Project-based teaching methods are increasingly used in Malaysian secondary school classrooms 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. In project-based learning (PBL) students exhibit information literacy (IL) skills: they formulate authentic, meaningful questions; plan tasks; gather resources and information; evaluate information; collaborate with others; and report findings. This paper examines the affordances that a collaborative digital library (CDL) can bring to bear on supporting IL practices in the digital information environment (DIGIE). The CDL supports solitary information seeking, interaction among users as well as working with information. 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. It also allows students to organize their project reports in various presentation styles, cite the references they use in the appropriate format as well as submit the report and other resources in various formats, in order to create materials for publication in the digital library. The CDL places much of the responsibility for managing the digital library workflow into the hands of students, teachers and teacher librarians. Student responsibilities include the application of metadata, as well as conventional IL skills such as ascertaining information resource provenance and investigating intellectual property rights before depositing digital resources within the library. Findings regarding students’ and teachers’ reception of the digital library are encouraging.

**Keywords:** Collaborative digital libraries; Information literacy; Electronic publishing; Project-based learning; Secondary schools; Malaysia

**INTRODUCTION**

Information literacy (IL), in recent years, is inextricably associated with information practices and critical thinking in the ICT environment. Today, it is also seen as pivotal to the pursuit of lifelong learning, and central to achieving both personal empowerment and economic development (Bruce, 2002). Educators and librarians would have probably noticed that the way students research and discover information nowadays has changed tremendously compared to when they were children. Students now have more ways to find information for their schoolwork and their daily lives. With so many different resources available, students today need special skills – the skills of information literacy – to seek out information and to understand, evaluate, and apply what they find. As ICTs develop rapidly and the information environment becomes increasingly complex, teachers and librarians are recognizing the need for students to engage with the digital information environment (DIGIE) 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 idea of IL education and its potential is not new. IL education and associated issues have been discussed extensively since the late 1980s, and many programmes have emerged at all educational levels. At the secondary school level, a number of models, such as Kuhlthau (1993) and Eisenberg and Berkovitz (1990), have been proposed for teachers and teacher librarians to consider when implementing an information literacy programme in their school. These models, which are based on extensive research, have provided a useful basis for teachers and teacher librarians to develop IL instruction initiatives in order that students are equipped with a suite of generic and adaptable competencies. IL is conceptually closely linked to terms like “active learning”, “problem-based learning”, “student-centered learning”, “lifelong learning”, and “learning to learn” (Roes, 2001). One way that schools 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. 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. Another innovation in many schools concerns the role of libraries, which are providing more services through the Internet. Teacher librarians are supporting IL by teaching students how to use the available technology. In some schools, librarians and teachers are working together to include technology into the classrooms (AASL, 2000; Humes, 1999).

Therefore curriculum practices involving active, collaborative, resource-based learning are often pointed to as the ideal approach in an IL education. While effective information use underpins enquiry learning, problem based learning, action learning and various other student-centred modes, Bruce (2002) opined that an effective IL education requires explicit attention to information processes, as well as the careful crafting of real world information practices, and meaningful reflection, into the curricula. The DIGIE may potentially demand student fluency in competencies out with those outlined in various definitions of IL such as those by CILIP (2004), SCONUL (2005) and the Big Six (2006). Consequently, the digital library approach adopted for the CDL not only assumes that students exemplify the competencies noted by these definitions, but that students have some competencies normally associated with managing information itself. While many of today’s educators are concerned about creating learning activities that require students’ engagement with DIGIE, 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.

The CDL in this work has been conceived to support secondary students’ information needs in conducting research projects. 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. It can be said that school research projects are training grounds for real-life information explorations and the development of IL skills as 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). 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 Internet technologies such as digital libraries have the affordances to support students in these activities, as discussed in the next section.
DIGITAL LIBRARIES AND INFORMATION LITERACY PRACTICES IN PBL

Digital libraries are becoming an integral part of the digital learning environment, and it is envisaged that digital libraries “emphasize competencies like information literacy to support lifelong learning (UNESCO, 2003, p.6). 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 the Internet 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.

There is a growing body of research and development in digital libraries for the K-12 communities. There are various projects that support school children in carrying out inquiry and attempt to move children from doing searches to doing research. Projects with names like American Memory (http://memory.loc.gov/ammem/ammhome.html) and California Heritage (http://sunsite.berkeley.edu/calheritage/) are taking the first steps in a vast, collaborative effort to extend historical digital resources. There are digital libraries initiatives worldwide whose mission is to promote information skills in students through the references services 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 and Soloway, 2002), Connecticut History Online (Foulke et al, 2004), and Canada’s SchoolNet Digital Collections (http://www.schoolnet.ca).

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 needed to gain access to information in order to create an information literate community. Research shows that Internet technologies such as digital libraries have been of tremendous use to students’ project works. Blumenfeld et al (1991), Means and Olson (1997), Coley, Cradler and Engel (1996) wrote that PBL is especially effective when supported by educational technology. Research has also shown the PBL approach to be effective in enhancing student motivation and fostering higher order thinking skills, especially when supported by Internet technology (Ryser, Beeler, & McKenzie, 1995; Grant, Michael, M, 2002; Sidman-Taveau, R & Milner-Bolotin, M, 2004). Durrance & Fisher (2003) indicate that the ability to use technology as a tool is very significant in helping students to support their project work. Lynch (2003) contends that the resource-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.

The distributed authorship of digital libraries 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.

Digital libraries can provide a broad range of resources, electronic and human, 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.

INFORMATION LITERACY IN PROJECT-BASED LEARNING: THE KST CONTEXT

Initial work has focused on the PBL approach to conduct research project, which clearly links information creation, sourcing, searching, evaluating, organising and presenting, to the design process of the CDL. To ascertain the requirements and students reception of a digital library for school project, a survey was conducted on 397 secondary school students conducting school-based project. History has been chosen as the domain of the digital library test-bed based on our findings that indicated the students surveyed (n=395) mainly use Internet resources to get information for their History project (75.5%, 299). The survey indicates that high proportions 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. Student 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. 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 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. 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 history thinking skills (Kemahiran Pemikiran Sejarah (KPS)).

The subject of history in Malaysian secondary school integrated curriculum, is compulsory for all secondary students (ages 13-17). The history curriculum for lower secondary (ages 13-15) emphasizes knowledge of history of the Malaysian nation and the inculcation of values that help build the Malaysian spirit and identity. The learning of local history is also emphasized at this lower secondary level in the form of school-based project called “Kajian Sejarah Tempatan (KST)”. Students have to conduct a study focuses on various aspects of historical interest at the local level. The purpose of the project is to give students experience conducting research, expose students to information searching, gathering and analyzing skills, as well as to instill students’ interest towards the history subject. The main importance placed by the KST in the learning context of the Malaysian School Curriculum on History is in line with IL practices that is “to develop research and learning skills” (Abd Rahim, 2000). Teachers indicated that students are given increased freedom and responsibility in choosing topics for their KST projects in the hope that they will gain an increased understanding of the information seeking processes by taking a more active role in inquiry to develop understanding of particular research and learning skills.

Accessing the problems encountered by students in conducting their school projects, as had been highlighted by the students and teachers in the sample, 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 this digital library project, the use of the online resources would be an integral part of history 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 report 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 project.
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.

The objective of the CDL is to provide a learning environment and resources network for history education 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 DIGIE, that is, a networked, online information space in which students can discover, locate, acquire access to and, increasingly, use information.

INFORMATION LITERACY SUPPORTED FEATURES IN THE CDL

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, the authors have been experimenting with the implementation of an integrated and embedded 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 KST’s 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.

(a) 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.

(b) 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

(c) 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.

(d) 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 digital sources used and the locations of those sources to properly cite and credit those sources (Figure 4). 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.

![Figure 4: The Citation Generator (a) For Book; (b) For Web Resource](image)

(e) 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,
Synthesis with the CDL gives students the opportunity to publish their project report electronically (Figure 5). The system supports two classes of authoring tools – for the novice and for the expert Internet user (Figure 5a). 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; c) text editor that supports organization of heading and subheading, and various formatting features (Figure 5c); d) uploading of images to be integrated within text; e) generation of appendices; d) generation of reference list according to the appropriate citation style; e) display and browsing of report (Figure 5d). 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 may include a scanned photograph of the personality, a video of the Merdeka declaration, and a sound clip of Negaraku. Using the upload file feature, students can upload files of various types into the CDL (Figure 5a) to facilitate easy and organized 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 5b). 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.
(f) 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 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.

CONTENT MANAGEMENT SKILLS: 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 DIGIE 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 approach places much of the responsibility for managing the digital library workflow into the hands of students, as well as teachers and librarians. Student responsibilities include the application of metadata, as well as conventional IL competencies such as ascertaining information resource provenance and investigating intellectual property rights before depositing digital resources within the library.

The CDL resources are characterized and discovered mainly via “metadata records” that describe content at the collection or item level. As shown in Figure 5b, when students create or upload a resource into the digital library, they are presented with 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. 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 (Figure 6). 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 collection, where pertinent resources, irrespective of their specific content, were tagged with inadequate subject terms such as “Tokoh Sejarah, Kerjakursus Sejarah, Abdullah Badawi, Perdana Menteri and Abdullah Badawi dan rakan”. 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.

Figure 6: Data Object Description Using Dublin Core Metadata Elements

**THE SCHOOL’S RECEPTION OF THE CDL**

The school shares an interest to ensure that the digital library programme and the programme priorities respond to the students’ and teachers’ needs and interests, as indicated by the school principal, “I have no objections against this project as long as it instills interests and fulfills
students and teachers needs”. The school also perceives the following benefits in the implementation of this approach:

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.

According to some teachers in this study, students’ motivation to produce quality written work increased when they knew that they could word process their reports. The History Panel Head 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. A 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 webpages 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”.

One particular teacher sees the “relevance” of the digital library project to the current requirement of the PMR History coursework, which he quoted as to obtain “information seeking skills, resource study skills, experience conducting 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.

The results indicate that the teachers are taking an interest in the Internet, and they 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.

**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 DIGIE 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. 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 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 DIGIE 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 pedagogical issues, all of which are worthy of further investigation.

REFERENCES


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