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Empowering Students in Information Literacy Practices Using a Collaborative Digital Library for School Projects

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Abstract

This paper examines the affordances that a collaborative digital library (CDL) can bring to bear on supporting information literacy practices in the digital information environment. It suggests that the digital library can contribute to student empowerment in information literacy practices while searching, using and collaboratively building the digital library resources. To illustrate this, the authors have been experimenting with the implementation of an integrated information literacy model based on Eisenberg and Berkowitz' Big 6 Model and describes the CDL features in association with the information literacy dimensions in this model. The CDL focuses on the project-based learning approach to conduct students' project, which supports specific information behaviors that underpin research and learning such as information seeking, browsing, encountering, foraging, sharing, gathering, filtering, and using. Findings regarding teachers' reception of the digital library are encouraging as they feel the relevance of the digital library to the current requirement of the students' project and its potential to entrench information and resource study skills through project-based learning.

Keywords: *Collaborative digital libraries; Information literacy; Electronic publishing; Project-based learning; Big Six Model; Malaysia*

Introduction

Information literacy (IL) today is seen as pivotal to the pursuit of lifelong learning, and central to achieving personal empowerment (Bruce, 2002). IL in recent years is inextricably associated with information practices and critical

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thinking in the Information and Communication Technology (ICT) environment. The way students research and discover information nowadays has changed tremendously as they have more ways to find information for their schoolwork and their daily lives. With so many different resources available, students today need IL skills to seek out information and to understand, evaluate, and apply what they find. As ICTs develop rapidly and the digital information environment becomes increasingly complex, teachers and librarians are recognizing the need for students to engage with the digital information environment as part of their formal learning processes. They see the importance of providing students with the skills to manage electronic resources and providing services and technology to gain access to information, as it is more crucial and more difficult to be able to filter out unnecessary information and weave together a vast amount of relevant information.

The digital information environment may potentially demand student fluency in competencies out with those outlined in various definitions of IL such as those by the Chartered Institute of Library and Information Professionals (CILIP, 2004), the Society of College, National and University Libraries (SCONUL, 2005) and the Big Six (2006). As digital libraries are becoming an integral part of the digital information environment, and it is envisaged that digital libraries "emphasize competencies like information literacy to support lifelong learning" (UNESCO, 2003). Mardis and Hoffman (2003) indicated that in the growing digital world, the potential for digital libraries to have a massive impact on education is no longer a theoretical future limited by access. Various studies have found that K-12 students are using Internet resources libraries for school research even when this is not a requirement, and noted that it was their primary source for school assignments. However, use does not necessarily equal efficiency or literacy in the use of information sources. Mardis and Hoffman (2003) recommended that digital library developers acknowledge and address this by designing tools and services that can adequately meet the needs of education. While many of today's educators are concerned about creating learning activities that require students' engagement with digital libraries, it is attention to information practices that are fundamental to effective information use. It is bringing these information practices into the curriculum and the classrooms, and ensuring that students have the opportunities and capabilities to engage in, and reflect upon such practices, that constitute IL education. Consequently, in using digital libraries, students not only exemplify the competencies noted by IL definitions, but they also have some competencies normally associated with managing information itself.

This paper attempts to show how a digital library can contribute to user em-

powerment in information literacy practices, through collaboratively building the digital library resources. Harvey (2004) defines empowerment as the development of knowledge, skills and abilities in the learner to enable them to control and develop their own learning. Using the definition of student empowerment related to the use of information given by Hewer (cited by Harvey, 2004), where empowerment provides students with the necessary skills to find and use information they need for school, study and leisure and equips them with transferable skills which they can use for all sorts of information retrieval and usage tasks enabling them to cope with the information age, we find that the various digital library features meets the requirements of this definition. First and foremost we emphasize that the students engage in their own development of a generic set of IL skills, and these skills can be practised and fortified using the collaborative digital library.

The collaborative digital library (CDL) in this work has been conceived to support secondary students' information needs in conducting research projects, and it may further be used to inculcate IL practices. Project-based teaching methods are increasingly used in Malaysian secondary school classrooms, in subjects such as Science, History, Geography and Living Skills, with the expectations that students will be engaged by the chance to use different information sources creatively and will especially benefit from the use of various presentation types to improve learning. One way that secondary schools in Malaysia are promoting IL is through resource or project-based learning (PBL), which places student projects at the center of the curriculum and encourages students to use a variety of technologies to find the information they need. In PBL students interpret, analyze, synthesize, generate, and evaluate information about a topic, collaborate with others, and report findings (Blumenfeld et al., 1991; Barron, 1998). As such, it can be said that school research projects are training grounds for real-life information explorations and the development of IL skills. The students produce products such as portfolios, learning and research logs, presentations, and papers that are evaluated by their teachers (Plotnick, 1999; AASL, 2000). Humes (1999) and Plotnick (1999) wrote that many students learn better from this kind of active involvement than they would from lectures and textbooks. Through the exploration of a theme and essential question that results in a product, students develop a more in-depth, applied understanding of an academic content area, philosophical issue, or social problem. To support students in these types of activities, students need a full compliment of tools designed to meet the unique needs of learners, and digital libraries have the affordances to support students in these activities, as discussed in the next section.

Digital Libraries Support PBL and Information Literacy Practices

Gersch (2000) noted that IL is the key to a successful technology initiative and emphasized the need for school libraries to provide Internet services and technologies such as digital libraries to gain access to information in order to create an information literate community. There are various digital library initiatives that support school children in carrying out inquiry and attempt to move children from doing searches to doing research. Fine examples of these, whose mission is to promote information skills in students through the references services, are such as KidsConnect (Lankes, 2003), Kid's Web (http://www.npac.syr.edu/textbook/kidsweb), and the International Children's Digital Library (ICDL) (http://www.icdlbooks.org/) and collaborative resource development such as Middle Years Digital Library Project (Abbas, Norris, & Soloway, 2002), Connecticut History Online (Foulke et al, 2004), and Canada's SchoolNet Digital Collections (http://www.schoolnet.ca).

As digital libraries have been of tremendous use to students' project works, PBL can be especially effective when supported by digital libraries. Research has also shown that PBL approach is effective in enhancing student motivation and fostering higher order thinking skills, especially when supported by Internet technology (Ryser, Beeler, & McKenzie, 1995; Grant, 2002; Sidman-Taveau, & Milner-Bolotin, 2004). Lynch (2003) contends that the project-based learning movement has given rise to considerable interest in the use of information resources as the basis for student-centered learning. Lynch is in the opinion that while print and audiovisual resources remain important tools in the learning process, it is the interactive digital resources that bear the greatest assurance for enabling students to engage with information and use it meaningfully in their lives. She adds that research that explores students learning with electronic resources will benefit them the most. Neuman (1997) has cited many studies to show how digital libraries become a platform for higher level thinking skills and higher level learning such as problem solving, decision making and creative thinking, skills which constitute IL.

Collaborative digital library

This research defines collaborative digital libraries as user-constructed systems, which serve to document the shared knowledge of the digital library community. Unlike other digital libraries which may grow around a shared discussion point or scenario, a collaborative digital library exists to allow the users to document and contribute their knowledge collaboratively. Collaborating to construct

digital libraries is a matter of building learning resources as well as an effort to show how authoring is possible, through a substrate technology, and an authoring tool allowing users to generate their own content and resources. This definition ties in the alternative "communal" views of libraries and publishings where holdings are created and managed by library users themselves (Sumner, 2000). Hedman (1999) pointed out that a collaborative digital library houses the possibility of being both an information storage facility as well as tools for production, and should work as information substrates, entities that allow for the dynamic generation of content. This enables the creation of digital libraries from grass root levels and this situation perpetuates the creation of communal repositories of knowledge resources. With this aim in mind, authoring tools are placed in the CDL, a feature that allows users to author their own information structures and to create or add existing content to those structures as they visit the digital library.

The distributed authorship of in a collaborative digital library has the affordances of students to become authors, as well as users of knowledge (Marchionini & Maurer, 1995); it also affords students the opportunity to access information from a variety of perspectives. Distributed authorship means that the digital library does not have central producers or gatekeepers of information (Cunningham, 1997). Also, as a result of its decentralized authorship, the types of resources available in digital libraries are different than more traditional K-12 resources, such as books, because of the identity and purpose of the publisher, and because of the media type of the information. Much of the content of a digital library, especially educational digital libraries, is published by individuals or organizations who are not professional publishers, but who may have some vested interest in the subject matter. What this means is that when a student performs a search on a specific topic, they will find resources that vary widely in source, quality, level, audience, and purpose, and this provides an avenue for them to analyse and evaluate these resources. Bos (1998) who studied the affordances of the Web as a publishing medium for students projects found out that the Web not only creates motivation and sustains engagement in students, but it also allows multiple presentation of knowledge in the forms illustrations, graphs or tables, diagrams, flow charts, or video, sound, and animation, as well as providing information resources and a setting to practice critical evaluation of these resources.

Collaborative digital libraries can provide a broad range of resources that make it possible for students to engage and be supported in meaningful inquiry. The challenge for teachers and teacher librarians is to help students develop strategies for collecting, evaluating and analyzing information which they find in digital libraries and observe in the physical world. When students are using a

digital library for conducting inquiry, they need to collaborate with other students, interact with a wider community of knowledgeable people, create projects, reports or other artifacts, publish their work, and have access to appropriate technological tools for making meaning of data and information, to manipulate, construct, and revise their representations and share them with others (Wallace et al, 1996). The CDL has been designed to support all of these activities and functions, and to assist its member providers in implementing these functions in a way that is consistent across many different resources and collections. The following section details out how we ascertain the requirements of the collaborative digital library to meet the needs to support PBL and information literacy practices

Ascertaining CDL Requirements to Support PBL and IL Practices

The CDL has focused on the PBL approach to conduct students' project, which clearly links information creation, sourcing, searching, evaluating, organising and presenting, to the design process of the CDL. In order to identify what is required of a digital library in a Malaysian context, our works initiate an examination of the needs of the digital library stakeholders and how the collaborative digital library might be designed to meet their needs through a case study approach. A single selected urban secondary school in Selangor, Malaysia is chosen for the following reasons: a) The school is willing to participate in the study; b) the school provides Internet connections and is situated near numerous cyber cafes, putting the stakeholders in an ICT rich environment; c) the school has an open and friendly atmosphere, encouraging community involvement and extracurricular students' activities. The study adopted multiple data collection techniques which incorporate (a) survey questionnaire involving 397 Secondary 2 and 3 students; (b) focus group interview involving 30 students who were willing to participate in the digital library project; (c) interview with six History subject teachers, teaching the Secondary Year 2 and 3 students; (d) site observations involving a series of visits to the school to observe specific environment of the collaborative digital library implementation; (e) document analysis of students projects and other documents related to the goals and objectives, as well as processes and procedures of implementing school-based projects; and (f) user testing and evaluation of the digital library prototype. History has been chosen as the domain of the digital library testbed based on earlier survey findings that indicated the students in the case school (n=395) mainly use Internet resources to get information for their History project (75.5%, 299). Students in an earlier focus group interviews (n=30) most of the time narrated examples of searching for information on History when using the Internet. As such, it is assumed that a digital library collection scope on History

would benefit the students.

An earlier study related to this paper indicated that the school is ready to use digital libraries as it has the infrastructure and the supporting environment, as well as willingness from students to act as potential collaborators to develop content (Abdullah & Zainab, 2007). A high proportion of students feel comfortable with digital resources, use them substantially, and are relatively well equipped to find these resources. Basically, the students do solitary information seeking, have spontaneous interactions with other people such as parents, siblings and friends and ask for help, and work with information in a group. However, a naive way of students' information seeking process emerged through the empirical study. Students' Internet explorations often are premature. In fact, they may grossly underestimate the research process, often forgetting the human side of the information picture: the planning, the processing, the thinking; the skills that we label **information literacy**. Their problems are most of the time associated with finding and gathering information. Since the learning activities are focused on information gathering, such important phases as refining the question, synthesizing and evaluating and information, are often neglected (Abdullah & Zainab, 2006). The teachers interviewed however indicated that the entire research activity is a cyclic process, and should be more than simply gathering information. It should encompass "posing and identifying the question, exploring available information, coming back to refine the question, gathering and evaluating further information, and synthesizing, using and presenting it" (Malaysia, Ministry of Education, 2006; Abd Rahim, 2000).

In other earlier works, we foresee the CDL as a tool to inculcate ICT skills among students and teachers (Zainab, Abdullah, & Badrul Anuar, 2003). IL did not come into the picture in the first place and the need to support IL comes by chance when we interview 30 students from the survey sample and analyse the students report (Abdullah, 2007b). During data-gathering, we are mostly concerned to answer the following questions: **What are the sources students use to obtain information? How do students conduct research in unfamiliar content areas? What are the unexpected problems students face in getting the information for their project? Do students engage in high-level synthesis and transformation between presentation forms, or do students simply copy and assemble information from different sources?** Document analysis of students' projects shows that most reports are mere recitation of information. Contents, especially pictures and illustrations, are either not cited, or cited inaccurately. Some reports have even inaccurate information. This was also supported by their teachers who indicated that difficulties in getting information from various resources leads to the presentation of reports that are "stereotype" and that very few students

can really produce reports that fulfill the objective of the PBL, which is in line with IL practices "to develop research and learning skills" (Abd Rahim, 2000).

Accessing the problems encountered by students in conducting their school projects, as had been highlighted by the students and teachers in the case study, formulate a new model for accessing, producing and sharing resources. The CDL focuses on serving students information needs in conducting research projects. As such, in the implementation of the digital library, the use of the online resources would be an integral part of PBL activities. Students should be enabled to access digital resources, create and publish their own documents in the digital library and share them with others. In this case, students should be allowed to create and submit their project reports in the electronic format. They are the content developers of the digital library. Though historically, project reports were written and submitted in paper or scrap-book form, the digital library may move the student community towards an emerging genre of digital resources as teachers too have been allowing students to word-process their report. Thus, as time moves forward, it is more and more common for students to prepare their project report with a computer. Reports that are submitted in the form of scrapbooks could be digitized and published in the "space" allocated for participating schools. With respect to end user access using the digital library, they may search the contents, retrieve collections of search results, and display the contents of result items consisting of multiple media resources. Figure 1 presents the projected effect on the activities, which are transformed into the processes the CDL should conduct. These processes are also in line with the school's plan to use the CDL to manage school projects (Abdullah & Zainab, 2006).

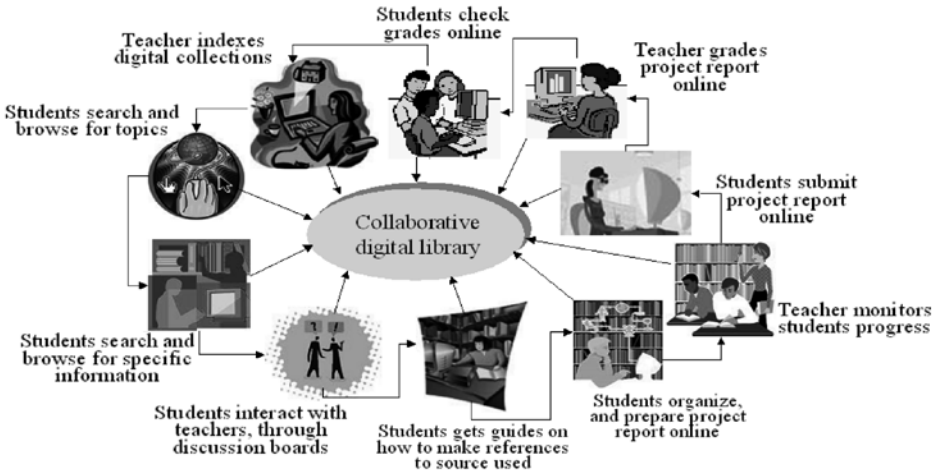

Figure 1 Activities Performed in the Collaborative Digital Library

Derived from the rich picture of the description of the activities, students and teachers would be able to perform the following activities in the CDL:

a) Students in general perform searching (seek specific information through) or browsing (navigate and expect to find topics available and some useful information). These two features have to be supported by the digital library. Students may search and browse graded project reports from previous years. The system is browseable at a minimum by collection to facilitate students to know the availability of topics.
b) Students and teachers perform simple search through a Google-type box for free-text searching although an advance search would be desirable. The survey found that students are very familiar with Google, they employed few search terms, rarely modified their queries, and rarely used advanced search features. Results are presented in a clean manner with a brief description of the digital content.
c) Students interact with teachers, through discussion boards, or other students via e-mails, especially when they have a vague idea of the information they are looking for or have difficulties in formulating specific queries. The research found that they were likely to confer with others during the topic selection stage. They often consulted with colleagues to obtain references at an early stage.
d) Students organize, prepare and submit their project report online. The digital library supports an authoring tool to author structure and content. Students may add and modify content and requires no special technical skills other than being able to click on links and buttons and fills in forms. Students prepare the references adhering to the correct format.
e) Students get other relevant and accurate information through linkages to other local history web resources; guides on how to write good reports and guides on how to make reference to each source used.
f) Students get information on how to use the digital library. User documentation is prominent throughout the system although the system should be easy to use by anyone familiar with the Internet.
g) Teachers check students' progress from time to time and keep track of students who have started documenting their project and those who have not.
h) Teachers evaluate and mark their students' project online, and communicate the grades to students once the projects have been evaluated.
i) Teachers index the project and other digital resources to make the contents available to be used by the students and other users.

As such, the objective of the CDL is to provide a learning environment and resources network for PBL which is: a) designed to meet the information needs of learners, in both individual and collaborative settings; b) constructed to enable dynamic use of a broad array of materials for learning, primarily in digital format; and c) managed actively to promote reliable anytime - anywhere access to quality collections and services, available both within and without the network. In this capacity, it establishes a digital information environment that is, a networked, online information space in which students can discover, locate, acquire access to and, increasingly, use information. In what follows, it is shown how the CDL can contribute to student empowerment in IL practices.

How Can the CDL Contribute to Student Empowerment in Information Literacy Practices?

While IL skills may be taught in Malaysian schools or school libraries, they can be practiced and fortified using the CDL. The CDL support specific information behaviors that underpin research and learning such as information seeking, browsing, encountering, foraging, sharing, gathering, filtering, and using. To demonstrate this, we have been experimenting with the implementation of an integrated IL model based on Eisenberg and Berkowitz' Big 6 Model (Eisenberg, 2001). The Big 6 Model has been embraced as it has a resonance with the objectives of the History curriculum PBL approach and CDL design process model, and uses similar, and therefore, familiar terminology. Developed by Mike Eisenberg and Bob Berkowitz, the Big 6 is a widely-known and widely-used approach to teaching IL. The information problem-solving model is used in thousands of K-12 schools, higher education institutions, and corporate and adult training programs, and is applicable whenever people need and use information (Eisenberg, 2001). The Big 6 integrates information search and use skills along with technology tools in a systematic process to find, use, apply, and evaluate information to specific needs and tasks. The model encompasses six stages namely task definition, information seeking strategies, location of access, use of information, synthesis and evaluation. The CDL features are described in association with the IL dimensions in the Big Six.

Task definition

The first step in the information problem-solving process is to determine exactly what the information problem is and then to determine the specific information needed to solve the problem. CDL facilitates this process as students will be able use e-mail or discussion board to generate topics and problems, communicate regarding tasks and information problems, either with teachers, or among group of students.

Information seeking strategies

This dimension of IL refers largely to students' level of ability to identify and find all possible sources, interpret the information and select the best sources. The CDL supports two types of search facilities, the simple search and the advanced search (Figure 2). The simple search is a Google-type box that basically provides free-text searching that will suit most new to experienced users, as the survey indicated that students in general underutilized advance search features of search engine. This is a combination of two settings, which are the Type Delimiter setting and the Dropdown Menu setting (Figure 2a). As illustrated, information seekers will be able to choose what best meets their needs based on these settings. In the Type Delimiter setting, each object type (such as documents, images, audio, video, hyperlinks and projects) can be unchecked to limit the search from retrieving the particular type. The Dropdown Menu setting on the other hand is a set of three pre-set options that each represents a search methodology. The three available options are "Match Any Of These Words", "Match All Of These Words" and "Match Exactly This Phrase". At the same time, a reasonable compromise between Google and a system to please an expert searcher who wants to search for specific occurrences of words is provided (Figure 2b). The system has taken on this responsibility of assisting the users to fine-tune their queries through multi-criteria search settings. Students can learn the more fluent use of search tools, mainly in the capacity to narrow and revise searches to better specify what they want. If the user's goal is browsing, s/he may view the resources by collection, period (year), resource type, alphabetical order and thumbnail images (Figure 3). Browsing is based on Modified Dublin Core metadata and the historical collections are also categorized based on multimedia type to facilitate users to choose based on categories.

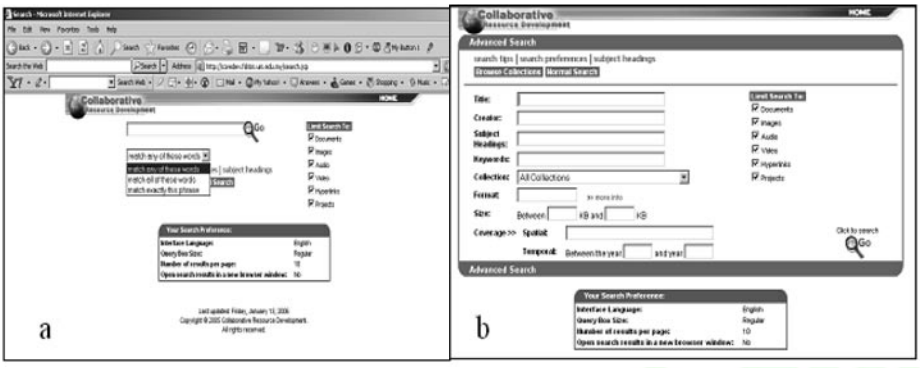

Figure 2 The Search Facilities a. Simple Search; b. Advanced Search

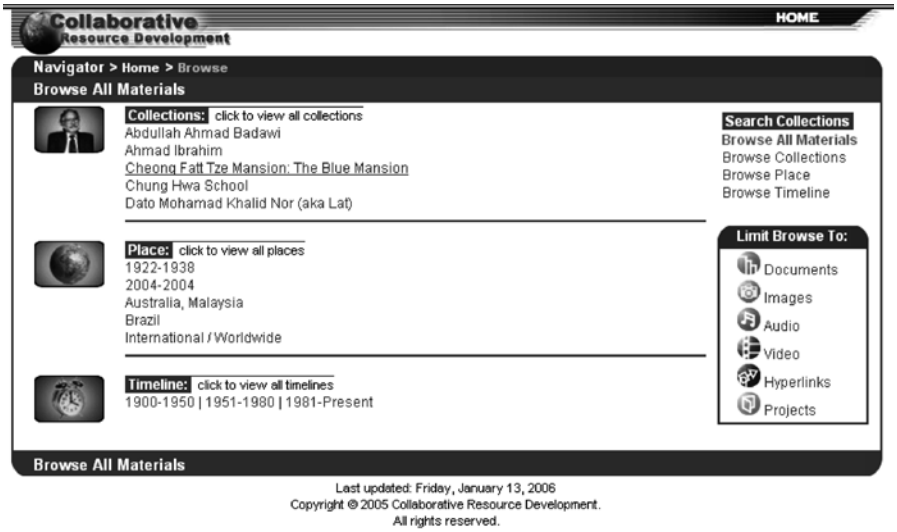

Figure 3 Browsing Feature

Location of access

After students determine their plan for information seeking, they must locate information from a variety of resources and access specific information in those resources. The CDL has three main categories of resources in various media types and format to cater for students' information needs. These resources are (a) Resources that are born digital. This includes web documents such as online reports, textual documents and still images that are accessible and usable via conventional browsers. Digital items used outside the browser environment or with special plug-ins (usually after downloading) include dynamic images, moving pictures (video), sound collections (audio) and learning objects; (b) Digitized resources or digital proxies for physical items, such as report folio, teachers guides, certificates and transcripts, photographs and newspaper cuttings; (c) Links to other resources relevant to the domain focus of the digital library, such as websites of libraries, archives, government departments, ministries, academic institutions and other authoritative resources. Students will be able to locate the relevant information as related resources are hyperlinked to one another using relation and collection metadata, which define the relationship between a resource and other targeted resources. Students may select the resources using appropriate selection criteria, such as relevance, accuracy, authority, and audience level, as described by the metadata accompanying the resource. The collaborative environment provides the platform for the students to participate in e-publishing of reports and digital resources that can be shared by others. Students can consult teachers, view other students' work, share information through discussion board by copying URLs into

messages to help a friend access a recommended web site.

Use of information

At this stage, students need to identify resources that are useful, information that fits the selected focus and information that comes from valid and documented sources. Students view, download, decompress and open documents and files from the system or various Internet websites and portals connected to the CDL. It is imperative that students understand the concept of plagiarism, copyright, and citation guidelines as they relate to electronic resources since it is so easy to "copy" or download graphics from the CDL, Internet or to cut and paste text from an electronic source. Use of information is much easier with the CDL as each resource in the digital library has rights management description. The reference template in the CDL report generator assists students to adhere to the correct citation style, record the sources used and the locations (for Web resources) of those sources to properly cite and credit those sources. This tool gives guidelines for accurately citing information sources. Students select the type of resource they want to cite (either print or electronic), indicate the official standard they want to use, fill in the interactive form and the Wizard automatically formats the citation and display it in the students report.

Synthesis

In synthesis, students organize all the information they have collected from multiple sources and integrate it with their prior knowledge and experiences. This is the stage students decide how to present their report, how will the final product look and what medium should be used (The Big 6, 2006). Synthesis with the CDL gives students the opportunity to publish their project report electronically (Figure 4). The system supports two classes of authoring tools — for the novice and for the expert Internet user (Figure 4a). The former is a report generator, which facilitates the organization and presentation of students' reports and it has the following features: (a) a template to generate cover and background for the report; (b) text editor that support organization of heading and subheading, and various formatting features (Figure 4c); (c) uploading of images to be integrated within text; (d) generation of appendices; (e) generation of reference list according to the appropriate citation style; (f) display and browsing of report (Figure 4d). The latter supports uploading of reports and presentations, which may incorporate one or more types of multimedia contents. For example, a biographical report of **Tunku Abdul Rahman** (Malaysian First Prime Minister) may include a scanned photograph of the personality, a video of the **Merdeka** (Malaysia's Independence)

declaration, and a sound clip of **Negaraku** (the national anthem). Using the upload file feature, students can upload files of various types into the CDL (Figure 4a) to facilitate easy and organised retrieval and engage in information sharing. They may use commonly used multi-media presentation software programmes such as Powerpoint and Flash, technology formats such as HTML and upload text, audio, video files on the CDL. Both authoring tools support creating of description portion of the works by the contributors (Figure 4b). Once within the CDL, resources are organised, managed and made retrievable according to conventional LIS principles. The CDL has an immediate use for students, but its long term use by future students and teachers is expected to be particularly important as users will have access to a variety of internally and externally created resources pertaining to history. In addition, the teachers will be able to re-use or point students to invaluable information sources or examples of previous student contributions.

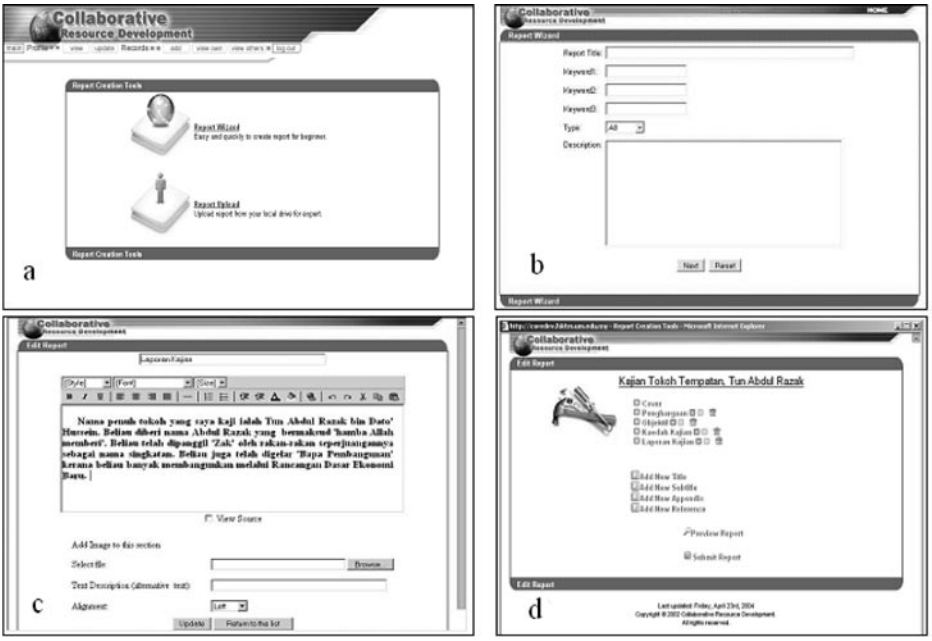

Figure 4 a. Publishing in CDL via Report Wizard and Report Upload;
b. Describing portions in work in Report Wizard;
c. Generating a report via Report Wizard;
d. Table of Contents Display

Evaluation

Evaluation focuses on effectiveness or how well the final product matches the original task. Evaluation also looks at efficiency in the information problem solving process. Students need to ask themselves, "How can I do better?" At this stage in the process, there is still time for the students to examine and refine their

final product. Evaluation with the CDL requires the students to apply the same high standards to their own work that were applied to the resources used or the samples of good quality reports in the digital library. Both format and content should be critiqued. Reports can still be edited and revised before the final submission to the teachers. They were more amenable to making revisions because composing and editing on the computer are much easier than hand-written assignments.

Practising IL and Content Management Skills through the Metadata Creation Workflow

Understanding metadata is the first step in capturing the extent of a resource, just as understanding the scope of the traditional card catalog helped users to find books. This "data about data" plays an increasingly important role in the digital information environment as the hyper textual nature of each Web site connects users through its hyperlinks to hundreds of related web sites, and assists users in deciding whether information is relevant and useful. The CDL resources are characterized and discovered mainly via "metadata records" that describe content at the collection or item level. The CDL approach places much of the responsibility for managing the digital library metadata work flow into the hands of students, as well as teachers and librarians. Student responsibilities include the application of metadata that incorporates conventional IL and content management skills. IL skills include ascertaining information resource provenance and investigating intellectual property rights before depositing digital resources within the library. Content management skills involves the task of describing portions of the resource or their work and this is done by applying metadata elements such as title, creator, description, subject/keywords and resource identifier when students create or upload a resource into the digital library.

Therefore, in order for the CDL metadata workflow to function successfully, students must have a sound knowledge of the storage, organisation, and general management of information itself. The descriptive metadata schema used for the object data description is the Dublin Core (DC) Metadata. (Dublin Core Metadata Initiative, 2004). The CDL has altogether 16 metadata elements and incorporates DC's 14 out of 15 elements, namely title, creator, subject, description, publisher, contributor, date, type, format, identifier, language, relation, coverage and rights. Since the students are applying various mandatory metadata within a workflow, erroneous elements are rectified by the teacher or teacher librarian when they apply additional metadata further down the workflow.

Experience working with students during the user testing of the CDL development revealed that their IL aptitudes were wholly inadequate to support

the meaningful creation of quality metadata and this is consistent with findings of Wodehouse et al, 2004 and Juster et al, 2004. This is particularly noteworthy since at the time of user testing the CDL was a prototype, and has a metadata schema with fewer elements for students to complete. Despite this apparent reduction of student responsibilities and a brief orientation session, very few students applied metadata or even understood the need for metadata. Those who did apply metadata provided meaningless descriptions or subject descriptors that were too broad to support useful document retrieval. Testing further demonstrated that this multiplicity of subject terms was further muddied by the inability of students to discern the subject from which their self-created resource derived. This was perhaps best exemplified by their observed behaviour when creating **Abdullah Ahmad Badawi** (Malaysia's present Prime Minister) collection, where pertinent resources, irrespective of their specific content, were tagged with inadequate subject terms such as "**Tokoh Sejarah** (historical figure), **Kerjakursus Sejarah** (History coursework), **Abdullah Badawi**, **Perdana Menteri** (Prime Minister) and **Abdullah Badawi dan rakan** (Abdullah Badawi and friends)". In particular cases these same subject terms were mirrored in the title and description fields also. Yet such an outcome was not surprising: why should students understand a concept that has traditionally been the preserve of librarians for centuries? Towards the end of user testing and evaluation, students understand the need to write an accurate description for their project work that capture the gist of the content, the importance of assigning appropriate subject headings and keywords and the effects of doing so. Furnished with this knowledge, students would be better placed to improve their searching strategies according to the environment in which they find themselves in future, whether it be an online host using complex metadata or a Web search engine that relies on post-coordinate indexing. This may further enhance their information literacy skills at the information seeking strategies, location of access and synthesis dimensions of the Big Six.

Teachers' Reception of the CDL

Interviews with six teachers who are willing to collaborate in the digital library initiative offers important insights on History subject teachers' perceptions its potential use and how it fits within the general curricular goals in general, and history education in particular. As the intent of the paper is to demonstrate and suggest that using the collaborative digital library is one way how information literacy practices can be approached systematically in schools, the answer to how the CDL provides benefits in terms of promoting information literacy based on the problem-based learning, or the assessment of students' information literacy skills

to evaluate the effectiveness of the CDL requires a carefully planned empirical study and is beyond the scope of this paper.

The school shares an interest to ensure that the collaborative digital library priorities respond to the students' and teachers' needs and interests, as indicated by the school principal in an interview, "**I have no objections against this project as long as it instills interests and fulfills students and teachers needs.**" According to some teachers involved in the case study, students' motivation to produce quality written work increased when they knew that they could word process their reports. The History Head teacher noticed a difference in her students' projects once the Ministry allows the students to use computer to produce their reports. "**My students seemed more motivated to complete their reports and showed a greater interest in creating quality work when I told them the possibility that the reports would be published online, in this project**", she said. Another teacher felt that the students would invest more time in their project work when they knew it would be published online and available to a wide audience. He explained in an interview response: "**The Internet provides an audience. All these while, students wrote for the teacher and for a grade. Now when they** [students] **publish it** [report] **on the Internet, they are writing for a larger audience. This makes them more aware of the quality of their work.**" He also feels that students have no obstacles publishing their work online as students have the experience as content creators — they are sharing self-authored content and working on web pages for others. Another teacher also felt that students would put more effort into the quality of their work if the work would be published on the Internet. Another teacher, a non-Internet user remarked: "**I believe the students will be more careful in their work. Errors are pretty easy to see on the Web, they can easily change them. If hand-written, it is difficulty to get them change what they have written.**"

A senior History teacher expressed concern over the uncontrollable and inappropriate nature of content on the Internet. He was the only respondent who felt that students need to be information literate when using Internet resources and frequently emphasized this issue throughout the interview. He remarked: "**I am a bit worried the resources might not be suitable. When students use Internet resources, they must be ready to filter and evaluate, ensure that the information is appropriate with their level, and not bias to a particular** [body of] **information, but do they know this? They do not even cite resources.**"

One particular teacher sees the "relevance" of the digital library project to the current requirement of the PBL History coursework, which he quoted as to obtain "**information seeking skills, resource study skills, experience con-**

ducting research through KPS and presentation of research finding." He indicated that students would know about "real events" published in the form of various formats such as videos, images, as well as text in the form of memoir and diaries. He also felt that the digital library helps solve the problems of students who cannot get certain information due to logistic problems. Again, what the teacher described, in many ways, align with the objectives and roles of a digital library.

A positive aspect in the study is that teachers state it is important that students learn how to select and use information in the digital environment. The History Head teacher believes that her students have to learn to find and use digital resources, as it is a skill that is required in learning History. She said in an interview response: "**My students are exposed to these skills, it is important in (learning) history, being able to recognise various resources, authoritative sources, primary sources, old and new. Any work must have resources, reference list. Your digital library can support this..... .**" She feels that given the time, students should be given the opportunities to publish their work online because students have the interest and potential to be local content providers. She said, "**I see potential in these students, their deep interests when writing. They tend to write more than what we have in our textbooks. That is what happening in America and England, when students write on local history, they get a lot of information, some of which is not written in books. The same thing is what we want in our students, to be able to provide local content on the Internet.**"

The results indicate that the teachers are not exclusively negatives in their judgments of the possibilities of digital libraries. Teachers see the value of digital resources and online publishing for their students. Nevertheless, they are not aware of and have not used a digital library before. In general the teachers expressed willingness to play the role as a facilitator, making sure that their students have the resources and scaffolding that they need to use the CDL in conducting their History project. In general, the school community also perceives the following benefits in the implementation of the approach (Adbullah, 2007a):

a) This approach would "push" teachers and students to be active players in building the digital library and indirectly inculcates ICT literacy among the education community.

b) It enables students to practise self-accessed and self-directed reference, at their own learning pace. There is intense interest in digital content from around the world since it serves many educational purposes. First, students preparing their own project report can learn from the work of others. They can, not only

learn about the specific content, but they also can learn about style and organization, presentation and even about the use of multimedia technologies. Students may be aided to carry out their own literature review, and may have an easier time getting oriented to the related work in their project topic, since they can obtain references or bibliographies from other works. By mining the students' project, students should also be able to avoid wasting time to reinvent the work already carried out by others, when that related work is not easily discovered.

c) The good work of students can be proactively showcased to the whole nation, and student research becomes much more available. Whereas paper reports historically have been read by very few beyond the set of teachers involved in advising and examining the student, digital reports are typically read by hundreds or thousands. Given the investment of time and effort by the student, and the institutional support that they receive over several years of study, it is clearly sensible to leverage that investment by making student work accessible.

d) The result of this approach would be an establishment of a library of exemplary historical resources and services. The digital library can be a locus of technical innovation for educational digital library of historical resources. Students' projects can be easily managed in terms of repository, preservation and access.

Discussion and Conclusion

PBL takes a different approach compared to the conventional learning approach. In PBL, students design authentic, meaningful questions, plan tasks, accumulate resources and information, evaluate information, collaborate with others, and report their findings. As students are relying more and more on the digital information environment for resources, they need to develop greater fluency to search, locate and use information. Greater fluency here means more effective IL skills, such as more effectively using search engines to find information; taking a greater evaluative stance toward information, using a browser's features to more effectively organize (store and retrieve) digital resources or making use of the resources (for example cut and paste web information, or cite it correctly). To support students in these types of activities, students need a full compliment of tools designed to meet the unique needs of learners. This paper has shown that Internet technologies such as digital libraries have the affordances to support students in these activities. The CDL in this work could provide a place for students to collaborate with others and present their research project, with the intended benefits that the project work would then be more meaningful to the students, and when given a chance to publish for the right audiences, students would produce higher

quality products.

This paper has suggested that IL skills may be practiced and fortified using the CDL. The CDL has various features to support IL and position it in the context of implementing The Big 6 which integrates information search and use skills along with technology tools in a systematic process to find, use, apply, and evaluate information to specific needs and tasks. The collaborative digital library features are summarized in association with the information literacy dimensions in the Big Six (Appendix 1). Teachers in this study see the value of digital libraries and online publishing for their students. They may take two possible approach on how to spearhead the digital library project; either (a) by training them to integrate Internet use in their History instruction; or (b) let loose students to their own initiative by instructing the students to use the digital resources and services in the CDL system. The latter would be a more viable solution to empower students in information literacy practices as (a) students could contribute original works to be shared with other students since some local contents are not available in textbooks; (b) students would be more careful in their research output since it will be available to a wider audience; (c) students could share resources and teach each other as more are ICT literate and this would make them aware from an early age the potential of digital libraries for learning. Perhaps this is one way how IL practices can be approached systematically in schools.

The CDL is not an isolated example of a digital information environment necessitating student participation in the information management process. There are various digital library initiatives that take a similar approach to the CDL, but places greater emphasis upon making the student creation of metadata a reflective process designed to underpin the learning experience, as well as for the purposes of information management (Stouffs et al, 2004). Projects such as the “Spoken Word” (Goldman et al, 2003) and DIDET (McGregor and McGill, 2005) are demanding that students participate in the “enhancement” of digital object metadata by creating detailed annotations and tagging items with additional metadata. Although such metadata need not conform to sophisticated library standards like AACR2, a degree of standardisation is nevertheless required and a clearer understanding on the part of students is required as to the purpose and function of such metadata elements. Like the CDL, such examples may suggest that there are considerable IL anomalies to be addressed as students should be made aware of the effects of assigning appropriate metadata to facilitate resource discovery. This has obviously laid bare research issues relating to digital library design, student information literacy, the use of ICT in education and design, and related IL pedagogical issues. As such, conducting an empirical study to prove that the CDL provides

benefits in terms of promoting IL based on the problem-based learning is worthy of further investigation.

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Appendix

Collaborative Digital Library Features Described in Association with the Information Literacy Dimensions in the Big Six*

Description	Collaborative Digital Library Features	How the Features Support Information Literacy
TASK DEFINITION		
Students determine exactly what the information problem is and the specific information needed to solve the problem.	1. E-mails 2. Feedback and discussion	Users generate and choose topics, post problems, communicate regarding tasks and information problems, either with teachers, or among group of students in the process
INFORMATION SEEKING STRATEGIES		
Refers largely to students' level of ability to identify and find all possible sources, interpret the information and select the best sources.	1. Simple search • Type Delimiter setting • Dropdown Menu setting 2. Advanced search • Multi-criteria search settings 3. Browsing • Display text, audio, video, images to show availability of multi-variant format of resources	1. Users narrow and revise searches to better specify what they want 2. Users search for specific occurrences of words 3. Browse and view resources by collection, period (year), resource type, alphabetical order and thumbnail image
LOCATION OF ACCESS		
Students locate information from a variety of resources and access specific information in those resources.	Three main categories of resources in various media types and format: • Resources that are born digital. • Digitized resources or digital proxies for physical items • Links to other resources relevant to the domain focus of the digital library.	1. Users locate the relevant information as related resources are hyperlinked to one another using relation and collection metadata. 2. Users select the resources using appropriate selection criteria, such as relevance, accuracy, authority, and audience level. 3. Users can consult teachers, view other students' work, share information through feedback and discussion to help a friend access a recommended web site.
USE OF INFORMATION		
Students identify resources that are useful, information that fits the selected focus. Students ascertain that information comes from valid and documented sources. Ensure that ethical use is practiced, acknowledgement to sources used given.	1. Resources have rights management descriptions. 2. Reference generator	1. Students establish their rights by publishing under their names. 2. Reference generator assists students to adhere to the correct citation style, record the digital sources used and the locations of those sources to properly cite and credit those sources. This tool gives guidelines for accurately citing Internet resources. Students select the type of resource they want to cite (either print or electronic), indicate the official standard they want to use, fill in the interactive form and the Wizard automatically formats the citation and display it in the students report.
SYNTHESIS		
Students organise all the information they have collected from multiple sources and integrate it with their prior knowledge and experiences. This is the stage students decide how to present their report, how will the final product look and what medium should be used (The Big 6, 2006)*.	Synthesis with the collaborative digital library gives students the opportunity to publish their project report electronically. Incorporate two types of authoring tools. 1. Report Wizard 2. Upload objects 3. Both authoring tools support creating of description portion of the works by the contributors via metadata tools.	1. Report generator has • a template to generate cover and background for the report; • text editor that support organisation of heading and subheading, and various formatting features • uploading of images to be integrated within text • generation of appendices • generation of reference list according to the appropriate citation style • display and browsing of report 2. Using the upload file feature, students can upload files of various types into the digital library to facilitate easy and organised retrieval and engage in information sharing 3. Students understand the need to write an accurate description for their project work that capture the gist of the content, the importance of assigning appropriate subject headings and keywords and the effects of doing so

EVALUATION		
Focuses on effectiveness or how well the final product matches the original task. Evaluation also looks at efficiency in the information problem solving process. Students need to ask themselves, "How can I do better?"	At this stage in the process, there is still time for the students to examine and refine their final product. Evaluation with the collaborative digital library requires students to apply the same high standards to his/her own work that were applied to the resources used or the samples of good quality reports in the digital library. Both format and content should be critiqued.	Reports can still be edited and revised before the final submission to the teachers. They were more amenable to making revisions because composing and editing on the computer are much easier than hand-written assignments.

Note. From *Information skills for students achievement*, Big 6., 2006, Retrieved April 4, 2008, from http://www.big6.com