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Building an Education Infrastructure for Allied Health

R. David Lankes, Ph. D.
Assistant Professor of Information Studies
Director Information Institute of Syracuse
Syracuse University
Syracuse, NY

621 Skytop Road
Syracuse, New York, 13244
rdlankes@askeric.org
(315)443-3640
Fax; (315)443-5448

Hugh W. Bonner, Ph.D.
Dean and Professor
College of Health Professions
SUNY Upstate Medical University
Syracuse, NY

Building an Education Infrastructure for Allied Health

ABSTRACT

This article discusses the emerging Education Information Infrastructure. It uses a five part framework (aggregating, organizing, using, tool building, and policy making) to describe this infrastructure and then uses the same framework to argue for a tightly coupled education information infrastructure specifically for allied health. This tightly coupled education resource would allow educators, allied health professionals and the general public to gain improved access to education resources on the Internet through metadata and digital reference services. Specific benefits of the building effort are discussed.

Introduction

Over the past decade much work has been done to exploit emerging Internet and digital technologies for education. This loosely coupled combination of websites, software, and services has been promoted as a means to improve how teaching and learning is conducted in primary, secondary and post secondary education. While there is some conflicting evidence as to the effectiveness of this emerging Education Information Infrastructure (EII), development and investment in it continues at a break neck pace[i].

Recent efforts in the construction of this infrastructure have taken several forms. The first is the creation of standards for education objects and services[ii]. The second is the development of targeted digital libraries for a given education audience such as the NSF's National SMETE Digital Library[iii]. This article presents a framework for

extending and enriching the EII for allied health. The authors attempt to: identify significant existing efforts that can be applied to allied health in their current form, where existing efforts can be modified for allied health education, and areas requiring significant development. The authors will also discuss perceived benefits to the development of an allied health EII.

A Framework for the Emerging Education Information Infrastructure

The authors adopt a five part framework established by Lankes and Sutton.[iv] The framework used to define various aspects of the EII in the context of the Internet, consists of five distinct core functions of the EII: (1) aggregating, (2) organizing, (3) using, (4) tool building, and (5) policymaking. The first three functions represent the core of the information system infrastructure that connects end-users with needed educational resources. The last two functions may be viewed as enabling functions without which a fully operable system as envisioned in our scenario is not possible. The remainder of this section will describe the parts of this framework.

Aggregating

Aggregating is defined as "bit bucket" or digital repository that is neutral towards file format, document purpose, or organization scheme. The digital repository simply stores digital objects for use by some third-party agent. One could use the analogy of a computer hard drive, where it stores hundreds of different files (word processing documents, music, programs), as a set of 1's and 0's.

Organizing

Organizing is the creation of context, or creating a higher level, abstract view of the information stored in a repository. Where the repository is simply a collection of digital objects with no inherent structure, an organizer imposes some structure, or broadly, a point of view, on the objects. As Lankes and Sutton state, "the organizing function can be likened to the organizational functions of the traditional library—albeit a library that contains only metadata (data about data) and no primary resources.[v]"

Using

Using is the application of some digital information or object, as housed in a repository and organized by some service or agent, to a given situation. Lankes and Sutton describe two aspects of information use:

> "(1) direct end-user information discovery and retrieval of educational materials through one or more of the mechanisms of organization, and (2) indirect information discover and retrieval performed for the end-user through digital agency.[vi]"

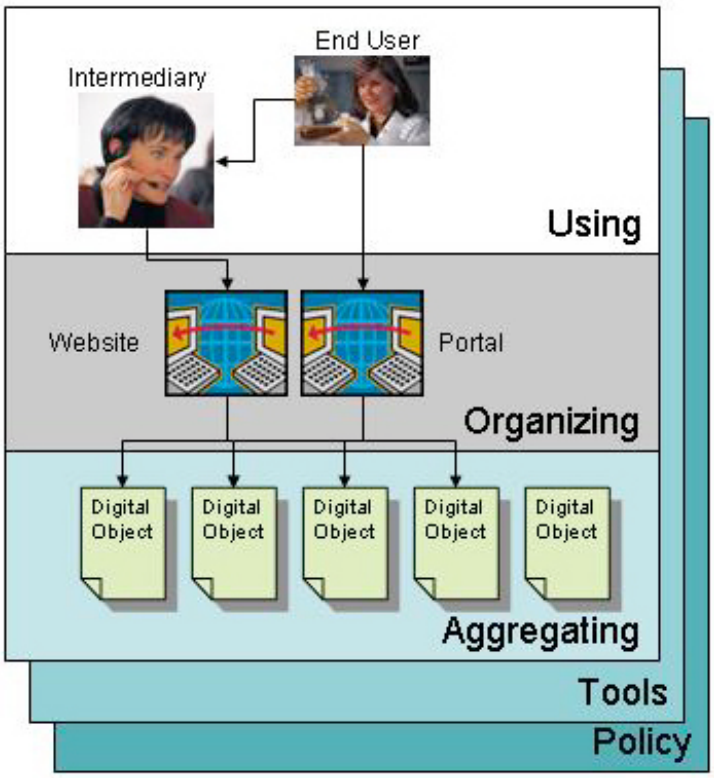
Digital agency is a form of intermediation by an automated agent or information consultant, such as a reference librarian or topical expert.

Tool Building and Policymaking

The enabling factors in the framework are tool building and policymaking. Tool building is "the design, development, and deployment of the enabling technologies for

aggregating, organizing and using.[vii]" These tools can be "soft," such as metadata and organizational schema, or "hard" such as code or hardware access devices. Policymaking is a human process for developing rules and guidance for building, maintaining and using the EII.

This framework is represented in figure 1:



Benefits of Building and Allied Health EII

The application of the Lankes/Sutton framework to the allied health education is an act of specifying and refining. Certainly the existing loose coupling of websites and Internet tools is already available to the allied health community. The purpose of determining existing and missing aspects of the EII for a specific community is to build a starting

point to produce a more tightly coupled and domain specific set of information and tools to improve allied health education using educational technology. By "coupling" the authors refer to the means by which information resources can be combined and linked. At one end, loose coupling might be a set of links retrieved from a full-text search engine where the information resources have no idea of each others existence, and the sites are aggregated simply by an outside and uninvolved piece of software.

An example of tightly coupled resources would allow for automatic inclusion of materials from different sources. So one college might mount a simulation of a heart lung machine on the web, then another college could create a lesson plan that pointed to that simulation, as well as launch the simulation with a set of specific conditions and settings appropriate to their curriculum. The pointer between the lesson plan and the simulation could be a "two-way" link that would be automatically updated if either the simulation or lesson plan changed Internet locations (URL's). The ability to create smart pointers to, and pass information between two separately created Internet resources are two critical aspects of tightly coupling resources.

Current efforts in allied health education are loosely coupled. Resources include college and university web pages, PubMed[viii], ERIC[ix], and public health web sites such as WebMD.[x] While many of these sites contain information that may be useful in the allied health classroom, they vary widely in quality, organization, terminology, ease of use, intended educational level and management. These resources are as easy to find and use in a classroom as is information about shopping, car repair or any other consumer field.

What is more, there seems to be a significant gap in the curricular dimensions of the information. When information is found on the web it is rarely ready for classroom use, or able to be tightly integrated into a course.

What the allied health educator needs is the ability to discover pertinent information, evaluate that information's applicability (including quality), retrieve that information, and integrate it into a larger curriculum. In order to do this more effectively, allied health information must be more tightly coupled. Imagine the following scenario that describes a tightly coupled EII system for allied health:

> A physical therapy instructor wants to teach a class on treating back pain. The instructor opens a web browser to a personal health care information portal mounted by his institution. Quickly browsing through a hierarchical list of terms he finds back pain. With a single click the browser window displays, according to the instructors preferences, courseware, articles from PubMed with full-text where provided by the local medical library, available experts for consultation, and syllabi mounted by the college. Quickly scanning through the image archive the instructor easily downloads them into a PowerPoint presentation that he is working on, embeds links to relevant articles in the class online website, and e-mails a few colleges for suggestions. He also downloads a few simulations demonstrating exercises for strengthening the back, and even attaches a short, automatically graded, quiz to the end of the simulations.

The ability to display information from a wide range of local and remote sources in a variety of formats (images, articles, software) on a single screen, and locate the resources through a single organizational view, in this case a hierarchical presentation of terms, necessitates a tightly coupled information space. A networked service or an organizer in the language of Lankes/Sutton, must be able to know ahead of time the way that information is described, and must be able to match these descriptions to personal profile information dynamically. This simply is not possible today with the loosely coupled

nature of allied health resources. The same instructor would have to do separate searches of PubMed, image databases, and no doubt, conduct several general web searches using a search engine such as Google, or Yahoo!, and be responsible (and technically literate) to incorporate the results of this information seeking behavior into yet another software package or packages if we include online course management software.

Allied health educators are faced with a choice: either develop a more integrated or coupled, set of resources and tools or expend resources constantly training faculty to use new loosely coupled tools and resources. Eventually stop gap measures such as hiring curricular support staff, will grow too expensive and introduce too many delays in the design and delivery of Internet enabled curriculum. Unless faculty are able to engage digital resources on their own, and quickly integrate them into an increasingly technical education environment, there will either need to be a massive change in how faculty teach, in essence team teaching with a curriculum support staff person, or a near perpetual faculty development process. A tightly coupled allied health EII will allow faculty to master a single set of logically interconnecting tools to access a collection of classroom ready resources of a predefined quality.

Applying the Framework to Allied Health Education

In order to achieve the benefits of creating a tightly coupled EII for allied health, the Lankes/Sutton framework must be tailored to the needs of the allied health education community. The following sections outline the areas needed to be modified, expanded, or developed for the allied health education arena.

Aggregating for Allied Health Education

Using the definition of aggregating as a digital repository of digital objects, there is nothing difficult or unique that needs to be done for allied health education. Because allied health education will produce digital objects, and repositories are by definition uncaring of purpose or format, any digital repository will do. Current repository research and technologies[xi] can be used. The only reason to build a repository specifically for allied health education would involve architectural issues such as network availability, responsiveness, scalability as well as an easily identifiable Internet location.

Organizing for Allied Health

There is a great deal of work to be done in organizing digital objects and services for allied health education. It is the means of organizing digital objects, as much as the objects themselves that makes information domain specific. For example, a video of a beating heart could be used in a discussion of surgery in identifying anatomical features of the heart, public health to discuss the importance of a health heart, or physical therapy to discus cardiac rehabilitation. This is an example off one video, three domains, and three contexts.

Organizing information for allied health education could be performed in a number of ways ranging from the current practice of providing a list of "approved" links to existing websites to a more centralized selection, description, management and dissemination of information in a single allied health education clearinghouse. However, each of these

approaches has inherent problems. In the case of the list of links there is nothing to create tightly coupled resources. In the case of a centralized clearinghouse, it belies the nature of the Internet and restricts the rapid development and deployment of information. Instead, existing research and development in education information infrastructure points to the need for the creation of distributed, specialized systems as a successful means of organizing information[xii].

A distributed organizing approach would use standard definitions of description (see the discussion of tool making below) and quality to enter information into the allied health EII through multiple interfaces into a single repository. By developing distributed access to a single digital repository organizations and educators could enter data quickly by distributing the task of creating, identifying, describing and entering educational items of interest to allied health, thus avoiding the bottleneck of a single gatekeeper. It would also allow a distributed set of stakeholders to create value-added interfaces to information for a given constituency.

So, for example, a given allied health college could organize the materials one way, highlighting information most relevant to its faculty and student body based on programs offered for example, where a hospital setting might present the same information very differently for a public health and patient audience. The point is, in both these cases the underlying data, and data structure are the same, it is interface and emphasis that differ. This mode of multiple interfaces on common data is preferred in that it allows individual stakeholders to meet the particular needs of a community. It also creates more specific

interfaces for specific users, rather than one monolithic interface for all, and it allows individual interface providers an opportunity for ownership and identity.

Using in Allied Health

As previously stated, Lankes and Sutton identify two aspects of Use in an education object economy or what this paper refers to as the education information infrastructure: direct end-user information discovery and retrieval, and/or indirect information discover and retrieval performed for the end-user through digital agency. There have been many studies evaluating the use of Internet resources for health education and in allied health[xiii], so this article will concentrate on the concept of digital agency.

Digital agency is the concept of using intermediation to represent a user to an organized collection. It is analogous to having a medical librarian search for articles on behalf of a physician, nurse, or allied health professional. The term used in the library science arena for providing intermediation in a digital environment is digital reference[xiv]. Digital reference constitutes a collection of intermediary services in libraries and expert populations (often referred to as "AskA Services"[xv]) that take user questions via the Internet and provide answers.

There is a number of existing digital reference services for health in general, but few in allied health or for allied health education[xvi]. One could imagine the creation of an allied health digital reference network that linked allied health educators and librarians together. Students, educators and even the public could send questions to this network and the

question could be distributed to the best answer source, based on factors such as expertise, curriculum offered, user preferences, or answer capacity.

While there are many issues in creating a digital reference network for allied health, much of the foundation for this work already exists in library practice and the research on digital reference[xvii]. Standards of practice would need to be created relating to quality[xviii], response time, ownership of created resources, and means of disseminating (routing) questions.

Tool Building for Allied Health Education

Lankes and Sutton identify the development of metadata as a key to the creation and ultimate success of the EII. Metadata is also a key element in the organizing function discussed previously. Metadata is simply defined as sufficient information about a digital object to understand that object's content and purpose without actually utilizing an object[xix]. A food label is an example of metadata. A consumer can know the name of an item (say "Peanut Butter"), the calories, ingredients, nutritional content, needed preparation, and even potential health risks about that food stuff without ever opening the jar. That information is a form of metadata. It is not the peanut butter, but everything the consumer needs to now about peanut butter to make an informed buying decision.

In a digital environment metadata can be used for even more elaborate transactions. Metadata can be attached to a digital object for discovery (describing where on the

Internet an object resides), retrieval (describing the contents of an object such as its subject or match to a given query), management (describing an objects use, currency, ownership), or use (describing an objects format, options for manipulation, size). What aspects of an object are to be described in metadata are up to particular use communities. A use community is constituted by a set of stakeholders including producers of information, such as authors, consumers of information like educators, distributors of information like publishers, and intermediaries like libraries. This use community is bounded by stakeholders who must interoperate.

Once this use community, in this case the allied health use community, comes together metadata can be standardized to allow tight coupling of education resources. The various parts of standard metadata that must be developed and/or agreed to include elements (the aspects of description such as subject, title, author, format, etc), values for those elements (such as the use of the National Library of Medicine's MESH[xx] for subject terms) and rules of encoding value information into elements ("is it first name, last name? What format do we use for dates?"). Taken together these elements make up a metadata scheme. This scheme can then be bound to other network technologies such as XML, RDF or even HTML. The emphasis of this article is on what aspects of the existing EII can be adopted in an allied health EII. The following paragraphs will identify existing metadata standards that can form a basis for an allied health education metadata scheme.

While there is a great deal of research and development in education metadata, there is a need for a great deal of translation and modifying needed for the allied health domain.

Lankes and Sutton cite several metadata standards in their article that are in use within the existing EII. Most of these metadata standards have coalesced in recent years into the Dublin Core Working Group on Education[xxi]. The Dublin Core "is an open forum engaged in the development of interoperable online metadata standards that support a broad range of purposes and business models[xxii]." It has become a sort of lingua franca in the metadata world. Dublin Core is, however, by its very nature broad and domain independent. The Dublin Core Element Set consists of 15 repeatable and optional elements (such as NAME, IDENTIFIER, VERION, LANGUAGE, etc) that should be able to describe any document-like object on the Internet.

Because of its broad nature, it has always been assumed that Dublin Core would be extended, or modified, for a given use community. The prime example of extending Dublin Core for the education community is the Gateway to Educational Materials or GEM[xxiii] which adds eight education specific elements to the Dublin Core (Audience, Cataloging, Duration, EssentialResources, Grade, Pedagogy, Quality, and Standards). The intention behind GEM is to create a standard means of describing education objects such as lesson plans, curriculum units and courseware. However, it is not intended to describe all educational objects for every domain equally well. For example looking at the vocabularies used to describe health information (table 1), it may seem quite obvious that allied health educators might use more specific terms based on career or degree paths (such as physical therapy, radiation therapy, clinical laboratory sciences, etc.)

Table 1: GEM Terms for Health used in the Subject Element	
Aging	Human sexuality
Body Systems and senses	Informal education
Careers	Instructional issues

Table 1: GEM Terms for Health used in the Subject Element	
Chronic Conditions	Mental/emotional health
Consumer Health	Nutrition
Death and dying	Process skills
Disease	Safety
Environmental health	Smoking
Family Life	Substance Abuse prevention
History	Technology

GEM also demonstrates the need to create an aggregating and organizing system specifically for allied health. Searching the GEM database (http://www.thegateway.org) for materials concerning health careers pertaining to higher education it found 70 documents. None of the documents found were cataloged for use only within higher education, with the vast majority cataloged as intended for grades 6 through higher education. Surely resources that sixth graders can use are not going to be easily used in a bachelors or masters program in allied health. This is not a criticism of GEM, it is intended for education generally, and K-12 education to a large extent. Rather, this simple search demonstrates a need for allied health as an educational domain to extend and specify tools for its own needs.

Policymaking for Allied Health

This article has made extensive use of the term stakeholder. Building an education infrastructure for allied health will require a wide commitment of various organization and individuals. These stakeholders will be called upon to perform several key functions in order to build an EII for allied health; namely:

- Determine the most appropriate means of aggregating allied health educational materials

- Define an organizational (metadata) scheme for allied health education information
- Describe educational items being shared
- Determine quality criteria/criteria for acceptance into an allied health EII
- Determine appropriate use policies for shared materials including fee structures and/or attribution

There are many facets of providing allied health education information in a shared and distributed fashion. What is ultimately needed is some form of governance structure that can widely solicit input from the allied health community at large, and the allied health education community in specific, and transform this input into operational systems and policies. Governance can be in the form of established professional societies, a new funded entity or project, or even an "adhocery" of interested parties willing to expend resources (time, money, equipment) to the purpose of making allied health education information more valuable and widely accessible.

Conclusion

This article has laid out a model for thinking about an education information infrastructure for allied health. This infrastructure could be used to improve education of both students of the health professions as well as the general public. Much work already exists in the area of infrastructure for education information, but there utility and a need to extend this infrastructure specifically for allied health. By creating a series of tools such as metadata schema, and organizing bodies allied health will be able to efficiently share information and improve the use of the Internet and information technology resources for education.

While improved access to Internet and information technology resources for education for allied health might seem abstract, there are real benefits. A tightly coupled system should decrease costs associated with faculty training, instructional support staff and costs associated with increased use of technology in the classroom. More than this, however, the goal is to increase the quality of education in allied health. The very processes of determining how information is structured, policy for selection and us, definitions of quality and technologies for rapid sharing of new educational materials are direct benefits of building a tightly coupled EII.

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[i] For a discussions of positive effects of educational technology and the EII see Carol A. Twigg, *The NLII Vision: Implications for Systems and States*. [Online] Available: http://www.educause.edu/nlii/keydocs/publicpolicy.html, 1997; see also, Twigg, "The Changing Definition of Learning," *Educom Review*. 29 (4): 23-25 (1994); Twigg, "The Need for a National Learning Infrastructure," *Educom Review*. 29 (5): 17-20, 1994; Twigg, "Navigating the Transition," *Educom Review*. 29(6): 21-24, 1994; Twigg, *Academic Productivity: The Case for Instructional Software.* 1996 (http://www.educause.edu/nlii/keydocs/broadmoor.html).

[ii] See IMS Global Learning Consortium, Inc. [online] http://www.imsglobal.org/ and IEEE Learning Technology Standards Committee (LTSC) [online] http://grouper.ieee.org/groups/ltsc/index.html and DCMI Education Working Group [online] http://www.dublincore.org/groups/education/

[iii] For more information on the NSDL see NSDL (2001). The National SMETE Digital Library [online] http://www.smete.org/nsdl/

[iv] Lankes, R. David & Sutton, Stuart A. (1999). "Developing a Mission for the National Education Network: The Challenge of Seamless Access." Government Information Quarterly 16(2).

[v] Lankes, Sutton pg 174

[vi] Lankes, Sutton pg175-6

[vii] Lankes, Sutton pg 177

[viii] PubMed [online] http://www.pubmedcentral.nih.gov/

[ix] ERIC [online] http://www.eric.ed.gov

[x] WebMD [online] http://www.webmd.com/

[xi] Robert Kahn and Robert Wilensky. *A Framework for Distributed Digital Object Services*. 1995 (http://www.cnri.reston.va.us/home/cstr/arch/k-w.html).

[xii] Assessing the Provision of Networked Services: ERIC as an Example. Lankes, R. David (2001). In McClure, C. and Bertot, J.C. (Ed.), Information Today: Medford, NJ.

[xiii] See for examples Bernstein, S. R.(1999) Web-Based Learning and Videoconferencing for Students of Physical Therapy. Journal of Instruction Delivery Systems; 12(4) p13-17 and Sosabowski, M. H. & Herson, K. & Lloyd, A. W. (Fall 1998). Implementation and Student Assessment of Intranet-Based Learning Resources. American Journal of Pharmaceutical Education; 62(3) p302-06 and Hedaya, M. A. (Spring 1998). Development and Evaluation of an Interactive Internet-Based Pharmacokinetic Teaching Module. American Journal of Pharmaceutical Education; 62(1) p12-16

[xiv] For more information on Digital Reference see Lankes, R. & Collins, J. & Kasowitz, A. (eds.). (2000) Digital Reference: Models for the New Millennium. New York: Neal-Schuman. And a Wasik, J. (2001). Digital Reference Resources. [online] http://www.vrd.org/pubinfo/proceedings99_bib.shtml

[xv] "Lankes, R. D. (1999). AskA's: Lesson Learned from K-12 Digital Reference Services." 38(1) Reference & User Services Quarterly.

[xvi] AskA+ Locator [online] http://www.vrd.org/locator/subject.shtml

[xvii] ibid Lankes, Collins & Kasowitz

[xviii] Lankes R. D. & McClure, C., & Gross, M. (2001).Assessing Quality in Digital Reference Services., In 2001 Proceedings of the 64st Annual Meeting (Vol. 38). The American Society for Information Science, Silver Spring, MD.

[xix] For more information about metadata see Introduction to Metadata [online] http://www.getty.edu/research/institute/standards/intrometadata/

[xx] Medical Subject Headings [online] http://www.nlm.nih.gov/mesh/meshhome.html

[xxi] DCMI Education Working Group [online] http://www.dublincore.org/groups/education/

[xxii] Dublin Core Metadata Initiative [online] http://www.dublincore.org

[xxiii] Gateway to Educational Materials [online] http://www.geminfo.org/