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招待論文

Digital Information Services Sponsored by the U.S. National Library of Education: ERIC · AskERIC · GEM

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The development of high-quality digital information networks is indispensable for global sharing of digital educational materials in supporting ICT-based learning in Japan. The trend is toward implementation of the global metadata standard in sharing high-quality educational materials worldwide. This article introduces three information services sponsored by the U.S. Department of Education including

(1) the ERIC database developed to facilitate international sharing of research outputs in the domain of education, supported by a distributed network of the ERIC system, (2) the AskERIC Question-Answering Service provided on the Internet to respond a variety of educational questions, supported by the Virtual Reference Desk (VRD), and (3) Gateway to Educational Materials (GEM) established to provide a one-stop shopping site for educational materials distributed on the Internet, with its supportive network of GEM consortium. Metadata standards developed by these three information services are described. Finally, the role of government in educational information resource sharing is discussed, using the three information services as a model.

Keywords
Educational Information Resources, Learning Materials, Databases, Question-Answering Services, Metadata

1. Introduction

The development of online communities has led to a variety of educational resources becoming available internationally via the Internet. The limitless amount of constantly updated information on a huge variety of topics makes the Internet a convenient tool, but this information can be a mixed blessing in that its reliability is at times questionable. It can also be difficult to find a specific source of information, such as a journal article, using detailed search conditions (e.g. author name, title, name of journal that carries the article, etc.) on an existing general-purpose search engine, as such engines operate only by keyword and classification. Recently, numerous Internet sites known as portals or gateways have appeared, enabling users to pick out high-quality relevant information from the Internet's resources.

The construction of a digital information

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network in the field of education is vital to support learning based on information communication technology (ICT). The U.S. Department of Education, one of the first to recognize this fact, set about developing the ERIC database in 1966 as a tool to efficiently locate sources of printed educational information, facilitating the worldwide sharing of such information among those involved in education. The U.S. Department of Education has also sponsored AskERIC, an e-mail-based question and answer service launched in 1992, (commonly known as the first year of the Internet era,) by the ERIC Clearinghouse on Information and Technology. Its aim is to provide information to those involved in education, including teachers, students, and parents. Since 1998, the U.S. Department of Education has sponsored the development of the Gateway to Educational Materials (GEM), a one-stop gateway site provided to assist people in finding digital teaching materials on the Internet. Various projects for Internet information sharing by the educational community have been implemented in this way. These projects, sponsored by the U.S. Department of Education, have resulted in the emergence of a de facto standard for metadata (i.e. data about data; the equivalent of a catalog of individual educational information resources) with which a range of highly reliable educational information resources can be easily shared and retrieved.

Even in Japan, where the progress of computerization is generally thought to be slower than the norm, there have been proposals for Internet-based promotion plans to circulate educational information resources. Preparations are underway to establish a core portal site for a range of information relating to education and learning at the National Institute for Educational Policy Research, as well as the EduMart initiative for promoting the circulation of educational materials. The implementation of these projects internationally and globally as well as in Japan depends on the incorporation of standards, especially those for metadata, created overseas. Additionally, the acquisition of the information sharing techniques cultivated over a number of years by the U.S. Department of Education will enable Japan to implement even more effectively the circulation of educational information resources.

With these points in mind, this paper describes the ERIC database sponsored by the U.S. Department of Education, the ERIC system supporting the database, the AskERIC Question and Answer Service, and GEM, a gateway to digital teaching materials, mainly in terms of the metadata standards created for them.

2. The ERIC System

The ERIC database, an information retrieval tool indispensable for those involved in education nationally and internationally, is provided by the ERIC system, which consists of ERIC clearinghouses based in various parts of the U.S. The following describes the roles of the ERIC clearinghouses and includes an overview of the ERIC database

2.1 ERIC Clearinghouses

The Educational Resources Information Center (ERIC) is an educational information network created by the U.S. Office of Education in 1966,and covers the whole of

the U.S. ERIC is run mainly by subject-specific ERIC clearinghouses located at the sixteen locations shown in Table 1. At subject-specific ERIC clearinghouses based at institutions such as a universities that have researchers of the target subject field, documents on the target subject are exhaustively collected from around the world, abstracts, indexes, commentaries and reviews are created on major themes and topics, and the ERIC database is constructed as a joint effort among these sixteen subject-specific clearinghouses of the ERIC system, as well as twelve adjunct clearinghouses[1] and four assisting organizations around the U.S.

The ERIC system assumes a dispersion-type organization through subject-specific clearinghouses because the U.S. educational system is regionally based; this organization is considered appropriate for the efficient collection of information. Since the institutions at which these clearinghouses are based have a research front for the target subject field, this organization also enables the collection of a wide range of education-related information resources through a network of people such as members of related societies and researchers of other organizations. Furthermore, it enables the construction of a chain mechanism effective in disseminating resources throughout the community of the target field.

Through such a mechanism, each ERIC clearinghouse periodically contributes an "ERIC Column" to an educational journal and creates Newsletters (public relations journals) carrying descriptions of practical models that serve as good examples, bibliographies carrying reviews and commentaries, and ERIC Digests de

Table 1. List of ERIC clearinghouses

Code	Applicable subject	Name of host organization
CE	Adult, Career, andVocationalEducation	Ohio State University
TM	Assessment and Evaluation	University of Maryland, College Park
JC	Community College	University of California at Los Angeles
CG	Counseling and Student Services	University of North Carolina at Greensboro
EC	Disabilities and Gifted	Council for Exceptional Children
EA	Educational Management	University of Oregon
PS	Elementary and Early Childhood Education	University of Illinois at Urbana-Champaign
HE	Higher Education	George Washington University
IR	Information & Technology	Syracuse University
FL	Language and Linguistics	Center for Applied Linguistics
CS	Reading, English, and Communication	Indiana University
RC	Rural Education and Small Schools	AEL, Inc
SE	Science, Mathematics, and Environmental Education	Ohio State University
SO	Social Studies / Social Science Education	Indiana University
SP	Teaching and Teacher Education	American Association of Colleges for Teacher Education
UD	Urban Education	Teachers College, Columbia University

scribing such topics as high-priority research and policy, periodically distributing them to those involved in education in the target field.

2.2 The ERIC Database

Abstracts and indexes created by each subject-specific ERIC clearinghouse are not only collectively published in printed-edition abstract and index journals but also accumulated in the ERIC database, a global database in the educational field, and offered worldwide via the Internet. ERIC database users in any country can retrieve necessary documents on any theme or topic related to education, and obtain the entire text on paper or microfilm (partly in digital data).

The ERIC database contains the metadata2 shown in table[2].

The ERIC database is available free of charge via the Internet[3] or on a paid basis on CD-ROM or commercial online services.

3. AskERIC—Digital Reference Service in the Educational Field

Since its opening in 1992, the AskERIC Question & Answer Service, an Internet

Table 2. Metadata of the ERIC database

Item name	Label	Overview
ERIC document number	ERIC_NO	Unique number assigned to each document contained in the ERIC database (ED number/CJ number)
Title	TITLE	Name (title) of document or object
Author	AUTHOR	Person responsible for the contents of the document or object
Publication date	PUBLICATION_DATE	Date when the document or object was published
Note	NOTE	Note on the document or object
Abstract	ABSTRACT	Summary of the document or object
Descriptor	DISCRIPTORS	Control keyword (assigned from the ERIC thesaurus)
Identifier	IDENTIFIERS	Free keyword
Document type	PUBLICATION_TYPE	Type of the document or object
Page	PAGE	Number of pages of the document or object
Clearinghouse number	CLEARINGHOUSE_NUMBER	Accession number at each clearinghouse
Availability	AVAILABILITY	Where the original document or object is available from
Prices	EDRS_PRICE	Prices of the printed and microfilm editions
Institution name	INSTITUTION_NAME	Institution that published the document or object
Sponsoring agency	SPONSORING_AGENCY	Sponsoring agency for the study or research
Contract number	CONTRACT_NO	Contract number of the sponsoring agency or sponsored organization
Education level	LEVEL	Target grade of the document or object
Language	LANGUAGE	Language in which the document or object is written
Region	GEOGRAPHIC_SOURCE	Target region
Abstract index magazine issue	ERIC_ISSUE	Issue of the printed-edition abstract index magazine (year and month published)

site that accepts and answers via e-mail various inquiries regarding education, has been popular among those involved in education, including teachers, parents and students. The following is an overview of the AskERIC Question & Answer Service, the mechanism of question response, question metadata items created based on previous question answering experience, and the archive of past questions used for sharing knowledge.

3.1 Overview of the AskERIC Question & Answer Service

Since 1992 the ERIC Clearinghouse on Information and Technology based at Syracuse University has been supplying an e-mail-based digital reference service in the field of education under the sponsorship of the National Library of Education at the U.S. Department of Education. The AskERIC Question & Answer Service, which started out as a short-term project involving one graduate student, was at first intended to be a question-answering expert system, but two years later became, and remains, a human-based information retrieval service for those involved in education.

The ERIC Clearinghouse on Information and Technology, staffed by eight full-timers in charge of AskERIC and over fifty part-time experts around the U.S., responds to a weekly average of 1000 questions received from around the world, normally within two business days.

3.2 Sending a Question to AskERIC

Users wishing to send questions to AskERIC should send the question either via e-mail [4] or by filling out the website's question submission form [5]. This form was designed based on the experience of the people in charge of the AskERIC service, as well as the results of user surveys and user information behavior analysis. The form contains items (see Table 3) to extract information useful in enabling the expert answering the question to provide the user with an appropriate answer.

3.3 The responses of AskERIC

Rather than providing users with direct answers to questions, AskERIC usually gives information on (1) Web sites likely to contain answers, (2) mailing lists related to the question, and (3) results of a search on the ERIC database based on the question. The links to Web sites and mailing lists that may be useful in providing answers are classified by theme, accumulated as the answering tool, and updated periodically.

AskERIC does however provide direct answers to questions regarding use of the ERIC system, such as how to search, submit documents, and handle the copyright of documents contained in the ERIC database. If an inquiry needs to be handled by an expert, such as a consultation from a parent or teacher with a problem child, AskERIC may refer the questioner to an expert such as a counselor or lawyer and /or attach an article of a law or its interpretation to the answer as required.

3.4 Users of AskERIC

The following shows the results of the analysis of questions submitted to AskERIC from January 1 to September 2000. Looking at the roles of questioners (see Figure 1), pre-school and K-12 teachers account for about a quarter of the total, followed by K-12 students (17%). Those

Table 3. Metadata items of AskERIC Questions

Item	Overview
Name	Name of the questioner
E-mail Address*	E-mail address to which the answer should be sent
Subject Line*	Subject of the question (eight English words or less)
Telephone	Contact telephone number of the questioner (used by the answerer to make an inquiry if the meaning of the question is unclear)
Your Question*	Write your question in plain text (English) .
Educational Level	Select an educational level from: ① Early Childhood,② Elementary Education, ③ Middle School / Junior High, ④ High School, ⑤ Higher Education, and ⑥Adult Education.
AskERIC Category	Select an AskERIC category from: ① not sure,② Counseling, ③ Educational Management, ④ Educational Technology, ⑤ ERIC, ⑥ Evaluation,⑦ Family Life, ⑧ General Education,⑨ Librarianship, and ⑩Specific Populations,⑪Subject (Math, Language, Art, etc.) .
Use Orientation	Select a use orientation from: ① Brief Research or Class Assignment, ② In - depth Research Report,③ Thesis,④ PhD Dissertation,⑤ To inform committee/school board decision-making, ⑥To guide classroom practice, ⑦to guide parenting, and ⑧Other/personal interest.
User Role	Select a user role from: ①Pre-School Teacher,②K-12 Teacher,③College Faculty,④ Adult Education,⑤ K - 12 Student,⑥ Undergraduate Student, ⑦ Graduate Student,⑧ Administrator,⑨ Counselor,⑩ Librarian,⑪ Parent, ⑫Policymaker, and ⑬Other.
Sources Already Searched	If you have already searched for information before sending your question, enter the Web sites that you used, printed information source, and ERIC database (and keywords that you used) .
US State You Are In	If you live in the U.S., select the state in which you live.
Country You Are In	If you live outside the U.S., select the country in which you live (Type one if it is not available in the list) .

*Items with an asterisk are mandatory.

related to universities such as undergraduate and graduate students (13%) and college faculties (12%) account for a quarter, while administrators (such as principals) accounts for 10%. Questions from children's parents account for 5%, while others (librarians, those related to the education profession, and government officials) account for 17%. The survey classifies users by role rather than by profession. This is because it is considered more beneficial to know the role a questioner plays in regard to the question than his/her profession, in order to infer and understand the intention of the question based on the characteristics of the questioner. As an example, a teacher who is also a graduate student is a "teacher" by profession, but is classified as a "student" if he/she asks a question as such.

In terms of use orientation (see Figure 2), class assignment or brief research (38%) comes out on top, followed by guidance of classroom practice (22%). The service is also used to inform PTAs and school boards (7%) and prepare for theses (7%). Other uses (26%) vary, including decision-making, marketing, and public preparation for lectures.

As to the geographical distribution of

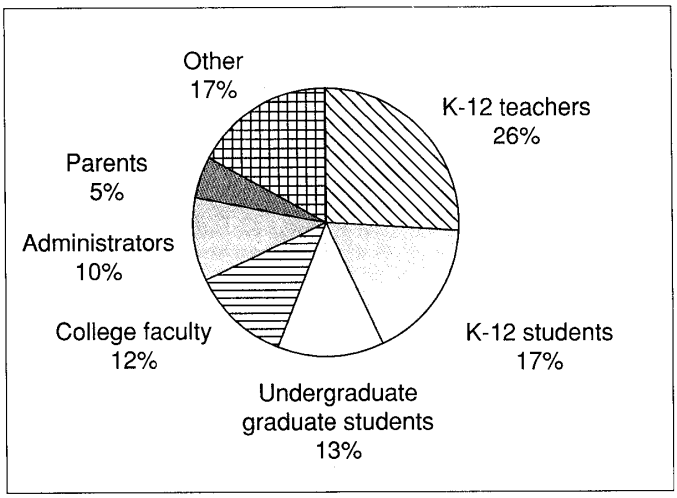


Figure 1. Breakdown of user roles (from AskERIC user survey 2000)

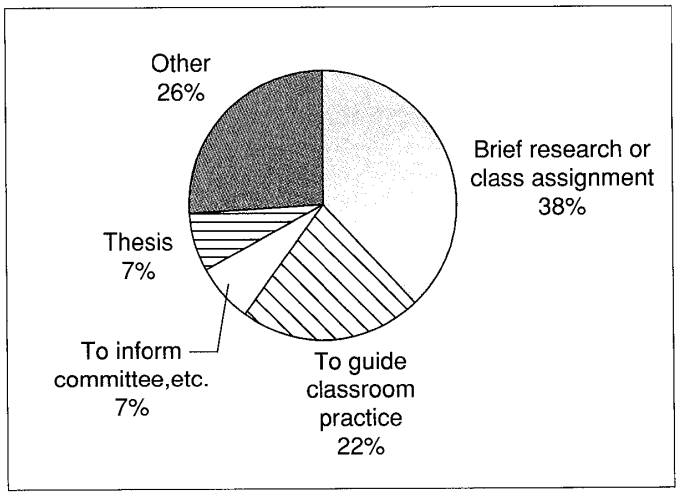


Figure 2. Use orientation of AskERIC (from AskERIC user survey in 2000)

users, those holding top slots in the U.S. are the States of New York, California, Texas, Pennsylvania, and Illinois. Outside the U.S., questions come mostly from countries where English is the mother tongue such as Canada, Australia, U.K., Israel, New Zealand, Malaysia, Hong Kong, and India.

3.5 Archive of AskERIC Questions and Answers

Like many other question and answer services, AskERIC receives many similar questions. AskERIC stores previous questions and their answers in an electronic archive to be consulted by staff. From this question and answer archive, a database of frequently asked questions (FAQ) has recently been created and made available to users[6].

By searching this database before sending a question to AskERIC, users can check whether a similar question has been asked in the past, along with any answers given. This database does not include the names or e-mail addresses of questioners and answerers in order to protect user privacy, but does provide for each question such resources as a list of information sources likely to contain answers, a list of related mailing lists, and the results of searches on the ERIC database.

3.6 Virtual Reference Desk as a Question Exchange System

In the U.S. field of education, many e-mail-based question and answer services, generically known as AskA services (pronounced ask-a), are provided as well as AskERIC. Fourteen AskA service providers (see Table 4) form a consortium. If questions outside the target range of each organization (out of scope questions) or too many questions to be handled by the processing capacity of each organization (overflow questions) are received, outside experts (volunteers such as librarians) are requested to supply answers. This organization, known as the Virtual Reference Desk (VRD), is run under the sponsorship of the U.S. Department of Education to provide appropriate answers to questions from as many users as possible. This consortium has held a conference[7] every year since 1999 to share technological trends and research results on digital references.

4. GEM—Gateway to Learning Materials

The Gateway to Educational Materials (GEM) is a gateway site used in sharing digital teaching materials. This site is run by the ERIC Clearinghouse on Information and Technology based at Syracuse University, under the sponsorship of the Educa

Table 4. AskA services participating in the Virtual Reference Desk project

AskA service	Service provider	URL
Ask Dr. Universe	*Washington State University*	http://www.wsu.edu/DrUniverse/
AskERIC	*Educational Resources Information Center*	http://www.askeric.org/
Ask Joan of Art	*National Museum of American Art, Smithsonian Institution*	http://www.nmaa.si.edu/referencedesk/
Ask a Librarian	*Florida International University Libraries*	http://www.fiu.edu/~library/services/asklib.html
Ask Shamu	*Sea World/Busch Gardens*	http://www.seaworld.org/ask_shamu/asintro.html
Eisenhower National Clearinghouse for Mathematics and Science Education	*U.S. Department of Education*	http://www.enc.org/
Internet Public Library	*University of Michigan School of Information*	http://www.ipl.org/
Kentucky Center for School Safety	*Eastern Kentucky University*	http://www.kysafeschools.org/
MAD Scientist Network	*Washington University Medical School*	http://www.madsci.org/
National Digital Library Program	*Library of Congress*	http://www.loc.gov/
NASA Quest	*NASA*	http://quest.arc.nasa.gov/
National Information Center for Children and Youth with Disabilities	*U.S. Department of Education, Office of Special Education Programs*	http://www.nichcy.org/
The Math Forum	*Swarthmore College*	http://forum.swarthmore.edu/
Urban Studies Laboratory	*Unicamp, Brazil*	http://www.labeurb.unicamp.br/

tional Library of the U.S. Department of Education. The above-mentioned AskERIC Question & Answer Service provided by the Clearing - house has received many questions on existing lesson plans from K-12 teachers having difficulties finding the desired teaching materials using a conventional search engine that allows users to search only by free keywords, although many lesson plans do exist as digital objects on the Internet. In response to such teacher information needs, a project was undertaken to collect lesson plans in the ERIC database. At the same time, the ERIC Clearinghouse on Information and Technology set about a project in 1997 to call upon organizations throughout the U.S. that collect digital teaching materials to form a consortium and provide a one-stop search facility for digital teaching materials created by these organizations. Opened in April 1998, the GEM gateway site stored only free teaching materials when the GEM consortium was established, but recently has come to store fee-based teaching materials due to requests made by publishers, etc. The GEM collection initially included about 2,000 items, grew rapidly in the three years since supply began, and as of July 2001 included metadata on 23,694 teaching materials provided by more than 300 organizations in and outside the U.S. (see Table 5).

Table 5 shows grade-by-grade distribution of GEM metadata (The cumulative amount of the recorded materials differs from the total as some teaching materials are intended for multiple grades.)

The following sections provide an over

Table 5. Grade Distribution of GEM metadata

Grade	Number of linked teaching materials
Kindergarten	4,044
Grade 1 (equivalent to first grade elementary school)	5,100
Grade 2 (equivalent to second grade elementaryschool)	5,380
Grade 3 (equivalent to third grade elementary school)	6,992
Grade 4 (equivalent to fourth grade elementary school)	8,436
Grade 5 (equivalent to fifth grade elemetary school)	8,995
Grade 6 (equivalent to sixth grade elementary school)	11,417
Grade 7 (equivalent to first year junior high)	11,497
Grade 8 (equivalent to second year junior high)	11,739
Grade 9 (equivalent to third year junior high)	11,792
Grade 10 (equivalent to first year senior high)	11,691
Grade 11 (equivalent to second year senior high)	11,518
Grade 12 (equivalent to third year senior high)	11,491
Community college (junior college)	931
Vocational education (special college)	242
Higher education (college and graduate school)	2,629
Adult and lifelong education	1,651
Total	23,694

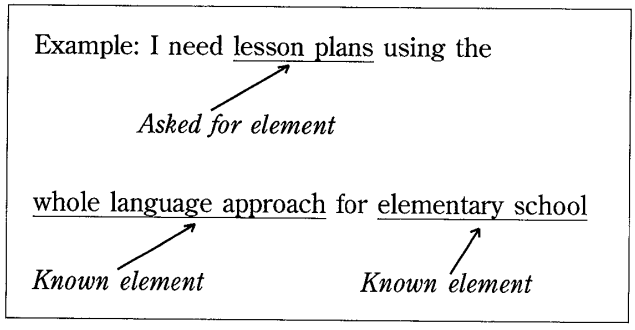
view of the research carried out to construct this gateway site, the design of metadata based on the results, and the service operation guidelines determined by the consortium.

4.1 Preliminary Research

(1) Analysis of existing teaching materials
From the lesson plans disclosed on the Internet, 95 samples were chosen. Through analysis of their contents, the following major elements were then extracted.

Activities (100%)
Teaching materials (96%)
Title (92%)
Purpose (90%)
Grades (79%)
Subject name (68%)
Author (writer) (58%)
Required time (34%)
Element that can be added (34%)
Additional teaching materials (28%)
Learning effect evaluation method (40%)

(2) Analysis of questions related to lesson plans submitted to AskERIC.
From questions related to lesson plans submitted to AskERIC, "asked-for elements" and "known elements" were chosen.



As a result of this analysis, the frequently asked-for elements were chosen as follows:

- Lesson plan(33%)
- Teaching material(9%)
- Idea/activity(8%)
- Curriculum(6%)
- Unit(4%)
- Purpose(2%)
- Guidance method(2%)

The frequently used known elements were chosen as follows:

- Subject name(49%)
- Grade(44%)
- Topic(40%)
- Attribute of questioner(18%)
- Characteristic of student(13%)
- Media(10%)
- Guidance method(8%)

Based on the above results, asked-for elements were selected as candidate items to be included in metadata; known elements were selected as candidate items in metadata to be used as search keys.

(3) Survey of information behavior by potential users
A questionnaire was e-mailed to teachers who had submitted questions to AskERIC. The survey was intended to identify the information retrieval behavior for creating lesson plans and the desired elements to be included in digital-version lesson plans.

A metadata database used to share teaching materials was created based on the results of these three research projects and the metadata element list known as

the Dublin Core, a recommended metadata standard used to locate information resources on the Internet. Opinions were then exchanged with the organizations concerned, including the GEM consortium members. For the construction of a metadata database, spider software that extracts metadata from existing digital teaching materials was developed and offered free of charge to the consortium members. At the same time, a metadata authoring tool (GEM-Cat) to facilitate the creation of new digital teaching material metadata was developed and offered free of charge to the members. To enable the smooth handling of copyright processing, the copyrights of metadata or content belong to the consortium on a shared basis, or to each of the authors and creating organizations. Copyright matters are then left to direct negotiations between users and creating organizations (authors).

4.2 Structure of GEM Metadata

Metadata is a set of data that describes an overview of contents. A library index, for example, is a form of metadata for the books in that library. Similarly, metadata with various structures is possible, depending on the nature of the contents. In 1997, the Dublin Core metadata item set (see Table 6) consisting of fifteen elements was proposed as a de facto metadata (catalog data) standard that enables a unified grasp of digital objects of all kinds in order to facilitate the retrieval of various information resources scattered across the Internet. In the GEM project, six original items (see Table 7) were established in addition to the Dublin Core metadata.

4.3 Relationship between GEM Metadata and Content-Owning Organizations

Each of the member organizations of the GEM consortium has local metadata corresponding to the content it owns. Such metadata contains HTML-format links to objects (contents as teaching materials). The GEM gateway site, at which people can carry out traversal searches, has a shared metadata database in which the local metadata of organizations are integrated.

Users searching the GEM gateway database can use an obtained link in metadata to arrive at the desired HTML object (contents as teaching materials).

To use the contents, however, the user must negotiate with the author regarding copyrights (or buy the teaching material if it is chargeable).

4.4 Copyright arrangements in the GEM Consortium

The GEM consortium operates the following arrangements[8] regarding copyrights of the shared metadata database, local metadata, and HTML objects (contents as teaching materials):

(1) Copyrights of shared metadata database

The GEM consortium owns all the copyrights for the gateway database in which GEM metadata records are registered. Members of the GEM consortium can use all or most of the gateway database in which GEM metadata records are registered for any of the purposes approved in the rules of the GEM consortium. Nonmembers of the GEM consortium, either groups or an individuals, wanting to use all

Table 6 GEM metadata items compliant with the Dublin Core

Item	Overview
Title	Name of object
Subject	Target area of knowledge, e.g. science
Author	Author of object
Description	Explanation of object, e.g. abstract or explanation of image data
Exhibitor (publisher)	rganization providing object. Internet site name is included.
Contributor	Intellectual contributor to object, e.g. editor, translator, illustrator
Date	Date of publication, revision, etc.
Object type	Object genre, e.g. lesson plan, unit, activity, etc.
Format	Format of object, e.g. postscript file, Windows file, etc.
Identifier	Character string (URL) used to uniquely identify the object
Relationship	Element indicating relationship between object (teaching material) and other objects (those with higher or lower ranks, other objects in same series)
Information source (source)	Information source of target object. Original version, other mediums with the same contents, etc. are indicated.
Language	Language in which target object is described, e.g. English
Target range	Space and time characteristic of target object (geography, history)
Right managem	Rights such as copyright and use conditions

Table 7 Metadata items added for GEM

Item	Overview (adopted by GEM)
Topic	Specific topic handled in teaching material, e.g.War of Independence, multiplication table, etc.
Grade	Grade targeted by teaching material (range of grades)
Purpose	Purpose of teaching material, why it is necessary, goals, etc.
External information	Related information sources on other sites on the Internet such as text, images, speech, and video
Standard	Curriculum standard (country or state) on which teaching material is based
Quality	Quality indication

or part of this database for profit or non-profit purposes must enter an agreement with the GEM operation group on a limited and non-exclusive license.

(2) Copyrights of local metadata

The copyright for each of the GEM metadata records contained in the gateway database belongs to the author of the record. However, the GEM consortium does not claim copyrights for metadata created by the GEM operation group by describing the teaching materials owned by GEM consortium members. The copyrights for these metadata records are reserved for the GEM consortium members who own the teaching materials thus described.

The GEM consortium does claim copyrights for GEM metadata records created by the GEM operation group by describing the teaching materials by non-members of the GEM consortium. The GEM consortium members provide each other with all the rights necessary for using the GEM metadata for non-commercial purposes.

(3) Copyrights of teaching materials described in GEM metadata records

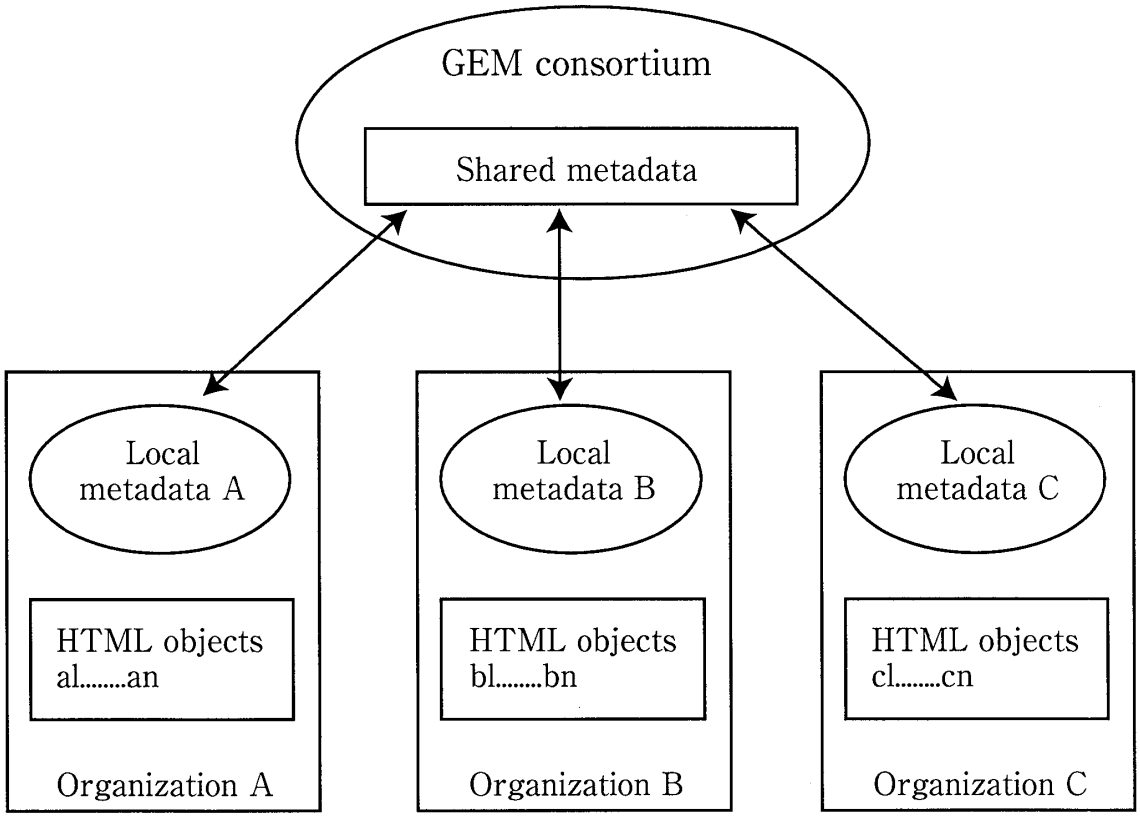


Figure 3. Relationship between data owned by member organizations of GEM consortium and shared metadata

The GEM consortium does not claim copyrights for teaching materials described in the gateway. All the rights and responsibilities for the copyrights for these teaching materials are reserved by the GEM consortium that provides the teaching materials.

As is apparent in the example of GEM, the system of sharing digital educational resources disclosed by multiple organizations on the Internet requires an information network technology and a metadata construction technology that effectively expresses information. Furthermore, it requires the establishment and operation of a body such as a consortium based on arrangements that define duties and rights, so that these organizations can interact on an equal basis.

5. Action Required to Popularize E-learning in Japan

The construction of a digital information network in the educational field is vital to support learning based on information and communication technology (ICT) in Japan. In recent years, the computerization of education in Japan has rapidly progressed, and as a result there are increasingly more digital teaching materials distributed on the Internet or via CD-ROM. Additionally, a wide range of electronic publishing and electronic journals is emerging. To date, however, Japan has not seen a system in which these digital educational information resources are integrated and shared on a nationwide scale. Although some of the

journal articles, books, and reports resulting from educational research are disclosed on websites independently opened by publishers, societies, and educational organizations, no tool enabling traversal searches of these resources like the ERIC database has yet been developed in Japan. If a system similar to the ERIC database is constructed to enable one-stop searches of educational documents of all kinds published in Japan, education researchers, teachers and students will thoroughly and efficiently be able to obtain research results related to their study or practice. Such a system would make an immeasurable contribution towards improving the efficiency and quality of education and research in Japan.

Although some digital teaching materials in Japan are posted by teachers on their websites, supplied by publishers to the educational market via distribution routes, and provided free of charge by education-related organizations including the National Institute of Multimedia Education, no gateway site has yet been developed to enable traversal searches of these teaching materials. The National Institute for Educational Policy Research's National Information Center for Educational Resources project aims to create a system enabling one-stop searches of all the education-related digital content scattered across the Internet as the core national center of all the information related to education and learning in Japan. A site providing one-stop searches of all the digital teaching materials of all the grade levels throughout Japan will enable the widespread sharing of high-quality teaching materials, allowing teachers to prepare more efficiently for lessons. Furthermore, students and parents will be able to select appropriate digital teaching materials themselves in order to promote spontaneous learning.

An Internet question and answer service to answer inquiries from a wide range of people involved in education (including teachers, students, parents, and administrators) and inform of related documents and experts and give educational advice, will contribute to solving various problems on education and promoting the sharing of educational knowledge. Additionally, it can be expected that users will obtain better information literacy by using such a question and answer service and nurturing skills to find necessary information for themselves.

As can be seen with the ERIC database, it takes time for the accumulation and sharing of educational information resources to have any kind of significant effect. In addition, an effort to attain standardization is required through the cooperation of government organizations, educational institutes, and private companies. An important role of the government organization in charge of education (the Ministry of Education, Culture, Sports, Science and Technology in Japan) is to assist wide-ranging efforts over the long term. The kind of information service provided and how it should be provided must vary according to the changes in needs of users. As an example, since the advent of the new information environment enabling widespread access to networked information resources, focus has been given to the necessity of functions to assist users of the ERIC database and facilitate searches for educational information resources on the Internet. As a result of this focus, the AskERIC question and answer service was

created. Since more and more lesson plans and curricula are now posted on the Internet, teachers have come to require one-stop searches for these materials, and AskERIC has received more inquiries on lesson plans and teaching materials. As a result of teacher requests for one-stop searches of high-quality digital teaching materials of AskERIC, GEM was created. Thus, an information service needs to be deployed on a long-term basis as well as flexible responsive to the changes in user needs whenever circumstances demand.

With the example of the U.S., the Department of Education has left the central tasks of information collection, accumulation, and sharing to education and research institutes with many personnel possessing expert knowledge and skills in the field of education. In this way, the operation can be continued at a relatively low cost over the long term, and the knowledge accumulated through the operation has been propagated widely in the special field of education. In Japan, too, it is expected that the government will cooperate with schools, colleges and private companies to promote the sharing of educational information resources in the long term. At this time, we should examine a way of globally sharing the educational information resources of Japan by adopting an internationally used metadata standard.

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[1] Adjunct clearinghouses of ERIC

[2] Metadata, generally defined as "(structured) data about data", refers to catalog data of target objects (theses and teaching materials for the ERIC database).

[3] URL of the Internet site at which the ERIC database can be searched free of charge: http://www.eric.ed.gov/searchdb/searchdb.html; http://www.askeric.org/Eric/ , etc.

[4] E-mail address: askeric@askeric.org

[5] URL of the question submission form: http://www.askeric.org/Qa/

[6] URL of the question archive: http://www.askeric.org/Virtual/Qa/archives/

[7] URL of the VRD conference: http://www.vrd.org/conf-train.shtml

[8] GEM Intellectual Property Statement: http://www.thegateway.org/legal.html

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