development of a sense of the “connectedness of things” Development of a sense of time Ability to recognize and confront stereotypes and bias	Analyzing Debating Confronting
Recognize and discuss key figures, events, and places in the development of the subject being studied	Ability to conduct some degree of primary research	Researching Information seeking
Understand differences between data and records, or information and knowledge	Ability to personalize information	Collating Synthesizing
Develop informational, textual, visual, and auditory literacy	Ability to handle complexity and solve problems Development of a critical and analytical perspective Development of presentation skills and a sense of audience	Replicating Recalculating Play acting Storytelling

- Collections for which property and intellectual rights are not an issue, so that digital and paper or digital copies may be made and modified in accordance with the user’s need or educational activity. For both archivists and K-12 users, this aspect represents perhaps the single most critical characteristic for selection for inclusion in a digital access system;
- Collections for which thorough, multilevel archival descriptions already exist in digital form, and which provide a means of connecting, both hierarchically and laterally, to related materials;
- Materials that have exemplary value (although these might sometimes be things to which an archivist attaches minimal informational value, such as ticket stubs or grocery bills);
- Materials that have a strong visual component. Audio materials are also useful, but are less appealing to children and young adults if the materials are not associated with visuals;
- Materials that have strong local interest. The relationship of primary sources to a local community seems to be important for teaching in

Table 3. Characteristics of digital primary sources that might interest K-12 teachers and perceived barriers to their use

Potentially valuable characteristics of digital primary sources for K-12	Potential barriers to K-12 use of digital primary sources
<i>Related to historical materials</i>	
Can be directly related to curricular standards	Lack of knowledge of how to work with primary sources
Multicultural	Too complex
Complex	Unaccustomed to working with unsynthesized and unvalidated sources
Contextualized	Overly textual descriptions
Incorporate multiple media, especially visual	Lack of detailed indexing of, and browsing access to, media
Exemplary value	Selection of examples can introduce subjectivity. Examples can also be taken out of context
Legally reproducible	Not legally reproducible
<i>Related to digital archival systems design</i>	
Multiple means of representation and presentation	Low level of comfort with technology
Availability of descriptive syntheses	Not designed for appropriate audiences. Lack of time, tools, and textual tolerance for locating, selecting, and compiling curricular materials
Predetermined linkages with related materials	Restrictions on ability to make individualized connections between digital objects
Downloadable	Digital objects can be taken out of context
Manipulable	Lack of version control

- that it is easier for students to identify with and to build upon in their own projects;
- Materials that document seminal advancements in knowledge, or seminal political, cultural, or social events or figures; and,
 - Collections for which corollary materials also exist, such as books (especially biographies and autobiographies), research articles, or artifacts.

In terms of selection for digitization, if these broad heuristics are followed, teachers and students are likely to be provided with a rich content environment upon which to draw in their activities. Indeed, teachers can create startlingly innovative curricular materials from a surprisingly small amount of documents or artifacts. Their biggest concerns and time commitments lie in how to identify those few items, integrate them into the curriculum, and then assess a student project or portfolio that also draws upon those resources. A bigger issue than selection of digital content for archivists, therefore, may be how they can make these teacher activities more effective through the ways in which that content is described and a digital access system is structured overall.

Conway has written that “In an archives, information transfer occurs in many different ways, but most typically when a researcher with a specific information need interacts with archivists and finding aids and in the process acquires archival information of use in meeting some part of the need.”²² Indeed, much of the archival user literature, as well as comments made by both archivists and teachers, point to the need for a consistent and comprehensive form of finding aid as the single most critical means for making the use of archival collections more frequent and more effective.²³ For the first time, with the development of EAD, it appears that the potential exists for the development of such a tool, and for that tool to be implemented as the descriptive infrastructure for on-line access environments.

If one takes the archival systems design needs and the barriers for K-12 that are identified in Table 3, and then examines which aspects of EAD-based digital access systems might begin to address those needs, the following functionalities of EAD appear to be highly relevant. EAD, through a combination of its structural capabilities and the rigor it encourages in the development of finding aids:

- systematizes descriptive structures across repositories and types of materials, even electronic records and museum collections;
- enables multiple media to be incorporated and transmitted over the World Wide Web;
- describes, to any level of detail, the context within which given collections and subsidiary components are created and managed, not just at a summary MARC level;
- is able to render hierarchical and lateral relationships within and between archival collections not only logically and intellectually, but also in a visual display;
- is able to include documentation of the provenance and chain of custody for materials described or incorporated;
- provides an infrastructure for creating virtual environments and built-in hyperlinks to related materials such as publications, artifacts, or electronic datafiles, thus facilitating the creation of an augmented context as well as built-in navigational trajectories to assist certain categories of users;
- can be delivered through any number of customized interfaces;

²² Conway, “Facts and Frameworks,” 395.

²³ For example, teachers participating in the Primary Sources Institute interacted first with Bruin Online, UCLA’s online catalog which contains brief MARC records of UCLA special collections, and then with Special Collections staff, in their search to identify historical materials around which to build their curricular units. Several teachers commented, however, that their interaction with the individual summary level records contained in Bruin Online did not assist them very much in identifying the details of the content of the collections, nor the relationship of those collections with other holdings of the library.

- through digital archival objects, allows for digital facsimiles and descriptions of components of collections to be linked directly to collection-level metadata, thus making it more difficult to take them unwittingly out of context; and
- enables the potential enrichment of description for certain user communities through links to files of on-line annotations contributed by users, on the contents of the system that were accessed and used.

Conclusions and Areas for Further Research

The data detailed in this paper leads the author to conclude that a promising strategy for increasing the usage and effectiveness of user interaction with digital primary source materials by K-12 teachers and students is to:

- use the few broad criteria identified by survey respondents and teachers to select and make available on-line a deeply and consistently described mass of materials representing multiple formats and media materials;
- seek to incorporate materials such as electronic records that are digitally created into access systems;
- exploit the potential power of EAD and begin to enhance description with user annotation and hyperlinks to related materials. (In other words, explore how to couple enrichment of description with user needs and information-seeking practices;)
- develop a set of selection, manipulation, downloading, feedback, and collaboration tools for users. Encode the finding aids for those materials using EAD and then link them from the finding aids to the digitized materials in the digital access system;
- provide an on-line mechanism whereby both K-12 teachers and students can provide feedback on the types of materials they seek (thus providing archivists with further information upon which to base future digitization selection decisions);
- provide an online mechanism whereby K-12 teachers and students can contribute critical annotations of the sources they used (and how they used them) that might provide useful descriptive feedback to other K-12 users and archivists. Teachers could then select first from digital descriptions, with the aid of digitized examples. They could also put in requests for additional materials to be digitized.
- develop an archival literacy (bibliographic instruction) program which would instruct teachers in archival research methods. They may then wish to incorporate this into what they are teaching their students.
- develop a variety of presentation and navigation mechanisms, including some with rhetorical markup.

These conclusions are currently being tested in a collaborative project funded by the National Science Foundation entitled “Digital Portfolio Archives in Learning.” This project involves the author, together with other faculty and doctoral researchers with educational and engineering backgrounds, in the development of a small prototype digital archives and classroom case studies. This project involves examining many of the educational, technological, and content issues associated with transforming primary source materials in the natural and health sciences into digital archives content and then using them to enrich K-12 science education. Specifically, this project is testing the effectiveness of EAD-encoded finding aids in assisting elementary school teachers in retrieving and understanding the nature of primary source materials. It is also exploring ways to enrich the EAD-encoded descriptions through the inclusion of teacher and student annotations of the primary content and how it was used in classroom activities.

In keeping with the model laid out by Conway ten years ago, the goals of the Digital Portfolio Archives project are to use an experimental system and assessment methodology to develop an understanding of what elementary teachers’ and students’ needs might be for locating, manipulating, and understanding primary sources in digital form; and draw conclusions about how the content and retrieval needs of teachers and students might be better anticipated and incorporated into digital archives development. Experimental research initiatives such as those advocated by Conway are essential if archivists are to move forward systematically and judiciously with digital access developments, and particularly if they are interested in expanding their access environments to address the needs of nontraditional user groups.