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# Creating Metadata for Children's Resources: Issues, Research, and Current Developments

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## ABSTRACT

A key challenge to retrieval in any type of system is how to represent the resources appropriately so that the user(s) can find what they are looking for. In systems being used by children, as well as those designed specifically for children, there exist two fundamental representation problems: (1) the metadata or representation scheme of the system may not be designed with this specific user group in mind, and (2) few age-appropriate controlled vocabularies exist for use in creating metadata. Existing research in these two problem areas and the impact on the users' information seeking and retrieval experiences are presented. Current projects and developments, and the contribution that the users themselves can provide, will give the reader further insight into the issues and potential opportunities for research and application.

## INTRODUCTION

Children<sup>1</sup> have unique information needs and information-seeking strategies (Walter, 1994). In today's increasingly digital world, children have access to a wide variety of resources in many different formats. They access information by using a variety of information retrieval systems such as library online public access catalogs (OPACs), online database systems, and the Internet and/or the World Wide Web (WWW). Within the Web environment, children can now access specialized collections of resources in digital libraries, subject directories, and Web portals that are designed specifically for their use. Increasingly, children prefer digital resources to locate information for school, to surf for entertainment, and to locate personal information (Levin & Arafeh, 2002; D'Elia, Abbas, Bishop, & Rodger, 2004).

In order to maximize the success of children's information seeking and use of the information systems, the resources<sup>2</sup> contained within the system should be represented at a level that is appropriate for this particular group of users. The metadata scheme and the metadata<sup>3</sup> describing the system resources should reflect an understanding of how children access, organize, and use information, but it must also take into account the user's understanding of how the system works and how the resources are represented within the system. This article describes the complexity of the representation process and research and developments in metadata schemes and age-appropriate controlled vocabularies. Current projects and the contributions that the users themselves can provide are discussed. Insight into the issues and potential opportunities for research and application will conclude the article.

## REPRESENTATION

Information systems provide various means of accessing the resources of a collection. Users most often, with the exception of Web pages, are searching digital representations or surrogates of the resources and not the resources themselves. These representations can be in the form of bibliographic records in library OPACs, inverted indexes in online databases and digital libraries, or indexing codes embedded into the objects themselves. Each system's database structure or metadata scheme may vary, but the fundamental operation of the scheme or the metadata therein is to represent or describe the objects in the collection to facilitate retrieval.

Representation, or creating metadata, is not as simple as writing descriptions and/or choosing subject terms. It is a complex sociocognitive process in which many variables come into play. It has been defined using many lenses, such as library and information science, cognitive science, and linguistics, among others. O'Connor defines representation as "the set of means by which one thing stands for another. . . . [It is] a complex web of attributes of disparate objects and concepts, idiosyncratic and socially constructed codes and agreements, and neurological abilities" (1996, p. 11). Blair (1990) sees the problem of representation and information retrieval as linguistic in nature. How effectively we utilize language to represent an object determines the success or failure of the information-retrieval process. Blair also posits that the language that we use to express our information needs, as well as document representations, is learned in a social context or community. Using Wittgenstein's theory of "language games," Blair explains that we do not acquire language purely by learning the word and its definition but instead by learning its use and appropriateness within the context of our "forms of life" or everyday experiences. Furthermore, we have to possess some prior understanding of the form of life or the language game context we are engaged in before the words can have meaning.

An important aspect of learning in general is the acquisition and application of the terminology of the subject. Children engage in "language games" as they go through their daily "forms of life" or experiences. Direct influences on their learning are their parents, teachers, the documents they engage with (textbooks, Web resources, etc.), and the information systems they interact with. Learning and knowing the appropriate "language" or terminology to use within these contexts is vital to their success both in information retrieval and content understanding.

O'Connor (1996) also notes that the user's developmental and cognitive state and domain and system knowledge, and the indexer's knowledge of the user and his/her intended purpose(s) for the objects, can affect representation and retrieval. His assertion is supported by the research community's exploration of obstacles or problems children encounter during information retrieval, such as term selection, developing and expanding search terms, and use of truncation and stemming (Abbas, 2001; Bilal, 2000a, 2000b; Cooper, 2002; Solomon, 1993). Studies of children's book indexing further illustrate the importance of understanding children's cognitive and developmental levels. Choosing age-appropriate terms and consistent use of word tense, as well as other issues concerned with order, display, and formatting, are crucial to providing appropriate metadata within indexes (Bakewell & Williams, 2000; Miller, 1973, 1980).

When creating representations for children, the process is further complicated by: (1) our incomplete picture of this group of users, (2) metadata schemes designed for use by adults and not children, (3) the lack of age-appropriate controlled vocabularies and guidelines used to create metadata, and (4) the differing cognitive abilities, developmental levels, and system knowledge of children.

## RESEARCH AND APPLICATIONS

While there exists a significant body of research into adults' use of information systems, information-seeking activities, and understanding of the system's representation schemes, little research has focused on children. Use of OPACs (Borgman, Hirsch, Walter, & Gallagher, 1995; Solomon, 1993), CD-ROM and other electronic resources (Large, Beheshti, & Rahman, 2002; Large, Beheshti, Nettet, & Bowler, 2003), and the Internet and/or WWW (Bilal, 2000a, 2000b) or digital libraries (Abbas, 2001; Druin, 2002, in press; Druin et al., 2003) by children has been investigated.<sup>4</sup> While information-seeking research is beyond the scope of this article, it still remains a critical piece of the representation puzzle and serves to inform researchers, metadata creators, and system developers of the unique needs of children. Currently there exists a considerable gap in our understanding about (1) representation issues in information seeking, (2) metadata schemes designed to describe children's resources, (3) the development

and use of age-appropriate controlled vocabularies, (4) the impact that using an age-appropriate metadata scheme and controlled vocabulary can have on children's information seeking and access, and (5) the advantages and disadvantages of involving children in metadata scheme and/or metadata creation. Research in each of these neglected areas is presented in the next section.

### *Representation Issues in Information Seeking*

Many factors impact information retrieval. Representation of resources or creation of metadata is a key factor. Retrieval requires an intersection of metadata used within the system and the user's search terms. Information-seeking research has uncovered representation obstacles such as spelling errors, misuse of search features, difficulty in selection of initial and alternate search terms, and the inappropriate nature of the system's controlled vocabulary (Moore & St. George, 1991; Solomon, 1993; Borgman, Hirsch, Walter, & Gallagher, 1995; Hirsh, 1997; Bilal, 2000a, 2000b; Shenton & Dixon, 2003; Abbas, 2001). Other research links children's cognitive and developmental abilities to issues of retrieval as well as system design (Cooper, 2002; Bilal, 2000a, 2000b; Borgman, Hirsch, Walter, & Gallagher, 1995; Hirsh, 1997).

Children's understanding of how a system works (not just searching), in addition to what is being searched—the metadata scheme and metadata—as well as the rules for creating metadata, is also important but has received little attention by researchers. Children are required to understand and use a variety of systems, each of which (on the surface) contain different search mechanisms, interface designs, and metadata. These differences can be confusing to users. Behind the surface, systems use different metadata schemes and controlled vocabularies. Jacobson notes: "there is no metaphor or analogy within a child's experience that enables a useful link to this form of knowledge representation. . . . [Furthermore] this is not to say that an appropriate (or matching) mental model will always make children more proficient searchers, but it will give them a better chance of understanding the tool they use for searching and why searches might come out the way they do." (1995, p. 68).

Studies of adults' understanding of controlled vocabularies such as Library of Congress Subject Headings (LCSH) indicate that even they do not understand how controlled vocabularies are used in systems and that they, the users, can actually use these lists of terms in searching (Drabenstott, Simcox, & Fenton, 1999). Theimer (2002) also indicates a lack of congruence may occur between a user's meaning for the search term and the meaning or definition of the term by the controlled vocabulary's creators.

These studies indicate that the obstacles encountered by children during information retrieval may result because of representation issues such as inappropriate controlled vocabulary used to create metadata, or metadata

schemes that might not include elements children expect or need to find when searching. The research further suggests that systems designed for use by children should use both a metadata scheme and a controlled vocabulary that has been specifically designed with younger users' cognitive and developmental needs in mind.

#### *Metadata Schemes Development*

Few research studies of metadata scheme development or augmented metadata schemes for use in children's systems have been reported in the literature. This remains a largely neglected but vital area of research. Examples that we might learn from include (1) OPACs designed specifically for children, (2) commercial database vendors' renewed efforts to provide "kid-friendly" systems, and (3) developments within the digital libraries community to design user-centered digital libraries for children.

*Systems Designed for Children and Young Adults* Beginning in the 1990s researchers began studying children's OPAC and database use. Their findings led to many developments in systems and interface design based on an awareness of how children search, which features they like to use, and their obstacles to retrieval. Borgman, Hirsch, Walter, and Gallagher (1995) developed a keyboard-independent system that enabled children to browse subject content of a science collection. The focus of their studies examined children's engagement with the system and the effectiveness of the iterative design of three different interfaces. They did, however, make use of a standard controlled vocabulary (LCSH) to represent the documents within the collection.

Two examples of OPAC interfaces that augment an existing library catalog's metadata scheme in order to make representations more appropriate for children are the Bücherschatz and Book House interfaces. Bücherschatz, a prototype hyperlink catalog for children developed in Germany, uses descriptions written specifically for children. The descriptions are designed to peak the children's interest and to be whimsical, fun, and thrilling. This catalog uses three primary access points into the collection for the children: books for fun and leisure; books on children's life and problems; and other nonfiction books. Each of these three access points is represented by a picture: an octopus, a seagull, and a pirate. The catalog uses a treasure hunt theme as the metaphor of children searching for information or "treasure," hence the graphics used for the main access points (Kulper, Schultz, & Will, 1997).

Pejtersen developed Book House, a Danish interface for children's materials. This interface is icon based and includes very in-depth metadata. The bibliographic records include additional information such as level of reading difficulty, time period, geographic location, and the emotional effect the book may produce. At the time Book House was developed these elements were not traditionally found in bibliographic records, nor are they

all present today. Lundgren and Dalgaard further augmented the system with an online form that allowed the children to write book descriptions themselves. The book descriptions were primarily written by eleven and twelve year olds and contained very emotive descriptions of the books as well as evaluative comments of the books (Lundgren, 1998).

Commercial OPAC vendors have also been implementing child-centered interfaces to their OPACs. For example, the Kids Catalog, developed by Sandlian, Busey, and Doerr in 1990 (Sandlian, 1995); Kids Online, developed by the vendor Innovative Interfaces; DRA Kids, developed by Data Research Associates; Book House, developed by Pejtersen and later tested and augmented by Lundgren and Dalgaard (as mentioned above); as well as other Web-based interfaces such as Follett Software Company, Book Systems, Inc., Inspire Kids, and Just for Kids have taken into account researchers' findings on children's information-seeking activities in their design.

*Commercial Databases* Recently, emphasis on the development of age-appropriate interfaces for commercially available online databases (Gale Group's Kids InfoBits, EBSCOHost's Searchasaurus, and others) can be noted; however, more research into their use and impact needs to be conducted. While much of their efforts appear to be focused on interface design and searching functionality, they have begun to use content-specific metadata schemes and subject-specific controlled vocabularies.<sup>5</sup>

*Web Developments* A wide variety of metadata schemes are being developed as more subject directories, Web portals, and digital libraries appear online. Web metadata creators use either generic metadata schemes such as the Dublin Core (DC) to represent resources, or they adapt existing metadata schemes such as Machine Readable Cataloging (MARC) and DC by adding additional elements (or database fields) that are subject or audience specific. Additionally, specialized metadata schemes are being designed with a particular group of user(s), resources, and uses in mind. The research literature and case studies of metadata scheme creation focus on the development, use, and adaptation of metadata schemes. Other emphasis is concerned with system architecture and interoperability issues.

Subject directories and Web portals for children have either developed simplified metadata schemes or have augmented interface features to allow for subject-based category browsing or hierarchical browsing. KidsClick, designed by a group of librarians at the Ramapo Catskill Library System in New York, uses a simplified metadata scheme including only five elements: Web address, title of site, brief description (abstract), reading level, and subject headings. The KidsClick metadata scheme has been adopted by the Colorado Virtual Library for Kids with an additional metadata element added for content standards to make it useful for teachers who access the collection (Bailey-Hainer, 2001).

*Digital Library Developments* Digital libraries have mainly adult users (educators, business communities, general users of varying ages) as the focus with very few digital libraries being designed specifically for use by children. It is difficult to find documentation on each of the different systems' metadata schemes and controlled vocabularies. Visiting their Web sites unveils little in terms of system design. Few case studies have yet been published with metadata scheme development or controlled vocabularies as their focus.<sup>6</sup> A further issue is the lack of coordinated effort between the communities (El-Sheribini & Klim, 2004). A few researchers in the digital library community have designed systems and interfaces for children's use and have been exploring more innovative approaches to metadata scheme development and metadata creation. These are described briefly below.

*International Children's Digital Library (ICDL)* Druin (1999, 2002, in press), Druin et al. (2003), and Reuter and Druin (2004) have been working with young children as design partners to create the International Children's Digital Library. The research team worked with children to design the interface, specialized search features, metadata scheme, and categories for classification, access, and organization of the resources. The ICDL collection contains almost 600 digitized children's books in at least 30 different languages. Children are able to access the resources by several innovative means: (1) clicking on the geographic location or continent on a spinning globe, (2) browsing with three different interactive screens, and (3) searching with traditional and nontraditional access points (such as name and author, but also emotive response, shape, and color).

ICDL user studies relevant to this article indicate that children preferred searching using nontraditional metadata elements (search categories) such as age level, language, genre, color, or "how books made children feel." These findings suggest that we need to rethink metadata schemes in systems designed for children. Children *did not* prefer the same elements in metadata schemes as those traditionally used by adult users.

*National Science Digital Library (NSDL)* Members of the NSDL community have been developing a wide variety of digital library collections for use by K-16 users and educators. This digital library community is exploring issues of (1) system architecture, (2) metadata scheme development, (3) interoperability of metadata schemes, (4) harvesting (sharing) of metadata, (5) content creation rules/guidelines, and (6) controlled vocabularies for elements in the metadata scheme. The current and previous NSDL funded projects note other promising projects relevant to metadata scheme and metadata creation. For example, Alice Agonino's "Developing a Learner-Centered Metathesaurus for Science, Mathematics, Engineering, and Technology Education" (NSF DUE grant #121743) project is developing a user-centered metathesaurus by examining user queries; and Marcia Zeng's "Quality Analysis of the Metadata Records in the NSDL Metadata

Repository" (NSF DUE grant #333572) will develop standards for quality assessment of the metadata developed for NSDL records.

While there is a wide variety of metadata schemes available, content creation guidelines/rules are not as prevalent in the Web environment (Sutton, 2004), which can make representations inconsistent and present many problems to metadata creators who wish to share metadata or who are concerned with interoperability between their system and other online systems. Digital library communities such as Dublin Core, the Gateway to Educational Materials (GEM), and the NSDL have ongoing efforts to develop content creation guidelines for their members to use when creating metadata.

#### *Controlled Vocabulary Development*

Metadata for digital resources is obtained using three primary methods:

1. Catalogers/metadata creators or individuals not involved in the creation of the resource; these creators may or may not be librarians or subject specialists
2. Authors or creators of the resources
3. Software tools used to harvest the metadata, such as the Open Archives Initiative (OAI) Harvester used by digital libraries such as the NSDL

Libraries have been creating representations or catalog records for children's resources for many years. Catalogers create representations using the MARC database scheme and guidelines or rules for content creation present in the Anglo American Cataloging Rules (AACR2) and/or Library of Congress Subject Manual. Other resources used include controlled vocabularies and classification schemes such as the Library of Congress Subject Headings (LCSH), Sears List of Subject Headings (Sears), subject-specific thesauri, and the Library of Congress Classification (LCC) or Dewey Decimal Classification (DDC) schemes.

Controlled vocabulary use in Web and commercial systems also varies. It is often difficult to determine which vocabulary a system is using because of the scant documentation on the system's Web sites and/or the lack of literature containing this information. It is also difficult for collaborative efforts such as the NSDL and GEM to require their members to use any one specific controlled vocabulary. In several digital libraries LCSH and/or specially designed thesauri, ontologies, and classification schemes are being developed and used, but these controlled vocabularies are designed to meet the information-seeking needs of adult users, not children.

Development of controlled vocabularies has focused on the user as either a homogenous group with no age specified or on a specific discipline or domain. Few efforts to develop controlled vocabularies for children exist. The following section will outline efforts to develop age-appropriate controlled vocabularies, as well as detail the current systems that are being designed to involve users in the metadata creation process.

*Past and Present Efforts* Perhaps the most significant effort to develop or adapt an existing vocabulary for children's metadata creation is the Library of Congress' (LC) Annotated Card (AC) program. In 1966 the Library of Congress established the AC program, which is currently administered by the Children's Literature Team of the Library of Congress History and Literature Cataloging Division. The program has adapted the LC's cataloging guidelines and practices and has modified the LCSH as well as the guidelines for their application to be more appropriate for the representation of resources for children up to the age of fifteen years. The AC guidelines address issues of creating age-appropriate metadata in the description, name, subject, and classification elements in the MARC metadata scheme (Association for Library Collections and Technical Services [ALCTS], 1998).<sup>7</sup>

Another controlled vocabulary, predecessor to the Annotated Card list, is the Sears List of Subject Headings (Sears). It was designed for use by small libraries by Minnie Earl Sears in 1923. Sears differs from LCSH and AC in many ways that make it appropriate for representing children's resources. For example, it contains fewer technical terms, prefers common names instead of scientific names, uses direct geographic subdivisions, and has converted inverted headings into direct forms (Miller, 1998).

A further effort by members of the Online Computer Library Center's (OCLC) Knowledge Organization research team has produced "Subject Headings for Children," a list of approximately 20,000 LCSH subject terms. The list was compiled by searching OCLC's WorldCat database of bibliographic records. The list includes LCSH terms and some specially devised terms. Name headings from LC's Name Authority File are also included. Reviews indicate that the list is probably useful but still contains many inappropriate terms, such as "miscellanea," and it does not incorporate terms in common use by children (Towsey, 1999).

Other smaller-scale efforts include Jansson's development of a special thesaurus for children consisting of about 800 simple, concrete words within 21 areas of interest. Librarians using the list to represent documents are encouraged to add to the list as they feel necessary. This list has been distributed to libraries in Sweden, where it has been met with much approval (Lundgren, 1998).

*Users as Contributors* Even less attention has focused on the potential of involving the children who use the system in the creation of metadata. Abbas (2001, in press-a) has been exploring the use of children's search terms as a source for controlled vocabulary. She has created a list of student-generated keywords (SGKs) by comparing users' most frequently used search terms to those of the controlled vocabulary used by the ARTEMIS Digital Library, a digital library of science and technology resources for fifth through twelfth grade students. (The controlled vocabulary used by ARTEMIS is UMI's Proquest Controlled Vocabulary, not specifically designed for use in

children's resources.) Frequently-used search terms were mapped for direct, synonymous, related, complete, and partial phrase match. Terms that did not match the system's controlled vocabulary were then compiled into a list of student-generated keywords. Studies of using automated means to map user's search terms to terms used within the system's controlled vocabulary have been explored but mainly in the medical or business domains and *not* for systems used by children (Greenberg, 2001).

*Efficacy Studies* The efforts detailed above show promise. However, little effort has focused on determining if existing and developing sources of metadata meet the needs of children. Studies examining the impact the use of age-appropriate metadata schemes and/or controlled vocabularies can have on children's information seeking and access are difficult to find. Abbas (2001) used a list of SGKs, as detailed above, to augment existing metadata in the ARTEMIS Digital Library. She then re-executed a subset of the students' original queries and compared the two result sets. Thirty-two percent of the search results showed an increase in the number of relevant documents retrieved that contained SGKs.

Other studies we can learn from are the extent of match studies conducted by Taylor (1984), Markey (1984), Carlyle (1989), Doyen and Wheeler (1989), Lester, (1989), and Drabenstott and Vizine-Goetz (1990), in which users' search terms are compared to those of the controlled vocabularies used by the system. At least one study has tried to ascertain users' understanding of metadata descriptions. Drabenstott, Simcox, and Fenton (1999) studied end-user understanding of subject headings in library catalogs. Their study did include children and findings indicated the following: (1) there were differences between adults' and children's understanding of subject headings, and (2) children understood the meanings correctly only 31 percent of the time, while adults had the correct meanings only 39 percent of the time. Jacobson (1995) notes that the most prevalent controlled vocabulary in use in library systems, the LCSH, contains "arcane words that are at most above the sixth grade level," thereby making their use inappropriate for younger users.

These studies all illustrate to varying degrees *adults'* understanding of subject headings and their use in library OPACs, with little information on *children's* understanding of the metadata or the controlled vocabularies used. More research should be conducted into users' understanding of the controlled vocabularies being used by our systems, as well as the efficacy of the development and use of age-appropriate metadata schemes and controlled vocabularies.

## CHALLENGES AND OPPORTUNITIES

### *Challenges*

As illustrated throughout this article, there are many gaps in the research on metadata creation and the development of age-appropriate metadata schemes for children's digital resources. While designers of systems and the digital library community are working through many of the issues of building user-centered systems for adults, more attention needs to be paid to younger users and their unique needs.

Information seeking and usability studies *are* beginning to help paint a more complete picture of children's information seeking activities and the obstacles they encounter. From prior studies with children we know that (1) children have difficulty using systems designed for adults and encounter many obstacles such as spelling errors, misuse of search features, and difficulty selecting search terms; (2) children's cognitive abilities and levels of development have an effect on their information seeking and retrieval success; (3) systems designed for children may not include age-appropriate metadata schemes and metadata; and (4) children prefer using nontraditional search elements such as color, genre, age level, or emotional response.

What we do not know much about is (1) children's understanding of or mental models of systems or how they work; (2) how this lack of understanding affects their information seeking; (3) if the new child-centered systems have had a positive effect on their information retrieval, and (4) how the use of age-appropriate metadata schemes and metadata will alleviate some of the information retrieval obstacles children encounter. These gaps represent rich research areas that need to be explored further.

### *Opportunities*

The few studies conducted to date (Abbas 2001; Reuter & Druin, 2004) indicate that children can benefit from metadata schemes and metadata developed with their unique needs in mind. However, to date few efforts to develop age-appropriate controlled vocabularies for metadata creation have been reported. The author realizes that development of controlled vocabularies is a very lengthy process with many variables that must be considered and communities that should be involved. There exist, however, many as yet untapped potential sources of terms, including the following: (1) users' search strings that are gathered as part of OPAC, database, and digital library systems' operations; (2) textbooks and other resources used in classrooms that have been designed by education experts (thesauri, dictionaries, encyclopedias, etc.); and (3) Web resources created specifically for children. Another resource that holds promise is word frequency lists that are compiled by researchers in education and reading studies. These lists include terms that appear frequently in the literature (fiction and non-fiction) being read by particular age groups (Stuart, Dixon, Masterson, &

Gray, 2003). These sources could be a rich resource containing terms that children are currently learning in their "language communities."

Automated mapping from search terms to metadata is being explored for use in the business and medical communities. Why not for children's systems as well? If this proves to be a viable solution to resources for adults, it should also be explored as an option for younger users.

These are but a few suggested possibilities worth exploring. However, what might yield the *best* possible results is to continue working with the children themselves. Involving children in metadata creation will give us more insight into this user group's unique representation needs. Involving them in the *entire* system design process will teach us more about them, their information needs and system use, and the obstacles information professionals and researchers still need to address.

## NOTES

1. For the ease of the reader, the term "children" will be used to indicate both children (ages 0–11) and young adults (ages 12–18).
2. The term "resources" refers to any of the multiple formats of digital objects that might be found in an online system, for example, textual Web pages, images, multimedia, sound files, etc. This article is not concerned with specific issues of representing different formats.
3. There are many definitions in use for the term "metadata." The most popular is simply "data about data." Due to the complex nature of representation or metadata creation, our definition is expanded to include the structured nature of the end product and the variety of differing schemes and content rules in use to create metadata. For a more detailed coverage of metadata and its many facets, as well as the many efforts and schemes being developed, refer to Hunter (2003) and El-Sherbini and Klim (2004).
4. These are but a few citations to this valuable research. For more comprehensive coverage, see Abbas (2003, in press-b) and Large (2005).
5. Further information on commercial online database vendors can be found at their Web sites: Gale (<http://www.galegroup.com/schools>), EBSCOHost (<http://www.epnet.com/school/esmenu.asp>), and Proquest (<http://www.proquest.com/>). Reviewing commercial databases' online documentation revealed little information about the controlled vocabularies or the metadata schemes being used by the systems. Online databases developed specifically for use by children, such as Gale Group's Kids Infobits, mention briefly that users' searches are reviewed, but no explanation of how this research was applied is available in online documentation.
6. Two examples of developing metadata schemes for specific users and collections are Metadata Objects Description Schema (MODS) and Learning Object Metadata (LOM). MODS is being developed by the Library of Congress' Network Development and MARC Standards Office, as well as other metadata experts. It can be used for a variety of purposes, particularly for library applications. As an XML schema it is intended to be interoperable with existing MARC 21 records, as well as be used to create new metadata. To learn more, visit the project site at <http://www.loc.gov/standards/mods/>. LOM, under development by the Institute of Electrical and Electronics Engineers (IEEE), is intended for use with collections of learning objects. To learn more about the scheme and the project visit <http://ltse.ieee.org/wg/21>. Case studies outlining issues involved in the development of metadata schemes, interoperability, collaboration, and technical infrastructure of digital libraries currently being designed for adults are presented in *Metadata in Practice* (Hillman & Westbrook, 2004).
7. For an in-depth history of the Library of Congress Annotated Card Program and application of the guidelines and use of the AC list of subjects, please refer to Zuiderveld (1998). Of particular interest are chapters 1 and 2 by ALCTS and Janet E. Gilchrist respectively.

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