Proposing a 6+3 Model for Developing Information Literacy Standards for Schools: A Case of Singapore

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Abstract

Several comprehensive information literacy (IL) standards have been developed worldwide for use in the education sector specifically for students and teachers. Apart from the more generic International Federation of Library Associations (IFLA) IL standards, such standards are more appropriate for their countries of origins. If these standards are to be applied to schools in Southeast Asia, then some form of contextualization and customization is necessary to cater for gaps that surface due to their different and unique education environment and cultures. In addition, as a result of the growth of Web 2.0, information seeking moves rapidly in the social dimension. It is therefore timely to review ongoing research in the areas of collaborative information seeking and behavior, as well as values education in order to derive a set of up-to-date, relevant and holistic IL standards for schools. This paper proposes a model to help to develop IL standards for schools in Singapore that was constructed using the aforementioned standards as a guide, based on the paradigm of a popular information and technology literacy process model known as the Big6, and steered by related educational initiatives and values education that have been recently implemented in Singapore. The proposed model expounds each of the Big6 categories in terms of Techniques and Tools, and supplements those categories with three important mindsets of Ethics and Social Responsibility, Collaborative Information Behavior, and Attitudes and Perceptions.

Keywords: information literacy, standards, education, students, schools, Big6, Singapore

1. Introduction

Information literacy (IL) has been described as the ability to locate, access, search, evaluate and use information [6] in various contexts. Although its description and encompassing attributes were identified and developed two decades or more ago, its importance and utility cannot be underestimated to this day. With information being increasingly digitized, organizations and countries becoming more networked, and information and communication technologies (ICTs) being a part of daily life both in work and play, IL becomes an increasingly necessary competency in order to navigate through the deluge of information that each of us faces.

For students, being information literate is necessary so that they are able to effectively sieve through and identify relevant yet reliable information that they get through the Internet, television, newspapers, tabloids, and friends, among others. In schools, new educational
initiatives and learning strategies seem to point to the need for being information literate. For instance, educators and educational researchers increasingly emphasize the importance of establishing authentic assessment, resource-based learning and creative and critical thinking approaches in the school curriculum [36; 3]. Part of this involves being independent learners, looking up information from various sources, and analyzing information that is obtained. These are essentially the attributes of being information literate. Hence, IL cannot be removed from the school curriculum and instead should be an integral part of it.

This paper presents an overview of the more common IL standards and guidelines that have been used around the world, followed by a section on information seeking behavior and a popular information and technology literacy process model known as the Big6. The paper then focuses on Singapore and recent educational initiatives that are related to IL. The paper culminates with the proposed model for developing IL standards for use in Singapore schools, elaborating on the various components of the proposed model and its application.

2. Related literature

2.1 Overview of IL standards and guidelines

Several IL standards have been developed worldwide, and subsequently implemented in various schools and institutions of higher education. An overview of the more renowned and widely used IL standards was made by Mokhtar, Majid and Foo [16; 17]. In brief, these standards can be summarized as follows:-

2.1.1 American Library Association (ALA) & Association for Educational Communications and Technology (AECT)
The ALA-AECT landmark publication in 1998, *Information Power*, presented the information literacy standards for student learning [4]. The set of standards involves three categories of (i) information literacy; (ii) independent learning; and (iii) social responsibility. Each of these categories is further sub-divided into three standards that are described by two to five indicators each. The standards focus on defining the information need, identifying relevant information sources, evaluating information, determining accuracy, relevance and comprehensiveness of the information, organizing information and using information creatively.

2.1.2 Society for College, National and University Libraries (SCONUL)
SCONUL developed its Seven Headline Information Skills a year later, in 1999, which was later known as the Seven Pillars of Information Literacy [36]. The Information Skills Model that was presented in the document clearly showed the basic required competencies of library skills and information technology (IT) skills. When coupled with the seven headline skills, an individual was seen as being information literate.

2.1.3 Association for College and Research Libraries (ACRL)
The ACRL published its Information Literacy Competency Standards for Higher Education in 2000, which was meant to focus on IL competencies for students in the colleges and universities, as well as other institutions of higher learning [5]. The ACRL is essentially a division within the ALA; hence this set of standards complements the ALA-AECT landmark publication, *Information Power*, in 1998, which provided a more general set of competencies for schools. In addition, this set of standards emphasizes the importance of IT skills in supporting IL competencies, as well as the importance of problem-, evidence- and inquiry-learning in allowing IL competencies to be developed and nurtured. Five core standards were presented, each one illustrated by the specific performance indicators and outcomes.
2.1.4 Council for Australian University Librarians (CAUL) & Australia- New Zealand Institute for Information Literacy (ANZIIL)

CAUL, made up of representatives from different education and related sectors, convened in September 2000 and reviewed the US Information Literacy Competency Standards for Higher Education by ACRL for adaptation and implementation in Australia and New Zealand. Studies and practices by Australian researchers in the area were also taken into consideration when the standards were reviewed. A month later, CAUL approved the revision and adaptation of the ACRL standards and dubbed the new set of benchmarks as the Australian and New Zealand Information Literacy Framework, which was specifically intended for higher education [7]. Six core standards were presented, with the learning outcomes listed for each core standard. In turn, each learning outcome was illustrated with specific examples. Similarly, the standards focused on defining the information need, selecting relevant information sources, evaluating the information found as well as the information search process itself, managing the selected information, applying the selected information, creating new knowledge from the information found, and using information ethically.

2.1.5 American Association of School Librarians (AASL)

The AASL, under the ALA, put together the Standards for the 21st Century Learner in 2007 to provide an overview of the information skills, resources and tools that students in the current age need to have [1]. Four specific standards or actions were identified where each standard was illustrated by the relevant skills, dispositions, responsibilities, and self-assessment strategies. The Standards are complemented by the Standards for the 21st-Century Learner in Action, which is essentially a publication that contains specific examples or proposed activities that can be carried out to impart and inculcate the four standards.

2.1.6 International Federation of Library Association (IFLA) Standards

The IFLA IL Standards was developed based on the standards discussed above [18]. However, the IFLA IL Standards contains three basic IL components: (i) Access; (ii) Evaluation; and (iii) Use. Access comprises the definition of an information need, and location of needed information. Evaluation involves the assessment of information for accuracy and relevance, as well as the organization of information into logical categories. Use includes internalization, application, and presentation of the information product, and the communication and ethical use of information.

As can be derived from the different standards discussed above, information skills form a substantial part of being information literate. Information skills include the intellectual processes of information use as well as information seeking behavior. Since the intellectual processes of information use is very tacit, intangible and difficult to capture and define, information skills research has focused largely on the information seeking behavior, which has spawned extensive research and models of the behavior. The following section looks at this particular aspect of information skills.

3. Information seeking behavior

While there are many researchers who have made important contributions to the field of information seeking behavior, we highlight the contributions of Kuhlthau, Marchionini, and Eisenberg and Berkowitz being the most relevant to the context of this study.

Kuhlthau [9] developed the Information Search Process Model that comprises six stages of (i) Initiation or perception of an information need; (ii) Selection of topic or the approach in obtaining information; (iii) Exploration of the required information in order to gain a better understanding; (iv) Formulation of the focused information need; (v) Collection
of relevant information; and (vi) Information Search Closure. Kuhlthau’s model presents the process as being shaped by three realms of behaviors, namely: affective (feelings), cognitive (thoughts), and physical (actions and strategies). Hence, it is seen that the information search process involves more than sheer rigid technicalities of finding information, and that the complete involvement of the searcher (feelings, thoughts, and actions and strategies) is needed.

Marchionini [14] is another significant pioneer in the Information problem solving approach that involves the information search process. Marchionini presented five functions of the process that exist in a non-linear manner, comprising (i) Definition of the problem; (ii) Selection of the source; (iii) Articulation of the problem; (iv) Examination of results; and (v) Extraction of information. The functions are presented as non-linear components of the process since it is seen to be iterative.

Both works have been the basis for subsequent studies on information seeking behavior. Yet another pioneering model of the information search process, the Big6 model, developed by Eisenberg and Berkowitz in 1987, is very popular, and has been adopted by many schools for IL teaching and education (e.g. Washington-Saratoga-Warren-Hamilton-Essex schools; McDowell County schools in Marion, North Carolina; Alaska School Libraries; and Wisconsin Rapids Public Schools). In this study, we make use of the Big6 model as a framework to develop the proposed information literacy standards.

3.1 Information and technology literacy process model: Big6

The Big6 is an information and technology literacy process model. It consists of 6 stages of the information search process, with two sub-stages each, namely:-

(i) Task definition
   - Define the information problem
   - Identify information needed

(ii) Information search strategies
   - Determine all possible sources
   - Select the best sources

(iii) Location and access
   - Locate sources (intellectually and physically)
   - Find information within sources

(iv) Use of information
   - Engage (i.e. read, hear, view, touch, etc.)
   - Extract relevant information

(v) Synthesis
   - Organize from multiple sources
   - Present the information

(vi) Evaluation
   - Judge the product (effectiveness)
   - Judge the process (efficiency)

Eisenberg [21] claimed that generally, people go through the six stages of the information search process as listed in the Big6 model, either consciously or not. The six stages may not necessarily be covered in a linear manner, and they may also be done iteratively. The Big6 has been simplified for children in Kindergarten through to Grade 2 (7 to 8 years old), and the simplified version is known as the Super3, which is made up of the following stages:

(i) Plan
• What am I supposed to do?
• What will it look like if I do a really good job?
• What do I need to find out to do the job?

(ii) Do
• Read, do, tell or make a picture or do something about the job to be done

(iii) Review
• Did I do what I was supposed to do?
• Do I feel ok about this?
• Should I do something else before I turn it in?

It is seen that the first stage of the Super3 corresponds to the first two stages of the Big6. Similarly, the second stage of the Super3 corresponds to the middle two stages of the Big6, and so on.

3.2 Collaborative information seeking

The information search process that has been included in the standards discussed earlier as well as within the context of information skills have mostly assumed that the information search process is done at an individual level only. However, with the proliferation of the World Wide Web (WWW) and more recently the implementation of Web 2.0, information seeking has taken on a more interactive [14] or collaborative characteristic. To elaborate, when an individual is faced with an information problem or has specific information need, it is very likely that they would seek not just the “answer” but opinions on the possible “answers”. For instance, if a student wants to find a university that offers a particular program, the student will not just search for which universities offer that program but also get opinions about the various programs so as to eventually decide on the best program that would suit their needs. Opinions can be sought from friends through e-mails or social networking sites, from strangers through discussion forums, or through reading public weblogs on the topic. Hence, a lot of interest has developed around collaborative information seeking (CIS).

CIS has brought together the disciplines of Human-Computer Interaction (HCI), Information Retrieval (IR) and Computer Supported Cooperative Work (CSCW) [11], where the information search process is explored within a collaborative or group work setting. It has been found that with the proliferation of the WWW and Web 2.0, increasingly CIS behaviors are observed among information seekers [30]. Hence, CIS behavior (CIB) becomes an integral part of the contemporary information search process.

4. Background of Study

Singapore is a small island nation that is located in Southeast Asia, around 135 km north of the equator, and at the tip of Peninsula Malaysia. Singapore is a multi-racial and multi-religious society, made up of the Chinese (75%), Malays (14%), Indians (9%), and other races (2%).

Singapore is a very young country having gained her independence in 1965. Since that time, the country has undertaken great strides in industrialization, urban planning and education. The Singapore education system is a very dynamic sector that has evolved continuously over the years, and has been recognized as one of the most successful in the world [23]. For instance, Singapore students have performed very well internationally in Mathematics, Science, and even the English language, as shown in the results of Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS), where Singapore students have outperformed students from countries such as the United States and England.
These impressive achievements have come about as a result of iterative reviews of the education system in response to changing societal and global demands. To elaborate, Singapore used to have vernacular schools back in the pre-independent days (circa 1940s to 1950s), mainly for the Malays and Chinese [22]. However, upon gaining independence in 1965, the Singapore leaders decided that English would be the common language used in schools, so as to unify the various ethnic groups. The mother tongue languages were encouraged to be learnt and used as second languages in the schools.

Upon gaining independence, economic survival became a consuming priority in Singapore, and this has not changed much since [22]. The efficiency-driven focus of the education system paved the way for the young to attain the necessary knowledge and skills needed to create a skilled workforce and ensure the economic development of the country [8]. As the country developed, the efficiency-driven education system gave way to the ability-driven education (ADE) system in 1999, with the goal of identifying and nurturing the talents and abilities of every child to the highest potential, be it in the arts, sciences, sports or community services [12].

4.1 Recent educational initiatives in Singapore

ADE came under the all-encompassing vision of Thinking Schools, Learning Nation (TSLN) that was launched in 1997 by the then Prime Minister of Singapore, Goh Chok Tong. TSLN was established as a result of a strategic review of education in response to rapid globalization and increased economic competition from newly industrialized countries in the region. TSLN was to set the stage for creative thinking and learning skills to be nurtured in students, through less content knowledge and more problem- and project-based learning [10].

TSLN subsequently spawned several educational initiatives that were implemented in schools, such as Masterplans for Information and Communication Technology (ICT) in Education I, II and III; Project Work (PW); National Education (NE); Innovation and Enterprise (I&E); and Teach Less, Learn More (TLLM); among others. These initiatives were developed with the aim of (i) nurturing the range of abilities that students should or would have, such as IT competencies and research skills (through IT Masterplans and PW); (ii) encouraging students to pursue independent, self-directed and hands-on learning (through PW, I&E and TLLM); and (iii) focusing less on studying for examinations and more on studying out of interest and with passion (through I&E and TLLM). However, the one overarching initiative among these is that of NE, which aims to develop a sense of national identity, awareness of Singapore’s recent history as well as imminent challenges, and confidence in the country’s future [20].

4.1.1 Masterplans for Information and Communication Technology (ICT) in Education I, II and III

The Ministry of Education (MOE) started formulating the Masterplan for ICT in Education 1 (Mp1) in the mid-1990s, and on 28 April 1997, Mp1 was officially launched. This marked the start of a new era in education in Singapore schools where both students and teachers could forge ways to be connected to different parts of the world, without leaving the confines of their classroom walls. There were two foci in the development and execution of Mp1. First, it was to provide an overall map for the use of IT in schools. Second, it was to provide every school-going child with access to an IT-rich curriculum and school environment. Mp1 was implemented from 1997 to 2002. A conference cum exhibition, iTopia, was held on 24 July 2002, and was conducted to mark the end of Mp1. In addition, the next phase of the journey, the Masterplan for ICT in Education 2 (Mp2), was launched. The main purpose of Mp2 was to consolidate and leverage on the developments and achievements of Mp1, and to further stimulate critical thinking, creativity and independent learning among students through the use of IT. Mp2 was implemented from 2002 to 2007 [15].
Recently, the MOE introduced the Masterplan for ICT in Education 3 (Mp3). Mp3 seeks to “enrich and transform the learning environments of our students and equip them with the critical competencies and dispositions to succeed in a knowledge economy” [30]. Of particular interest is the strategy to strengthen the integration of ICT in the educational curricula, assessment and pedagogy, where among other competencies, students are expected to “use ICT to look for information, synthesise reports, give feedback on each others’ work and collaborate with peers within and outside school”. In other words, students should be able to demonstrate both ICT and IL competencies in their learning and in completing assignments.

4.1.2 Project Work
PW was made part of the school curriculum in stages, beginning in 2000. PW was developed with the aim of providing students with the opportunity to synthesize knowledge from different sources and critically and creatively apply them in various situations [28]. Students between Grades 3 and 5 are given their first experience of PW, while at the high school level, students between Grades 7 and 9 go through PW at a more in-depth level [2]. Students at Grade 11 take PW as an examinable subject that constitutes their overall university entry requirements. There are four domains of learning outcomes for PW, namely: Knowledge, Application, Communication, Collaboration, and Independent Learning. Of particular interest is the domain of Knowledge Application which states that “students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task” [28].

4.1.3 Innovation and Enterprise
I&E was introduced in 2004, with the aim of developing intellectual curiosity among students as well as the ability to think originally [39]. Students would question assumptions, evaluate information that they have found, experiment with different ways of doing things, recognize patterns and make connections among ideas and concepts [34]. In other words, students learn to look for different and new ways of doing things, be resourceful, and exemplify lifelong learning.

4.1.4 Teach Less, Learn More
TLLM was introduced in 2005 with the objective of focusing less on directed instruction and purely content knowledge, to doing more engaged learning and boosting the quality of learning [38]. Students would do less rote learning and recall of facts during assessments, and instead would do more learning through discovery and developing lifelong learning skills. Teachers would transit from information providers to learning facilitators. There would be greater emphases on construction of knowledge, understanding, social constructivism (or socially constructed learning experiences), self-directed learning, formative assessment and self-assessment, and metalearning [35].

It is seen that in general, all these initiatives necessitate students to fundamentally possess IL competencies which would in turn facilitate fulfilling the specific learning outcomes or objectives of these initiatives effectively.

4.2 Values education in Singapore
Values education is taught in Singapore schools through Civics and Moral Education (CME), which is a compulsory subject for all elementary and high school students. The CME syllabus launched in 1995 has undergone intensive revisions from earlier values education syllabi that started in 1959 [19]. The CME syllabus emphasized religious and cultural differences, community spirit, interpersonal relationships, and cultivating strength of character and
developing self potential. These are values or mindsets that are seen to be necessary in the multi-ethnic and multi-religious Singapore society, which sees people as its greatest asset in lieu of the country’s lack of natural resources. Hence, values become the integral core of the education curricula in Singapore, with its role mainly as the glue to the social fabric of this multi-ethnic and multi-cultural nation.

4.3 IL in Singapore

More than a decade ago, the School Libraries Unit of the MOE’s Curriculum Planning and Development Division (CPDD) prepared and published the Information Literacy Guidelines (ILG) and Information Literacy Supplementary Materials (ILSM) for use in Singapore schools [24; 25] from the elementary right through to pre-university level. The ILG provided a framework for teaching students how to manage their learning, handle the increasing amounts of information (especially with the then recent availability of the Internet), and make novel and creative use of the information obtained [24]. The ILG document also included a list of the various skills and knowledge that students at the elementary school, high school and pre-university levels should obtain, including the attitudes towards learning and carrying out collaborative work that they ought to exhibit; recommendations on how the IL programme could be implemented within the school curriculum; and rubrics for standards on performance in IL. Sample lesson plans for specific subjects at certain levels, sample pupil performance standard for specialized subjects, and sample school media resource library programs to impart IL competencies, were appended in the ILG document.

The ILSM contained six sample lesson plans for different subject areas specifically at the high school level, coupled with suggested activities of how information literacy skills can be integrated into the various subject areas [25]. The proposed lesson activities promoted resource-based and cooperative learning. The document sought to augment the ILG.

Another publication, The Extensive Reading and Information Literacy (ERIL) Program was also published in 1997. However, the focus of the ERIL document was on the incorporation of IL skills in the English Language high school curriculum in particular, with emphasis on reading [29]. The ERIL document provided suggestions on establishing the program, ways of monitoring students’ progress in the programme (i.e. post-reading activities and continuous assessment assignments), and the criteria for evaluating the program. A sample scheme of work was also included for teachers to refer to in implementing the ERIL program.

Although these three documents were very comprehensive, they had a short lease of life and have ceased to be used in schools.

In 1998, the MOE collaborated with the then National Library Board Institute (NLBI) and to conduct training programs for the Heads of Department for Information Technology and Media Resource Library (HOD IT/MRL) from the high schools [32]. Professionals and academics from the field were consulted and engaged to teach various courses in the program, where IL was one of the components. A year later, the MOE and the National Library Board (NLB) organised the Library@School Conference in September 1999 with the specific objective of helping schools enhance their libraries and extend their services to both students and teachers in the schools [27]. The conference aspired to be a platform for practitioners from schools and the NLB, and experts in the field of Library and Information Science to share ideas and strategies on how school libraries could transform themselves into the central learning hubs of the education sector in the new millennium. However, such IL-based workshops and conferences are no longer conducted for school practitioners.
4.4 IL and the Teacher Education Model for the 21st Century

Recently, the National Institute of Education (NIE) has published a report on A Teacher Education Model for the 21st Century, abbreviated as the TE21 Model [31]. In the report, it was identified that among the 21st century skill sets for students are Learning and Innovation Skills, which includes critical thinking, problem solving, and innovation; and Knowledge, Information, Media and Technology Literacy Skills, which lists information literacy and ICT literacy separately. Hence, it is seen that IL has been recognized as a separate yet necessary component from ICT literacy. The report also emphasized that the content and pedagogy employed by the sole teacher training institute “be able to produce teachers with 21st century skills, who are equipped in all aspects to guide the 21st century student”. IL then becomes a required basic skill set for teachers of the 21st century.

5. Proposed model for developing Singapore IL standards

With the execution of Mp3 and enhanced directions in PW and ADE, it becomes obvious that a new set of IL curriculum package for students as well as teachers needs to be developed and implemented. This package can be made up of IL programs for the various grade levels (elementary, high school and pre-university), IL courses for teachers, and curriculum-integrated activities to impart and nurture the necessary IL competencies. In addition, this IL curriculum package cannot simply adopt the existing IL standards that have been used in various developed countries such as the US, UK or Australia, without considering the unique multi-ethnic and multi-cultural setting of Singapore. This IL curriculum package has to include components of values education that are necessary in infusing citizenship values and social inclusion skills in education.

Prior to developing this IL curriculum package, an exploratory study has to be carried out to gather data on students’ and teachers’ perceptions towards and levels of competencies in IL. However, before the instruments for data collection can be created, a set of standards for IL must first be established. With this set of IL standards, perceptions towards and levels of competencies in IL can be more accurately measured and benchmarked.

With this in mind, a model to develop the set of IL standards is proposed, guided by the aforementioned international IL standards; based on the paradigm of the information and technology literacy process model known as the Big6; and steered by the educational initiatives that have been implemented in Singapore, as discussed above. It is imperative that the school curriculum and related educational initiatives be considered in the development of the proposed IL model, since this ensures that the eventual model and hence standards for IL makes the link back to the school curriculum and thus allows a more authentic learning process to take place [12].

Since the Big6 is a widely used model for the information search process and in inculcating IL competencies in students, and it is seen to be easily integrated in the school curriculum, it is the choice information technology literacy process model for use in schools. Each of the six categories in the Big6 framework is expounded in terms of Techniques and Tools. Techniques refer to the strategies that can be adopted to assist in the learning and development of the skills and knowledge under that particular category. Tools refer to the specific apparatus or instruments that can facilitate the strategies that are put in place.

However, it was felt that the Big6 model puts little emphasis on CIS, a growing trend in information seeking. In addition, it was felt that the Big6 model has not sufficiently included aspects of ethics and social responsibilities, or desirable attitudes and perceptions that would facilitate IL competency, and which are necessary, given the unique educational and sociological context of Singapore. Ethics and social responsibility is necessary to ensure that students are not just information literate but that they exhibit ethical and responsible use of information. Desirable attitudes and perceptions related to IL such as persistence, being
motivated, having confidence in one’s ability, and respect for diverse opinions, are necessary traits that complement IL competency and ensure that students are able to seek, evaluate and use information with an open mind and heart. In addition, the ability to work together and seek and evaluate information is essential for ensuring that students are able to collaborate and work within group settings, and that it is an inevitable trait of being information literate. These complementary aspects of IL are labeled as mindsets.

Hence, a 6+3 Model for developing the set of IL standards for Singapore schools is proposed, which sufficiently encompasses both the competencies and mindsets necessary to instill and nurture IL in students (Figure 1).

5.1 Development of the proposed 6+3 model

The proposed model was developed by a group of academics in the Information Literacy research cluster at the Wee Kim Wee School of Communication and Information (WSCI), Nanyang Technological University (NTU), Singapore, together with external inputs and contributions from collaborating academics and doctoral candidates from NTU, the National Institute of Education and the University of Malaya. The team met regularly over a period of four months to critically review the related literature on IL standards, information seeking behavior and mindsets that support IL competency. Furthermore, several brainstorming sessions were conducted to yield the proposed model for IL standards for use in Singapore schools.

The proposed model is essentially made up of six sets of Competencies (based on the Big6), with each set of competencies being dichotomized into Techniques and Tools. The Techniques and Tools are each illustrated by a set of descriptors (Table 1).

In addition, three important Mindsets are also included to complement the six sets of competencies of the 6+3 Model (Table 2).

5.2 Examples of using the proposed 6+3 model

This section provides two examples to illustrate how the model can be used in schools. First, in Task Definition, the following can be attempted for students who are doing a group project (Figure 2):
• The teacher or facilitator can initiate the definition of the group project task by carrying out a *brainstorming* session with the students in a *small group setting*. Students can be asked to discuss with their friends in the group a topic that has been given, such as what the topic is about, where the topic is seen to be in action, and so on.

• Once each student has a better idea of what the topic involves and entails, a group-based *mindmapping* exercise can be done. Students within the group can get together to create a mindmap of what they perceive the topic to be, using *WH* questions (i.e. why, when, where, what, who, how). They can also use *reference tools* such as encyclopedias to help them do this.

• From the mindmap, students in the group can *analyze it to broaden or narrow* the various components by using *KWL* (i.e. what they *Know*, what they *Want* to know, and what they *have Learnt*). This in turn will help them formulate their *Research topic and questions*.

• Once this is done, they can still carry out several *iterations* of the research topic and questions to further refine them. They can carry out further group discussions through *social networking tools* such as e-mails, a group blog, SMS (short message service) and so on. This can be extended to include the teacher or facilitator.

• Once the group members have decided what the research topic and questions are, they can start planning for the group project using *project management tools* to manage their schedule, budget and use of resources.

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**Figure 2**: Example of implementing the *Task Definition* set of IL competencies
<table>
<thead>
<tr>
<th>Task Definition</th>
<th>Information Seeking and Strategies</th>
<th>Location and Access</th>
<th>Information Use</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>Ability to recognize and define the need for and the extent of information</td>
<td>Understanding and Identification of suitable types and formats of potential sources of information</td>
<td>(A) Ability to locate information sources efficiently and effectively</td>
<td>Ability to select and evaluate information content</td>
<td>Ability to extract, organize, and create information</td>
</tr>
<tr>
<td><strong>Techniques</strong></td>
<td>▪ Brainstorming ▪ Browsing information ▪ Mindmapping ▪ Questioning ▪ Analysis for broadening or narrowing information needs e.g. KWL* ▪ Social networking ▪ Iteration to clarify, revise or refine need ▪ Project management</td>
<td>▪ Brainstorming ▪ Evaluation for authority, scope at source level ▪ Iteration ▪ Seeking expert opinion (e.g. teachers, librarians) ▪ Social networking</td>
<td>(A) ▪ Navigation of libraries and other agencies ▪ Information and knowledge organization ▪ Iteration ▪ Different kinds of libraries (e.g. National, public, school, academic, special, digital) ▪ Other agencies (e.g. government ministries, NGOs, SMEs, private) ▪ Reference services (physical and virtual) ▪ Locational tools (e.g. Online Public Access Catalogue (OPAC), parts of a book, ▪ Evaluation ▪ Cross-comparison of content ▪ Information processing ▪ Critical thinking ▪ ICT competencies ▪ VARK* modes of information representation ▪ Identification and inference of data ▪ Summarization ▪ Recording sources of information</td>
<td>▪ Note-taking and outlining ▪ Arranging and categorizing information ▪ Information representation ▪ Use of information reproduction technologies ▪ ICT skills for data transformation ▪ Creative and critical thinking, problem solving skills ▪ Packaging information for consumption ▪ Proper use of quotations and paraphrasing ▪ Iteration</td>
<td>▪ Gap analysis ▪ Ongoing monitoring of information updates ▪ Evaluation of information process/product ▪ Self-reflection ▪ Iteration (for revising, improving and updating) ▪ Planning (for future investigative directions)</td>
</tr>
</tbody>
</table>

Table 1: Six sets of IL competencies
<table>
<thead>
<tr>
<th>Task Definition</th>
<th>Information Seeking and Strategies</th>
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<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Keywords, controlled vocabulary</td>
<td>▪ Pearl growing, block-building and successive fraction strategies</td>
<td>▪ Stereotyping</td>
<td>▪ Graphical organizers, spreadsheets</td>
<td>▪ Peer review</td>
</tr>
<tr>
<td></td>
<td>▪ 'WH' questions</td>
<td>▪ Genre of information sources (e.g. News story, critical essays, satire, autobiography, biography)</td>
<td>▪ Censorship and freedom of speech</td>
<td>▪ Graphs, charts and other visualization tools</td>
<td>▪ Expert feedback (e.g. teachers, librarians)</td>
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<tr>
<td></td>
<td>▪ Interlibrary loans</td>
<td>▪ Type of searches (e.g. Keyword and phrase searching, known item search vs subject search, field search, free text)</td>
<td>▪ Values and beliefs</td>
<td>▪ Photocopier, scanner, cameras</td>
<td>▪ Alerting services</td>
</tr>
<tr>
<td></td>
<td>▪ Research topic and questions</td>
<td>▪ Search syntax and operators (e.g. Boolean, proximity)</td>
<td>▪ Authority</td>
<td>▪ Editing and format conversion software</td>
<td>▪ Reliability, validity, accuracy, currency, comprehensiveness, relevance, applicability</td>
</tr>
<tr>
<td></td>
<td>▪ Reference tools (e.g. encyclopedia, dictionary)</td>
<td>▪ Type of searches (e.g. Keyword and phrase searching, known item search vs subject search, field search, free text)</td>
<td>▪ Facts, point of view, opinion</td>
<td>▪ Web 2.0 tools</td>
<td>▪ Web 2.0 tools</td>
</tr>
<tr>
<td></td>
<td>▪ Class discussions, peer workgroups, electronic discussions</td>
<td>▪ Stereotyping</td>
<td>▪ Propaganda, misinformation, and disinformation</td>
<td>▪ Productivity suite software</td>
<td>▪ Journals and logs</td>
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<tr>
<td></td>
<td>▪ Primary vs. Secondary sources of information</td>
<td>▪ Search syntax and operators (e.g. Boolean, proximity)</td>
<td>▪ Reliability, validity, accuracy, currency, comprehensiveness,</td>
<td>▪ Assessment and</td>
<td></td>
</tr>
<tr>
<td>Task Definition</td>
<td>Information Seeking and Strategies</td>
<td>Location and Access</td>
<td>Information Use</td>
<td>Synthesis</td>
<td>Evaluation</td>
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<tr>
<td>Web 2.0 tools (eg. blogs, wikis, social networking tools, SMS tools)</td>
<td>communication channels of information</td>
<td>search)</td>
<td>and relevance</td>
<td>Principles of design (sequence and flow, aesthetic considerations)</td>
<td>rubrics</td>
</tr>
<tr>
<td>Project management tools (time, budget and resource)</td>
<td>Academic discipline, intellectual culture, divergent perspectives on information</td>
<td>Alerting services (eg. RSS feeds)</td>
<td>Categorisation and tagging</td>
<td>Citation styles</td>
<td>SWOT* analysis</td>
</tr>
<tr>
<td></td>
<td>Formal and informal information production, organization and dissemination</td>
<td>Index browsing, truncation, thesaurus, subject headings, range and limit search</td>
<td>Causation and correlation</td>
<td>Bibliographical system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reference materials (eg. Encyclopedia, almanacs, bibliographies, fact books)</td>
<td>Web 2.0 tools</td>
<td>Claim and evidence</td>
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<tr>
<td></td>
<td>Web 2.0 tools</td>
<td></td>
<td>Peer-reviewed content</td>
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<tr>
<td>Notes</td>
<td>KWL - what we Know, what we Want to know, what we have Learnt</td>
<td>VARK – Visual, Aural, Read-Write, Kinesthetic</td>
<td>Information as commodity (fee vs. free-based information)</td>
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<td></td>
<td></td>
<td></td>
<td>Skimming and scanning</td>
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</tr>
</tbody>
</table>

*Notes

KWL - what we Know, what we Want to know, what we have Learnt

VARK – Visual, Aural, Read-Write, Kinesthetic

SWOT – Strengths, Weaknesses, Opportunities, Threats

rubrics

SWOT* analysis
Table 2: Three mindsets that support IL

<table>
<thead>
<tr>
<th>Ethics &amp; Social Responsibility</th>
<th>Collaborative Information Seeking Behavior</th>
<th>Attitudes &amp; Perceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>Ability to understand and exhibit moral and social aspects of information use</td>
<td>Ability to seek, share, and create information as an individual and part of a productive team</td>
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<tr>
<td>▪ Acknowledge cultural, ethical, economic, legal, and social issues of information use</td>
<td>▪ Participate actively in seeking, sharing, and creating information</td>
<td>▪ Display initiative and engagement</td>
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<td>▪ Compliance with institutional policies and procedures</td>
<td>▪ Contribute positively to wider learning community</td>
<td>▪ Display curiosity</td>
</tr>
<tr>
<td>▪ Contribute to the improvement of institutional policies and procedures</td>
<td>▪ Listen to and respect others</td>
<td>▪ Display persistence</td>
</tr>
<tr>
<td>▪ Protect the integrity of information resources, equipment, systems, and facilities</td>
<td>▪ Be a responsible team member (e.g. punctuality, avoid social loafing)</td>
<td>▪ Display emotional resilience</td>
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<tr>
<td>▪ Respect privacy and intellectual property</td>
<td>▪ Exercise initiative and leadership as appropriate</td>
<td>▪ Demonstrate motivation</td>
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<tr>
<td>▪ Ensure the security of created information product</td>
<td>▪ Exercise due diligence and care when seeking and sharing information in informal settings</td>
<td>▪ Demonstrate confidence and self-direction</td>
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<tr>
<td><strong>Guidelines</strong></td>
<td></td>
<td>▪ Demonstrate adaptability</td>
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<tr>
<td>▪ Plagiarism detection software</td>
<td></td>
<td>▪ Demonstrate personal productivity</td>
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<tr>
<td>▪ Copyright, patents, trademarks, trade secrets</td>
<td></td>
<td>▪ Demonstrate proper use of library resources and facilities</td>
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<tr>
<td>▪ Fair Use</td>
<td></td>
<td>▪ Show constant improvement of literacy, skills and strategies</td>
</tr>
<tr>
<td>▪ Open Source</td>
<td></td>
<td>▪ Respect diverse perspectives, interests and experiences of others</td>
</tr>
<tr>
<td>▪ Netiquette</td>
<td></td>
<td>▪ Exhibit cultural, social, and religious sensitivity</td>
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<td>▪ Feedback forums</td>
<td></td>
<td>▪ Appreciate and respond to various expressions of ideas</td>
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<tr>
<td>▪ Licensing verification tools</td>
<td></td>
<td>▪ Be an independent and lifelong learner</td>
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<tr>
<td>▪ Permission granted notices</td>
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<tr>
<td>▪ Citations</td>
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<tr>
<td>▪ Firewalls, antivirus, filtering and anti-spamming software</td>
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<tr>
<td>▪ Backup tools</td>
<td></td>
<td></td>
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<tr>
<td><strong>Tools</strong></td>
<td></td>
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<tr>
<td>▪ Web 2.0 tools</td>
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<tr>
<td>▪ Face-to-face discussions (e.g. classrooms, seminars, conferences, workshops, meetings)</td>
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<td>▪ Idea processors</td>
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<td>▪ Computer supported cooperative work (CSCW) tools</td>
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<td>▪ Task allocation</td>
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<td>▪ Cross-referencing</td>
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<td>▪ Group role rotation</td>
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<td>▪ Peer assessment</td>
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<td>▪ Observation</td>
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<tr>
<td>▪ Ethnography</td>
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</table>
Second, in order to develop ethics and social responsibility among the group members, the following can be considered (Figure 3):

- The teacher or facilitator can remind students to respect privacy and intellectual property of the information sources that they use. For instance, students can be taught how to cite sources used in their project report through examples of papers that are written with citations and those without proper citations. In addition, students can be asked to submit draft copies of their project report through plagiarism detection software such as Safe Assignment or Turnitin.
- The teacher or facilitator can also explain to students the consequences of not respecting intellectual property (ethical and legal use of information and information products) as well as the differences between the different kinds of intellectual property such as copyright, trademark, patent, and so on.
- The teacher or facilitator can also remind students to ensure the security of the information product (e.g. project report) that they have created. This must be done to ensure that any confidential information is kept rightly so, and opportunities for indiscriminate copying of the information product are minimized. Tools such as antivirus or anti-spamming software can be used.

6. Application and Limitations of Proposed Model

By organizing the model into a set of techniques and tools along the dimensions of tasks associated with information seeking, easy identification of key techniques associated with each task can be done. These provide a useful framework for drawing information to define competencies and skills of an information literate person, design an IL-based school curriculum, and identify appropriate tools that can be used for hands-on IL training. In addition, the three mindsets that are presented can be used separately in various subjects in the school curriculum such as in National Education, Civics and Moral Education, or Project Work. Consequently, IL can be weaved into the subjects mentioned above since they are already facilitated by the three mindsets that support IL in the proposed model.

The proposed 6+3 Model for developing a set of IL standards for Singapore schools can be used as a benchmark for constructing the data collection instruments mentioned earlier to gather the perceptions towards and levels of competencies in IL of both students and teachers. The proposed 6+3 Model is not exhaustive. Data collected through the instruments can help revise and refine the proposed model.

7. Conclusion

This paper has proposed a model for developing IL standards for use in Singapore schools. The model incorporates the Big6 information and technology literacy model, which essentially outlines the six tasks that are necessary to exhibit the spectrum of IL competencies.

Figure 3: Example of implementing the Ethics and Social Responsibility mindset to support IL
In addition, the proposed model complements the six tasks with three important mindsets that will facilitate the development of the IL competencies.

The proposed 6+3 Model is currently being used to develop three sets of comprehensive questionnaires for students at the elementary school, high school and pre-university levels, and teachers respectively. A pilot run of the questionnaire for high school and pre-university level students is expected to be carried out by the end of 2009. The refined questionnaire will be administered nationwide in Singapore in 2010. It is expected that all primary and secondary schools as well as junior colleges in Singapore will be involved. Systematic random sampling will be adopted in identifying the students within each school that would partake in the survey.

In the longer run, it is hoped that the sets of questionnaires can be used as an IL benchmarking tool for students and teachers across Southeast Asia. The developers of the questionnaires will identify generic and specific questions in the questionnaires, and provide guidelines on how to customize the specific questions to suit local requirements and contexts while preserving the focus of the questions and their corresponding measurement scales so as to enable cross comparison studies to take place in future.

References


