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Auditing information literacy skills of secondary school students in Singapore

Shaheen Majid, Associate Professor, Wee Kim Wee School of Communication and Information, Nanyang Technological University. Email: asmajid@ntu.edu.sg

Yun-Ke Chang, Assistant Professor, Wee Kim Wee School of Communication and Information, Nanyang Technological University, Singapore. Email: ykchang@ntu.edu.sg

Schubert Foo, Professor, Wee Kim Wee School of Communication and Information, Nanyang Technological University, Singapore. Email: sfoo@ntu.edu.sg

Abstract

The aim of this study was to assess the information literacy (IL) and cyber-wellness skills of Secondary 3 (grade 9) students, age 14-15, in Singapore. The Ministry of Education in Singapore has introduced aspects of IL in schools through incorporating components into the syllabi of various subjects. A pilot-tested online survey, validated by IL experts from Canada, Hong Kong, Kuwait and Thailand, was used for data collection. The survey was taken by 2,458 students from 11 secondary schools in different geographical zones of Singapore. It was found that the use of school libraries and their resources was at a very low level. The majority of the students approached classmates and friends for help in solving their information-related problems. Only a small fraction consulted their school librarian. The overall IL assessment score showed that the students possessed a 'middle' level of IL skills which is better than previous (pre-curriculum integration) IL assessment studies in Singapore. As curriculum-embedded IL skills are taught by subject teachers, their level of preparedness could be a matter of concern. Similarly, fragmentation of IL concepts in different subject textbooks may cause co-ordination problems among teachers. This paper highlights the need for developing a roadmap for providing IL skills at different grade levels and in different subject areas. It is expected that the findings of this study will be useful to curriculum planners, teachers, schools librarians and others involved in IL education.

Keywords

information literacy; skills assessment; school libraries; secondary education; curriculum integration; Singapore; cyber-wellness

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1. Introduction

During the last three decades the concept of information literacy (IL) has gained tremendous acceptance and support. There has always been a recognition among library and information professionals that users need some assistance and training to identify, select and use relevant and more appropriate information sources to meet their diverse information needs. In 1972 Paul Zurkowski coined the term 'information literacy' and a new discipline of user education emerged which was much more broad-based than traditional library instruction. Though IL skills were always considered vital in the learning process, availability of an enormous amount of digital information through multiple platforms has further increased its importance (Blummer and Kenton 2014; Chan et al 2014; Yeh et al 2014). Without the necessary skills to search, locate, process, evaluate, and use information, people may experience various information-related problems, such as using low-quality information, experiencing information overload, inability to find the needed information, and

lack of skills to avoid using misinformation and disinformation (Andretta et al 2008; Majid et al 2013; Miller and Bartlett 2012). This led to the formulation of several IL models and standards in different geographical regions, with a considerable degree of overlap, that identify sets of desirable skills to help students to use quality information in an ethical manner. These standards also helped curriculum designers and educators to develop appropriate materials and resources for conducting IL training (Rowland 2005; Swanson 2004; Weiss et al 2005).

Education institutions have been using different methods for imparting necessary IL skills to their students including short IL training sessions, hands-on workshops, demonstrations, computer assisted instruction, self-directed independent learning, online tutorials and quizzes, YouTube videos, and credit and non-credit academic courses. Several studies discuss the scope and effectiveness of these methods (Koufogiannakis 2006; Latham and Gross 2013; Lei Hsieh et al 2014; Schroeter and Higgins 2015). However, several recent studies suggest that students are more likely to learn and retain IL skills if embedded in the curriculum (Kessinger 2013; Ballard 2014; Mackey and Jacobson 2014; Sullo 2015). Some countries, including Singapore, have started integrating IL skills into school curricula to allow students to learn and apply these skills in different learning situations. This integration is also likely to help students appreciate the importance of information skills and apply these in non-academic situations thus fostering the process of becoming lifelong learners. This study assesses the IL skills of Secondary 3 (15-year-old) students in Singapore to evaluate the impact of embedding IL and cyber-wellness across subject curricula in Singapore.

2. Literature review

We are currently in an era of renewed interest in different pedagogical approaches for teaching IL skills. Educators, researchers and practitioners are continuously exploring new ways of teaching these skills (Davis 2013; Gonzales 2014; Mullins 2014; Zhang et al 2015). Concurrently, efforts are being made to further expand the scope and coverage of the concept of IL, and to incorporate new skills including media literacy, visual literacy, social media literacy, cyber literacy and information fluency (Mackey and Jacobson 2014; Miller 2012). Majid et al (2013) asserted that an information-literate person also needs to possess basic personal information management skills. According to them, after seeking the needed information, such a person should be able to properly organise and maintain the information for current as well as possible future use. Some of the tasks associated with information organisation and maintenance are: categorising and labelling documents; renaming documents; moving documents to different folders/devices; deleting documents after use; backing up documents; and archiving documents for their possible future use. The recent proliferation of social media tools has also sparked the interest of many IL researchers as they have changed the way people identify, access, use, and disseminate information (Cirella 2012; Machin-Mastromatteo 2012). Some IL experts suggest the blending of IL and media literacy to engender a more comprehensive skill set, and studies conducted during the past decade strongly support this idea (Koltay 2011; Kymes 2011; Lee and So 2014).

Several higher education institutions and professional associations from different geographical regions have proposed IL standards and models to guide individuals and agencies involved in providing IL education. In the USA, a joint publication in 1998 by the American Library Association (ALA) and Association for Education Communication and Technology, proposed *Information Power* to provide a foundation for professional practice based on IL standards. Similarly, the Association of College and Research Libraries (ACRL) has produced *Information Literacy Competency.* Both are considered the *de facto* standard for IL competencies in the USA and many other countries worldwide. In 2012, ACRL established a task force to propose a revised framework which has presented its recommendations in January 2015 (ACRL 2015).

The United Kingdom and Australia have also developed their own IL standards. In 2000 the Council of Australian University Librarians (CAUL), with representation from New Zealand and from other organisations, reviewed the US IL standards for adaptation in the Oceanic region. The second edition of the standards was published in 2004 and called *Australian and New Zealand*

Information Literacy Framework (ANZIIL 2004) which provided the guiding principles of the six core standards. In 1999, the UK Standing Committee for National and University Libraries (SCONUL) proposed the *Seven Pillars of Information Skills*. The model was revised and expanded in 2012 to present a generic core model for higher education, to which a series of lenses representing the different groups of learners can be applied (SCONUL 2015).

Some efforts have been made to customise international standards to suit the unique local conditions of individual countries. In Singapore, Mokhtar et al (2010) proposed a 6+3 model for teaching IL skills to students. In addition to suggesting certain refinements to the Big6 IL model (Eisenberg and Berkovitz 1990), the 6+3 model proposed three additional competencies related to ethics and social responsibility, collaborative information behaviour, and attitudes and perceptions (e.g. initiative, curiosity, persistence). In Malaysia Edzan and Saad (2005) analysed IL initiatives and proposed a framework for the implementation of a national IL agenda.

2.1 Teaching IL skills

Different approaches have been used for imparting IL skills to different levels of students. However, many studies suggest that students still do not possess the desired levels of these skills (Foo et al 2014; Ladbrook and Probert 2011; Thonney and Montgomery 2015). A growing number of researchers are convinced that instead of standalone and independent IL training modules, an integration of these skills into appropriate subject syllabi could be more effective and meaningful as students would be able to appreciate the application of these skills in different situations (Moll 2009; Niedbala and Fogleman 2010; Vijay and Satish 2010). Kessinger (2013) outlined a procedure for integrating IL skills into a community college curriculum. Content analysis of the curriculum documents was conducted to identify subject areas for the possible integration of IL skills. Following this analysis, course specific research support forms were created to map IL instructional objectives into individual course outcomes. Stombaugh et al (2013) also discussed the procedure for integrating IL skills into the nursing curriculum while Sullo (2015) reported an increase in information use confidence among nursing students after the integration of IL skills into their curriculum.

Chen et al (2014) investigated the effect of integrating IL skills into science instruction. Two seventh-grade classes (age 12-13) from a public junior-high school in Taiwan were selected and students were divided into experimental and control groups. The experiment group received an inquiry-based science curriculum infused with IL skills while the control group received traditional lecture-oriented IL instruction. Both groups were taught by the same teacher. Students in the experimental group performed significantly better than the students in the control group on reading comprehension and problem solving.

In South Africa, a national curriculum provides learning goals for each subject (such as languages, mathematics, science, technology, social science, and arts and culture) which also helps pupils obtain IL skills (Moll 2009). The goal of this curriculum is to allow students to examine, utilise, find, evaluate and/or construe meaning from the information they use. Harris (2013) noted that the Quality Enhancement Plan (QEP), an accreditation requirement for the Southern Association of Colleges and Schools (SACS) in Australia, often involves IL learning outcomes being integrated into courses across the curriculum. Eighteen universities from 2004 to 2011 have focused on IL as the core skill to enhance their curriculum (Harris 2013). In Taiwan, Lin et al (2014) examined the effects of four-year integrated IL instruction via a framework of inquiry-based learning on elementary students' memory and comprehension. The IL instruction was integrated into various subject content. The results showed that inquiry-based integrated IL instruction helped students memorise facts and comprehend subject concepts more effectively.

However, one related concern is whether library and information professionals possess the required skills and competence to promote the integration of IL to academic staff due to their limited pedagogic knowledge (Moselen and Wang 2014). Likewise, in situations when school teachers are required to teach IL skills integrated into their subject syllabus, it could be a

challenging task for them without adequate acquaintance with IL concepts. It is, therefore, desirable that teachers should be exposed to information-related concepts through well-designed professional development programs (Ballard 2014).

2.2 Assessing IL skills

Irrespective of the approach chosen to provide IL skills to students, it is imperative that an appropriate assessment technique should be used to measure the level of skills possessed by them. Techniques including fixed choice tests, performance assessment and rubrics have been used by researchers (Oakleaf 2009). Gola et al (2014) explained the process of developing a rubric, in collaboration with Assessment and Accreditation Services of the University of Houston, for assessing students' IL skills. They believe the collaborative development of this rubric helped in gaining recognition for IL skills as well as initiating a discussion on how to strengthen IL education for students.

Three assessment approaches identified by McCulley (2009) were knowledge tests and surveys, performance assessment and informal assessment. The knowledge tests and surveys approach measures one's level of IL skills. Some examples of such tests are *Standardised Assessment of IL Skills* (SAILS); *Tool for Real-time Assessment of Information Literacy* (TRAILS); and *Research Readiness Self-Assessment* (RRSA). The second approach focuses on performance assessment, using a rubric or a descriptive scoring scheme to evaluate students' work, which allows measurement of higher-order thinking and enables students to understand the expectations of their instructors. It may also use the portfolio technique to consolidate a student's effort in various aspects of IL over a period of time. The third approach is informal assessment where different classroom activities and tasks are used by a teacher to test various IL-related skills possessed by students.

Different assessment techniques can be used that take into consideration the purpose of the assessment, the education level of students and the skills to be assessed. Chiung-Sui and Liu (2011) used a Chinese-language survey validated by six experts specialising in the field of information and communication technology education. Claro et al (2012) used a portfolio approach to analyse relationships between the ICT skills of high school students and individual and contextual factors such as access to ICT, types of ICT applications used, and confidence in doing different activities with ICT. Eskola (2005) used a combination of qualitative techniques such as interviews, students' diaries, observations, and content analysis of relevant documents to investigate selection, evaluation and use of various information sources and communication channels by students for different learning situations and assignments. In a study conducted by Floyd et al (2008), a rubric was used to gauge appropriateness of references used by the students for their assignments. In this rubric, timeliness, credibility and relevance of information resources were emphasised. However, the literature review suggests that a predominant number of studies assessing IL skills of school students have used performance tests and surveys (Islam and Murno 2006; Mokhtar et al 2008; Smith et al 2013).

2.3 IL in Singapore

The Singapore education system is considered one of the best in the world due to its innovative pedagogic approaches and readiness to incorporate novel ideas to make learning more holistic, interesting and meaningful (Barber and Mourshed 2007). Among other initiatives, efforts to teach IL skills to students started in 1997 with limited success (Foo et al 2014). However, renewed interest in IL started gaining momentum in subsequent years (Mokhtar et al 2008). More recently, in the Teacher Education Model for the 21st Century (the TE21 Model), IL skills were included in the skill set to be taught to students from a younger age (MOE 2010). As a result, a number of IL components were incorporated into textbooks of various subjects at different grade levels (Foo, Chang and Majid 2014).

3. Problem statement

In Singapore, some initial efforts were made in the late 1990s to teach basic IL skills to school pupils. However, there is now a renewed interest in IL as recent education policies have put more emphasis on 21st century competencies, critical thinking and communication skills. Similarly, heavy use of social media by students has triggered the need to create awareness about the safe and responsible use of cyberspace. Thus, some IL and cyber-wellness concepts have now been incorporated into school curriculum in Singapore.

To investigate whether these efforts have achieved the anticipated results, assessment of students' IL skills at different grade levels can reveal their competence level, identify areas of weaknesses and help explore the effectiveness of pedagogical approaches applied to teach these skills. To achieve this objective, three independent survey instruments were developed to assess IL skills of Primary 3 (age nine) (Foo et al 2014); Primary 5 (age 11) (Chang et al 2014), and Secondary 3 (age 15) students in Singapore. This paper reports the findings of the Secondary 3 students which is equivalent to grade 9 in other education systems. The findings of this study will be useful to curriculum planners, textbook authors and editors, school resource librarians and subject teachers involved in teaching IL skills.

4. Methodology

The study used the quantitative method of questionnaire survey to collect data. A majority of the previous studies on this topic have also used this method. It was also considered more appropriate as several schools, located in different geographical zones in Singapore, were expected to participate in the study. Moreover, it was a cost-effective method to accommodate a large sample size. The study was a collaborative research project, led by a group of IL researchers from Wee Kim Wee School of Communication and Information, Nanyang Technological University (NTU), Singapore. The other collaborating institutions were the National Library Board and the Ministry of Education Singapore.

The survey instrument was based on the i-Competency model developed by the members of Information Literacy Research Group at NTU (Figure 1). It is a refined version of the previous 6+3 model which was developed by the same team (Mokhtar et al 2010). Instead of six competencies, this model consists of the following five IL activities:

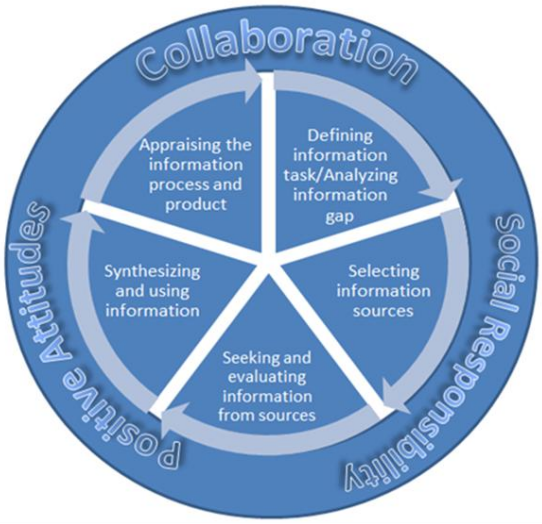
1. Defining information needs and analysing information gaps
2. Selecting information sources
3. Seeking and evaluating information from the selected information sources
4. Synthesising and using information
5. Appraising the information process and product.

The i-Competency model also reflects three elements that can contribute towards effective information seeking and use. Other IL models do not explicitly mention these attributes which are desirable for an information literate person in the fast-changing information landscape. These attributes are positive attitudes, collaboration, and social responsibility (Mokhtar et al 2010):

a) Positive attitudes: Students are expected to develop certain positive attitudes to enable them to successfully achieve the goals of their information tasks, such as confidence and self-direction, motivation, emotional resilience, adaptability and respect for diverse perspectives.
b) Collaboration: This attribute is particularly useful for students working on group projects where collaborative information-seeking and use has become a norm. Some elements of this attribute are: listen and respect others, become a responsible team member (e.g. punctuality, avoid social loafing), volunteering and accepting responsibilities, and coordination of group activities.

c) Social responsibility: The i-Competency model put a greater emphasis on social responsibility for ethical information-seeking and use, particularly in a socially-networked internet society. Some elements of this attribute are: respect privacy and intellectual property, avoid plagiarism and copyright violations, follow netiquettes and cyber-wellness, and respect cultural, social and religious sensitivities.

Figure 1. The i-Competency model



For developing the survey instrument, a number of previously developed and tested IL assessment tools including TRAILS (http://www.trails-9.org/) and SAILS (https://www.projectsails.org/) were consulted. Questions matching the scope of i-Competent model were identified, some of which were contextualised to Singapore. In addition, questions dealing with cyber-wellness were added. Only those questions which matched the IL concepts incorporated in subject textbooks were included. The draft questionnaire was sent to IL experts in British Columbia, Canada, Hong Kong, Kuwait and Thailand for their feedback and validation. Their recommendations related to the structure of some questions and length of the instrument were addressed. The questionnaire was subsequently pilot-tested on 20 Secondary 3 students who were not part of the sample (Mokhtar et al 2013). As a result, length and sentence structure of some questions were further refined and some words replaced to improve readability and comprehension. Table 1 provides a summary of the questions asked in different sections of the questionnaire. The highest number of questions were related to activity two (i.e selecting information sources) as several information sources needed to be covered. Three questions were also included on cyber-wellness.

Table 1: Number of questions asked in different sections of the questionnaire

Section	Number of questions
Demographics, use of libraries, and persons consulted for assistance	9
Activity 1. Defining the information task	6
Activity 2. Selecting information sources	10
Activity 3. Seeking and evaluation information from the selected sources	6
Activity 4. Synthesizing and using the information	6
Activity 5. Appraising the information process and product	1
Cyber-wellness	3

The questionnaire was divided into two sections – section one was on demographics while the second section assessed students' knowledge of different IL activities including cyber-wellness (Appendix A). In the section on demographics, in addition to questions related to gender, birth year and access to the internet at home, two questions asked students about their visit and resource use frequencies during the last 12 months of different types of libraries. Through a multiple choice question, the students were also asked who they would consult when undertaking different IL-related activities. The final question on demographics recorded students' self-assessment of their knowledge of different IL skills. The second section, comprising 32 questions, evaluated students' knowledge of various IL activities. All questions, except two questions on topic refinement, provided students four options each, out of which only one was correct. Altogether 41 questions were included in the questionnaire. The content validity and internal consistency of the questionnaire was assessed using Cronbach alpha coefficients. Coefficient values from 0.7 to 0.8 indicate good reliability and are excellent if above 0.9 (Hahne 2007). The overall Cronbach alpha of the questionnaire was 0.82, indicating a high level of internal consistency. The questionnaire was approved by the Internal Review Board (IRB) for research integrity, Nanyang Technological University, Singapore.

Principals of the selected schools were approached to seek their consent to allow Secondary 3 students to participate in this study. The survey was carried out on-site and in the form of self-administered paper questionnaires. The data collection exercise lasted for 3.5 months, from 31 July to 15 November 2013. A total of 2,458 students from 11 schools participated. In order to calculate the overall IL scores of the students during the data analysis stage, the questions were categorised into 'must have skills' and 'nice to have skills'. This categorisation, which was not shown in the questionnaire, was based on the importance and difficulty level of questions, as perceived by the researchers of this study. The basic IL skills which all Secondary 3 students were expected to possess were categorised as 'must have skills', while questions assessing certain additional or advanced skills were categorised as 'nice to have skills'. A correct answer to a 'must have skill' question was awarded two points while one point was given for a correct answer to a 'nice to have skill' question (Table 2). A zero was given for incorrect answers. The purpose of this categorisation was to calculate mean score for individual questions as well as for each of the five IL activities. The total raw score of the questionnaire was 53 which was converted to 100% to make it easier to understand and interpret.

Table 2: Categorisation of questions, assigned points and corresponding question numbers

IL Activities	**Question categories**		
	Must-know questions (2 points)	**Nice-to-know questions (1 point)**	**Maximum possible points**
Task definition	5 (Q10-11; Q13-15)	1 (Q12)	11
Sources selection	5 (Q16-17; Q23-25)	5 (Q18-22)	15
Information-seeking and evaluation	4 (Q26-27; Q29-30)	2 (Q28, Q31)	10
Information usage	5 (Q32-33; Q35-37)	1 (Q34)	11
Information process appraisal	-	1 (Q38)	1
Cyber-wellness	2 (Q40-41)	1 (Q39)	5
Total	21	11	53

5. Findings

The following sections present the findings of the study and their relationships with different variables.

5.1 Demographics

A total of 2,458 Secondary 3 (grade 9) students from 11 public schools from all over Singapore participated in this study. The proportion of female and male respondents was 51.6% and 48.4% respectively. As the internet is now a major tool for information-seeking, social networking and collaboration, as well as communication with teachers, classmates and other individuals, the students were asked if they have access to the internet from their homes. All public secondary schools in Singapore have well-equipped computer labs with internet access. An overwhelming majority (96.9%) of students indicated that they also have access at home.

5.2 Use frequency of libraries and their resources

In order to understand students' library use pattern and its relationship with their IL skills, the students were asked about their visit frequency to different types of libraries during the last year. As shown in Table 3, only 20% of the students reported visiting their school library once a week or more frequently. It was worth noting that 46.7% said that they had rarely visited their school library during the last 12 months. A similar finding was observed for public libraries and only 11.4% of the students indicated visiting these libraries once a week or more frequently. More than half of the students rarely visited public libraries. The use of the National Reference Library and academic libraries was very limited and more than 94% of the students had rarely or never used these libraries. On the whole, this was a worrying trend, as the majority of the students were not frequently visiting different types of libraries for their study-related and other information needs.

Table 3: Frequency of library visits during the last year

Visit Frequency	**Type of Library**		
	School (n=2454)	Public (n=2446)	Other (n=2449)
Daily	38 (1.5%)	18 (0.7%)	9 (0.4%)
2-3 times a week	249 (10.1%)	76 (3.1%)	20 (0.8%)
Weekly	206 (8.4%)	187 (7.6%)	27 (1.1%)
2-3 times a month	574 (23.4%)	652 (26.7%)	87 (3.6%)
Rarely	1147 (46.7%)	1247 (51.0%)	844 (34.5%)
Never	240 (9.8%)	266 (10.9%)	1462 (59.7%)

In addition, students were asked how frequently they had used library resources (including online materials) during the last year. It was disturbing to note that the usage of resources of all types of libraries was quite low. The percentage of students 'rarely' or 'never' using library resources was 71.9% for school libraries, 77.0% for public libraries, and 95.3% for the National Reference Library and academic libraries (Table 4).

Table 4: Use of library resources during the last year

Resource Use	Type of Library		
	School (n=2455)	Public (n=2448)	Other (n=2443)
Daily	22 (0.9%)	13 (0.5%)	8 (0.3%)
2-3 times a week	101 (4.1%)	46 (1.9%)	9 (0.4%)
Weekly	114 (4.6%)	105 (4.3%)	17 (0.7%)
2-3 times a month	452 (18.4%)	400 (16.3%)	81 (3.3%)
Rarely	1176 (47.9%)	1211 (49.5%)	700 (28.7%)
Never	590 (24.0%)	673 (27.5%)	1628 (66.6%)

5.3 Consultation for seeking information-related assistance

The students were asked who they would approach if they needed assistance to undertake IL-related tasks. The categories of people included in the questionnaire were classmates, friends, teachers, librarians and family members. The purpose was to identify the individuals consulted by the students for solving their information-related problems. It was a multiple-response question and the students were allowed to pick any number of options for each IL activity. For all activities classmates were the first choice for seeking information-related assistance (Table 5). This is understandable as classmates are usually easily-accessible as well as likely to know the context, scope and requirements of the topic. After classmates, the next preferred category was friends. Teachers played a secondary role in most IL activities, except *Appraising process and product* (37%), where they were as commonly sought-after as classmates. This was probably because teachers can provide feedback as well as indicate possible areas for improvement in students' reports.

A considerable number of the students also reported seeking help from family members. It was, however, alarming to note that only a very small percentage considered seeking help from their school librarians. This finding is consistent with a previous finding of this study (Table 4) where 71.9% of the students said they either rarely or never visit their school library.

Table 5: Persons consulted for seeking assistance for IL-related activities (multiple response)

IL Activity	N	Classmates	Friends	Teachers	Librarians	Family	None
1. Defining information task	2438	55.4%	49.1%	48.9%	4.2%	24.7%	10.4 %
2. Selecting information sources	2435	44.4%	41.7%	37.2%	8.0%	20.5%	18.6 %
Seeking and evaluation of information from selected sources	2432	42.8%	41.2%	38.8%	5.3%	20.4%	17.6 %
Synthesising and using information	2435	40.6%	37.1%	34.2%	3.3%	17.8%	19.3 %
Appraising information process and product	2435	37.5%	34.5%	37.0%	3.6%	19.1%	17.3 %

The following sections present findings related to students' perceptions of the level of IL skills they possess, their actual IL assessment scores, and relationships between different variables.

5.4. Self-efficacy of information competence

Before the actual IL skills of the students were assessed, they were asked to indicate their perceived level of skills for five activities, as well as for collaborative-information seeking. The purpose was to investigate if their perceived skill level was different from their actual level of competence. A five-point Likert scale was used for collecting their responses, where '1' represented very poor and '5' represented very good. As shown in Table 6, the mean scores of all the IL activities fell in a very narrow range of 3.25 to 3.55. It appeared students felt that they possess a 'middle' level of IL skills.

Table 6: Self-efficacy of IL skills

IL Activity	N	Mean (1~5)	SD
1. Defining the information task	2447	3.35	.791
2. Selecting information sources	2451	3.45	.812
3. Seeking and evaluation information from the selected sources	2450	3.41	.828
4. Synthesising and using the information	2447	3.35	.829
5. Appraising the information process and product	2449	3.24	.833
6. Complete an information task collaboratively with others	2451	3.55	.879

5.5 Assessment of students' IL knowledge

Figure 2 presents a distribution of the students by their overall IL assessment scores. The average score for the whole sample was 56.68%. However, the distribution of scores spread over a fairly large range. A considerable proportion of the students was in the 60% to 80% band while another concentration was in the 30% to 50% group. On the whole, it appeared that the majority of the students possessed 'middle' to 'good' levels of IL skills.

Figure 2: Overall IL knowledge of the students

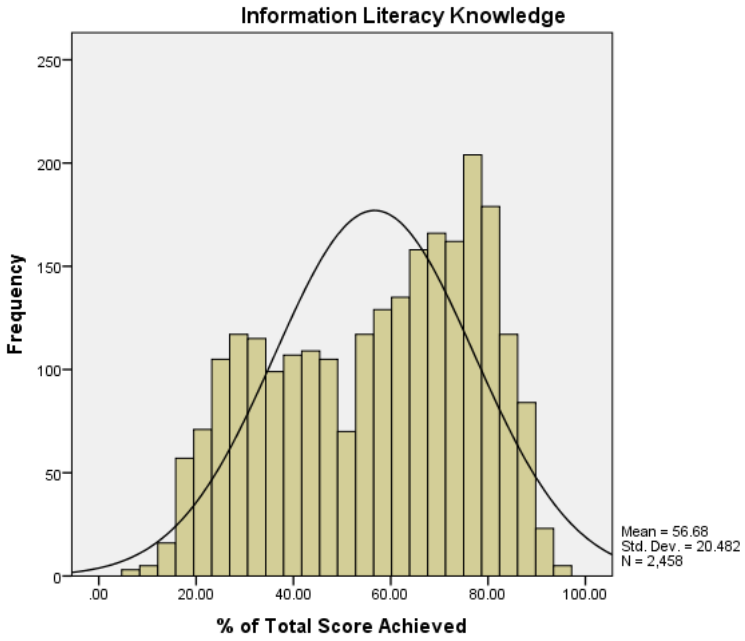


Figure 3 presents the overall average scores received by each of the five IL activities as well as for questions on cyber-wellness. Students' performance for activity 1 *Defining the information task* was the best and the students obtained an average score of 63.2%. It can also be seen that the average scores for the remaining four IL activities were more than 50%. It appeared that students possessed a 'middle' level of knowledge about all the IL activities and no task was particularly weak. It was also worth noting that the overall average score for cyber-wellness was considerably high (61.5%), indicating awareness of Singaporean students of the issues related to cyber security as well as handling cyber-bullying.

Figure 3: Average scores received by different IL activities

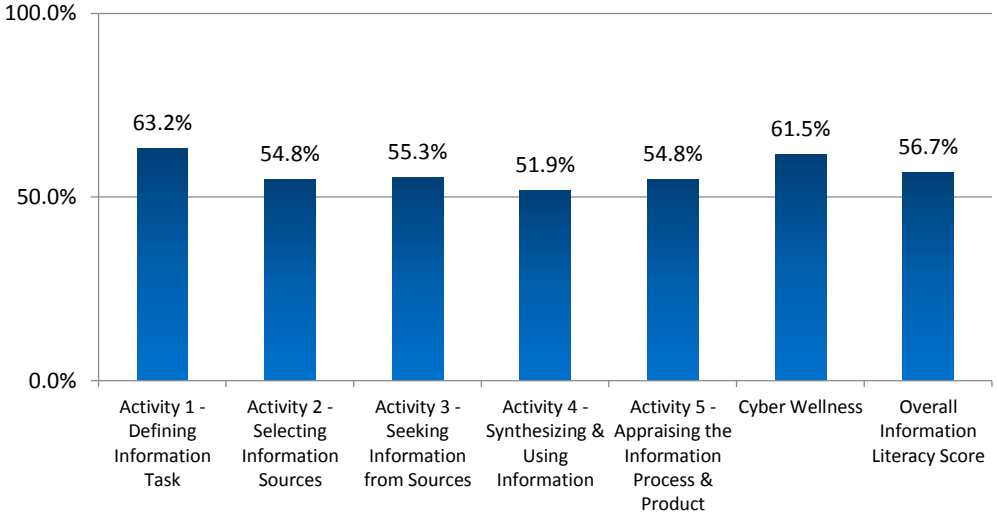
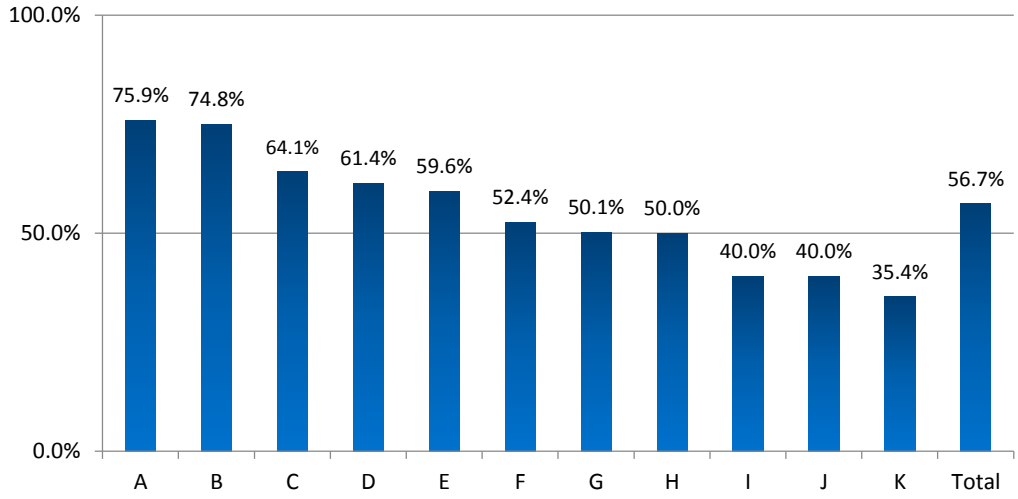


Figure 4 provides the overall average scores of 11 secondary schools which participated in this study. Names of the schools have been removed for the sake of anonymity. Students from two schools performed considerably better than other schools. These schools are considered elite schools in Singapore and they maintain well-stocked libraries, managed by professionally qualified library staff. Regular training sessions are conducted by the libraries of these schools to provide

basic IL skills to their students. The average scores of students from three schools were noticeably lower than the overall score for the whole sample (i.e. 56.7%). Two of these schools are neighbourhood schools with only basic library collections and facilities.

Figure 4: Distribution of overall scores by schools



5.6 Relationship between self-efficacy and IL assessment scores

A Spearman's correlation analysis was performed to investigate if any relationship exists between students' perceived level of IL competency (Table 6) and their actual assessment scores. It was found that generally there was a weak positive correlation between the students' self-efficacy and their actual IL knowledge and skills (Table 7). The IL activity *Selecting an information source* was the most strongly correlated (r (2451) =.181) to mean total score among the six measurements, while *Appraising information process/products* was comparatively the weakest (r (2449) =.076). It appeared that students' self-assessment of their IL skills was quite realistic and close to their actual assessment scores.

Table 7: Relationship between IL assessment score by self-efficacy score

Self-efficacy items	N	Spearman's rho (r_s)
Defining an information task	2447	.152**
Selecting information sources	2451	.181**
Seeking information from sources	2450	.138**
Synthesising and using information	2447	.153**
Appraising process and product	2449	.076**
Completing information task with others	2451	.155**

** Significant at 99% confidence interval

5.7 Predictive capability of self-efficacy on IL assessment scores

The influence of self-efficacy ratings on mean total score was examined via multiple regression analysis. The self-efficacy scores were found to predict mean total scores of IL assessment score at 99% confidence interval (Table 8). The Beta coefficients for four predictors to the model were significant and these were: selecting information sources; synthesizing/using information;

appraising information process/products; and completing an information task with others. The IL activities defining information task and seeking/evaluating information from sources did not contribute significantly to the model.

Table 8: Predictive capability of self-efficacy on IL assessment scores

Self-efficacy items (q9)	Mean	SD	Correlation with mean total score (*r*),1-tail	Multiple regression coefficients		
				b	β	t
IL skills score	56	20	-	37.864	-	18.358***
Defining information task	3.35	.791	.151***	1.438	0.056	1.833
Selecting information sources	3.44	.812	.172***	2.804	0.111	3.701***
Seeking information from sources	3.41	.828	.138***	.115	.005	.146
Synthesising and using information	3.35	.829	.148***	2.462	0.100	3.124**
Appraising process and product	3.24	.833	.067***	-3.947	-0.161	-5.296***
Completing an information task with others	3.55	.879	.157***	2.297	0.099	3.776***

* $p < .05$ ** $p < .01$ ***p<.001

5.8 Relationship between IL assessment scores and other variables

Students' IL assessment scores were cross-tabulated with some demographic variables to investigate the possible existence of relationships between them. The overall average score of female students (62.5%) was considerably higher than male students (50.4%). Difference between these two groups was significant at 99% confidence interval. For all the five IL activities as well as for cyber-wellness, the female students performed better than male students.

It was also found that students with internet access at home fared much better (57.5%) than students without (39.0%). Difference between these two groups was significant at 99% confidence interval. However, the number of students without internet access at home was very small (74 or 3.1%). The students with internet access at home also achieved better scores for all individual IL activities than those without this access. This difference was particularly notable for the questions related to cyber-wellness where students with internet access at home obtained a much better score (62.6%) than students without (38.6%).

A correlation analysis was performed to investigate the relationship between IL assessment score, self-efficacy of IL skills possessed, and gender of the students. Self-efficacy scores for all the six items were found to be positively correlated to IL assessment scores for both male and female

students, at 99% confidence interval (Table 9). The correlation figures were also higher for females than males in all individual IL activities, except *Selecting information sources*.

Table 9: Relationship between IL assessment score by self-efficacy score by gender

Self-efficacy items	Spearman's rho/ N	Male	Female
Defining an information task	r_s N	.171** 1177	.192** 1264
Selecting information sources	r_s N	.197** 1180	.194** 1265
Seeking information from sources	r_s N	.140** 1179	.195** 1265
Synthesising and using information	r_s N	.173** 1178	.197** 1263
Appraising process and product	r_s N	.109** 1179	.114** 1264
Completing an information task with others	r_s N	.149** 1180	.180** 1265

** Significant at 99% confidence interval

5.9 Relationship between IL assessment score, library visits and resource usage

In order to investigate the relationship between IL assessment score and other associated variables, various Spearman's correlation analyses were conducted. The first was to investigate the relationship between IL assessment score and visit frequency to different types of libraries. A positive correlation was found between frequency of visits to school as well as to public libraries, and to IL assessment score of the students, at 99% confidence interval (Table 10). The relationship between visits to the National Reference Library and to academic libraries was negatively correlated but not significant. This means that students frequently visiting their school and public libraries are more likely to learn and retain IL skills.

Table 10: Relationship between IL assessment score by library visits

Libraries	N	Spearman's rho (r_s)
School library	2454	.123**
Public libraries	2446	.096**
National Reference Library and academic libraries	2449	.024

** Significant at 99% confidence interval

A correlation analysis of students' IL assessment score and their usage of information resources at different types of libraries was also performed. Frequencies of resource usage at school and public libraries were also found to be positively correlated to IL assessment score, at 99% confidence interval (Table 11). The relationship between resource usage at the National Reference Library and academic libraries was negatively correlated but not significant. This means usage frequency of libraries resources positively contribute towards students' level of IL skills.

Table 11: Relationship between IL assessment score by use frequency of library resources

Libraries	N	Spearman's rho (r_s)
School library	2454	.125**
Public libraries	2448	.105**
National Reference Library and academic libraries	2443	.028

** Significant at 99% confidence interval

5.10 Relationship between IL assessment score and access to the internet

It was found that students with internet access at home had a self-efficacy score that was positively correlated to IL assessment score, at 99% confidence interval (Table 12). For students without internet access at home, their self-efficacy score was positively correlated but only *Selecting information sources* was significant at 95% confidence interval.

Table 12: Relationship between IL assessment score, self-efficacy score and home internet access

Self-efficacy items	Spearman's rho/ N	With internet access at home	No internet access at home
Defining information task	r_s N	.145** 2307	.200 74
Selecting information sources	r_s N	.171** 2311	.258* 74
Seeking information from sources	r_s N	.122** 2310	.148 74
Synthesising and using information	r_s N	.142** 2307	.098 74
Appraising process and product	r_s N	.068** 2309	.072 74
Completing an information task with others	r_s N	.146** 2311	.100 74

* Significant at 95% confidence interval
** Significant at 99% confidence interval

6. Discussion

The data analysis revealed some interesting findings. It was found that students' overall mean IL assessment score was 56.68% which can be considered as a 'middle' level of skill set. Some previous studies also suggest that, in spite of considerable awareness and focus on IL education, students still do not possess the desired level of IL skills (Ladbrook and Probert 2011; Foo et al 2014; Thonney and Montgomery 2015). It was, however, satisfying that students' overall score in this assessment was better than a previous similar study in 2010 (Foo et al 2014) where the overall mean score obtained by the Secondary 3 students was only 39.08%. Although Foo's survey (2014) was based on an earlier version of the questionnaire used by this study as well as a different assessment scoring scheme, an improvement in the overall assessment score is obvious. This improvement in the assessment performance could be due to integration of IL concepts in different subject textbooks. It is a matter of gratification that this integration approach is working and has

shown some positive results. Several previous studies have also reported that integration of IL concepts into curriculum help students learn, retain and apply IL skills in different situations (Niedbala and Fogleman 2010; Vijay and Satish 2010; Kessinger 2013; Sullo 2015). The overall information competence of the students in this assessment suggests that there remains much more to be done to improve the overall level of IL competence among students, particularly in the area of synthesising and using information. In order to achieve this, future studies could also evaluate other contributing factors such as the comprehensiveness of the IL syllabus, the quality of IL content included in textbooks (including the activities to be done as part of achieving the desired learning outcome), pedagogical approaches used for teaching IL concepts, and adequacy of resources required for teaching IL skills.

It was also found that only 20% of students were visiting their school libraries at least once a week. Their visits to public and other libraries, which may also hold some useful educational materials, was also rather low. A similar trend was observed for using library resources where nearly 72% of the students indicated either rarely or never using their school library. Several previous studies have also raised the problem of under-utilisation of school libraries (Foo et al 2014; Rodney et al 2003; Williams and Coles 2007). There could be several possible reasons for infrequent visits to libraries and limited usage of their resources, including: inadequate and irrelevant collections; lack of professionally qualified library staff; limited appreciation of the role of libraries in education and learning; and the perception that the needed information can be found somewhere else. The under-utilisation of school libraries is becoming a major concern as even with the proliferation of IL programmes, where importance of libraries is usually emphasised, there is no real change in the use of school libraries. Probably IL trainers need to use a different approach to highlight the role of libraries in education and learning.

Another interesting finding was that students often approached their classmates and friends to solve their information-related problems. In some situations they also consulted their teachers and family members. It appeared students preferred consulting those people, who would be easily accessible, and able to understand their information-related problems. It means that the IL level of such individuals is also important in handling students' information-related problems. Though classmates and friends are likely to possess a comparable level of IL competency, the IL skills of teachers and family members could be considerably different. It will be interesting to investigate how IL skills of teachers and family members affect students' ability to effectively finish an information-related task.

It was particularly disappointing to note that less than 8% of students reported seeking help from their library staff. It contradicts the extensive claims made in the literature that librarians play a predominating role in teaching IL skills to students and solving their information-related problems (William 2008; Yıldız 2012; Yaminfirooz et al 2013). It is a worrying finding as students in this study did not consider their school librarian as an appropriate person to solve their information-related problems. It is also possible that students might have a misperception about the role and responsibilities of school librarians, thinking that they are only responsible for administering and maintaining library resources and services, and not for assisting individual students. Black (2016) identified psychosocial reasons for not seeking help from librarians and these included: perceived threats to autonomy or self-esteem; perceptions of librarians; and feelings of confusion and fear. Stereotypes of the image of librarians and library anxiety are also considered possible reasons (Atlas 2005; Nicole 2009; Vassilakaki and Moniarou-Papaconstantinou 2014). It is, therefore, desirable that IL training programmes should clearly highlight the role of library staff and actively engage them in solving the information-related problems of individual users.

Among different information- related activities, the students achieved more than 61% scores for two activities, i.e. *Defining an information task* and *Cyber-wellness*. Students performed better for the activity *Defining an information task* probably because all secondary students are required to work on multiple school projects and, as a result, they may have learned how to properly define the scope and coverage of their projects. A comparatively higher mean score (61.5%) for the questions dealing with cyber-wellness could be due to active campaigns run for students by the Ministry of

Education (MOE), Media Development Authority (MDA) and other stakeholders to create awareness about the issues pertaining to cyber-crimes and the safe use of web space (MDA 2011). Students are given advice on how to handle and report cyber-bullying to the relevant authorities. The four key messages communicated by the Singapore Ministry of Education through its cyber-wellness curriculum are: embrace ICT yet maintain a balanced lifestyle between the physical and cyber world; harness the power of ICT for positive purposes; maintain a positive presence in cyber space; and be a safe and responsible user of ICT (MOE 2015a). It has also come up with a cyber-wellness syllabus for secondary students (MOE 2014).

As parents can play a key role in shaping students' online behavior, as well as encouraging their children to be vigilant in cyberspace, the Ministry of Education has developed a game app, C-Quest, through which parents can also learn how to be safe, respectful, and responsible cyberspace users. Once parents are exposed to these concepts they are likely to be more watchful and help their children overcome cyber threats (MOE 2015b). It appeared that multi-dimensional cyber-wellness campaigns run by different public agencies and schools were successful in creating awareness among students, resulting in better assessment scores for this activity.

7. Conclusion

The purpose of this study was to assess IL skills of Secondary 3 students after incorporation of IL skills in their school curriculum. It was satisfying to note that there was some enhancement in students' IL assessment performance although still there is a room for improvement. It would be desirable to take certain additional steps to further improve the impact of curriculum integration. As not all secondary schools in Singapore have qualified school librarians subject teachers are usually given the responsibility to teach the IL syllabus. As the IL component is scattered across several subject textbooks, it is likely that more than one teacher will be involved in teaching IL skills to the same group of students, which may cause co-ordination problems. Unfortunately there is no study available in Singapore investigating the preparedness of teachers to teach IL skills effectively. Such a study could identify possible areas where teachers need improvement in their IL knowledge and skills.

As different subject textbooks cover specific IL components, without proper co-ordination some IL skills may appear isolated and unconnected. As a result, students may have difficulty in building a holistic picture of IL, and in understanding how to apply these skills in different situations. Another related issue is to ensure continuity in IL concepts taught at different grade levels. There is a need for curriculum planners to come up with a roadmap for teaching IL skills, detailing what skills are to be taught at different grade levels, and in which subject areas. Such a roadmap should indicate how students would gradually obtain IL skills according to their age group and intellectual level. Such a roadmap could ensure continuity and, at the same time, minimise excessive overlaps or gaps in coverage.

Developing quality resources for teaching IL skills is equally important. A major challenge is how to smoothly integrate IL concepts into the subject topics covered in a particular textbook so that they do not appear artificially imposed or superficial. It is also desirable to involve qualified school librarians in writing the IL components in these textbooks. This will improve quality as well as provide more credibility to the IL teaching resources. Another related concern is the preparedness of teachers to effectively deliver IL content. As a short-term measure, a series of refresher courses and workshops can be organised to provide these skills to the teachers. Simultaneously, the National Institute of Education, responsible for training teachers in Singapore, should consider teaching IL skills as well as how to effectively infuse these skills in the curriculum. A multi-dimensional approach is inevitable and necessary if we wish to achieve the objective of preparing information literate students.

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