DEVELOPING INFORMATION LITERACY MEASURES
FOR HIGHER EDUCATION

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Abstract. This is the first part of a report of an investigation on Information Literacy (IL) among final year students in six Malaysian universities in the Klang Valley. The study attempts to measure students' IL competency in key areas, namely, the ability to identify, access, retrieve, evaluate, and organise needed information to achieve certain purposes. A self-administered questionnaire was used as the instrument for data collection, conducted during August and September 2005. Respondents comprised students from 3 main fields, i.e. Science and Technology, Social Science and Humanities, Business and Accountancy. A total of 1,100 responses are used for data analysis. Scores are assigned for identifying levels of competency as: 0 = wrong answer, 1= beginner, 2 = intermediate and 3 =advanced. Results of the analysis reveal that half (50.1%) of the respondents are at the intermediate IL level while more than one-third (38.4%) are beginners, and slightly more than ten percent (11.5%) can be categorized as at the advanced competency level. Respondents with higher competency levels are those who frequently read materials in English, use the Internet to download programs / software, search databases for academic materials, use the library to read academic journals and discuss academic matters, compared to those who go to the library for other reasons such as to borrow books, meet friends or study. Compulsory information skills courses are found to be related to competency levels, but this relationship is not statistically significant. There is no significant difference in the competency level between those who are currently writing a thesis and those who are not. However, there is a significant difference in IL competency between those who have written assignments in an essay format and those who have not.

Introduction

The knowledge economy is based primarily on the production and strategic use of information and knowledge. The ability to produce and use information effectively is thus a vital source of skills for citizens of the world. Countries in North America, Europe, and Asia have implemented programs to develop information literacy (IL) skills at various levels of education. There are also standards to be used as guidelines for developing IL programs in higher education, the most recent one being IFLA international guidelines on information literacy (August 2004). However, none of the above standard provides a specific measuring instrument to determine the competency levels of students who graduate from a university within the Asian context. Hence, this research is conducted to measure IL competency levels among university students, with the ultimate aim of designing an appropriate matrix to indicate IL competency levels to be used in higher education. The study also aims to find out whether the Information Skills programs conducted by university libraries have any relationship with students' level of IL competency.

As Malaysia is moving towards information and knowledge-based society, it is critical that her would-be university graduates who are going to form the educated workforce in various sectors of the country possess competencies and skills in information literacy. The question that seeks to be answered is to what extent our human resources (would-be graduates) possess the level of competencies and skills in information literacy that will enable them to seek gainful employment, to pursue life-long learning, and contribute to the overall national competitiveness. The measurement of Information Literacy among its citizens has become necessary as the nation aims to become developed and globally competitive, on par with other nations' workforce.

Objectives of the Study

1. To identify the competency level of information literacy among would-be university graduates in universities in Malaysia,
2. To make comparison of the level of information literacy among various disciplines and background of would-be graduates,
3. To make comparison on information literacy level between would-be graduates in private and public universities,
4. To identify areas of strengths and weaknesses in information literacy among the subjects of study.
5. To test the measuring instrument for the ultimate design of a reliable instrument for measuring IL competency in higher education.

Definition of Information Literacy

In a nutshell 'Information Literacy' is a set of abilities enabling an individual to recognise when information is needed, where to locate, evaluate and use it effectively. An 'information literate' individual is able to:
1. determine the extent of information needed for certain purposes
2. access and retrieve the needed information effectively and efficiently
3. critically evaluate information and its sources
4. incorporate selected information into one's knowledge base
5. use information effectively to achieve specific purposes
6. use information with understanding & acknowledging cultural, ethical, economic, legal, and social issues surrounding the use.

The above definition of Information Literacy has been used in several studies in schools and universities in US, Canada, Australia, UK, New Zealand and other European countries. (American Library Association, 2004; Bruce, 2002; Correia, 2002)

Literature Review

The Significance of Information Literacy

Many countries in the developed and developing parts of the world have recognised the importance of "Information Literacy" (IL) skills among their citizens and have implemented programs to inculcate the IL competencies and skills among students at all levels. In the US, the National Forum on Information Literacy, established in 1989, and the Institute for Information Literacy, established in 1998, have been instrumental in formulating IL Standards for school and higher education sectors. The US Department of Education have included IL as one of the country's five goals in education since December 2000. IL developments have also taken place in Canada, China, Japan, Mexico, Namibia, New Zealand, Singapore, and South Africa. (Bundy, 2002). Many European countries have implemented similar programs as a result of realizing the importance of IL, seen in the following Memorandum on Lifelong Learning (IFLA, 2001):

> *"Europe has moved towards a knowledge-based society and economy. More than ever before, access to up-to-date information and knowledge, together with the motivation and skills to use these resources intelligently on behalf of oneself and the community as a whole, are becoming the key to strengthening Europe's competitiveness and improving the employability and adaptability of the workforce…Hence, learning how to learn, to adapt to change, and to make sense of vast information flows are now generic skills that everyone should acquire."*

In 2001, the OECD's Educational Policy Analysis stated: "*The knowledge economy is based on the production and use of information and knowledge. The ability to produce and use information effectively is thus a vital source of skills for many individuals*". Another OECD report on Learning to Change (2001) stated: "*The skills of accessing, handling, using data and materials are more important than the ability to recall…across many fields of knowledge*".

The world-wide and keen interest in IL among educators, governments, and librarians is reflected in a vast amount of literature and research on the subject at the elementary, secondary, and tertiary levels.

Information Literacy in Higher Education

Research on information literacy among students in higher education has been carried out since the 1980s (Krentz and Gerlach, 1989; Fowler, 1990) using various methodologies, some of which were surveys, interviews, focus groups and tests (including pre and post test). Survey method was the most frequently employed as seen in major studies by Kunkel, Weaver and Cook (1996) and Maughan (2001). Kunkel, Weaver and Cook   carried out the survey among 245 undergraduates of Kent State University regional campus in the US to assess the basic skills of incoming undergraduates and how students' characteristics affect these skills. Maughan's study reported that between 1994 and 1999, the University of California at Berkeley conducted an ongoing survey of information competencies in selected academic departments, namely political science, history, sociology and philosophy in order to measure information literacy among graduating seniors.

Other studies using survey methods among students on US campuses are those conducted by Brown (1999) at Oklahoma University to explore the information literacy level of physical science graduate students; Nero's study (1999) at four Pennsylvania State System of Higher Education universities using a questionnaire as the instrument among graduating teachers; Case-Smith and Powel's survey (2003) to assess whether graduates of the occupational therapy programme of the Ohio State University were applying their information-seeking skills that they had learnt as undergraduates. All of the above studies used quantitative methods for data collection and analysis.

A rarely-used methodology – qualitative study, by Hepworth (1999) among students at Nanyang Technological University in Singapore is quite unique in its attempt to determine respondents' strengths and weaknesses in terms of their information literacy and skills. The methods included a combination of qualitative techniques, such as task analysis, talk through and observation which were applied while students conducted a research project. In general it was found that students had limited skills in the area of information literacy. Based on these findings recommendations were proposed to help develop information literacy skills and incorporate their delivery in the university curriculum, and not to treat it as a separate subject.

Information Literacy Studies in Malaysia

In Malaysia, university libraries have been conducting, in one way or others, courses under the umbrella of IL (Che Norma Bahri , 2004, Chan Sai Noi, 2003; Juhana Salim, 2000). These courses can be categorised as:
1. Orientation for all new undergraduates/post graduates,
2. Optional Information skills programmes for final year undergraduates,
3. Specialised information skills programmes such as use of databases and internet searching skills,
4. Compulsory Information literacy / skills courses which are accorded academic credits,
5. Information literacy course accorded credits at the same level as other electives under Co-curriculum.

At the completion of the program, students' feedback is collected through an evaluation form. Only the courses conducted to earn credits are evaluated from the students' ability to perform certain tasks through tests, work sheets, and final exams.

Serious attempts to find out the level of IL competencies and skills at the university level can be seen in two doctoral research studies currently being conducted at the Universiti of Malaya among students of Faculty of Information Technology and Computer Science (Mohd Sharif, 2004; NorEdzan, 2004). However these two studies confine their investigation to students of only one faculty at one university.

Considering the amount of research conducted overseas and in Malaysia, it appears that no one study has come up with a matrix or an integrated index as indicators of competency level in information literacy that can be applied in higher education and at the national level in Malaysia. The latest comprehensive review by Mohd Sharif, Nor Edzan and Zainab (2005) emphasizes the need for a standardised tool to measure the effectiveness of IL courses in Malaysian universities. Hence, the present study is considered timely in addressing the issues related to IL competency measurement in higher education in Malaysia.

Scope of the First Part of the Study

After careful and considerable search for suitable instruments to measure IL competency, we found that not all six abilities can be measured with certain degrees of validity and reliability within a short span

of time. Neither can they be measured using similar instruments. Hence, in the first part of the study we have decided to focus on skills that can be measured through respondents' actual performance reflecting the competent use of their IL skills. These are the abilities to: access, identify, retrieve, search, evaluate, organise, and select suitable sources and certain information for specific purposes. Other abilities, namely, "to incorporate selected information into one's knowledge base, to use information effectively to achieve specific purposes, and to use information with understanding & acknowledging cultural, ethical, economic, legal, social issues surrounding the use" will be further addressed in the second part of the study.

Methodology

The instrument for data collection is designed in the form of both open and closed-ended self-administered questions to test students' knowledge and ability in performing certain tasks which are indicative of their information literacy skills. The levels of their performance are categorized as: beginner, intermediate, and advanced based on their responses. The questionnaire was pilot tested among 50 final year students across universities and faculties during July 2005, the results of which led the research team to modify and simplify certain questions. Real data collection was carried out during September 2005 from among 1,118 final year students in 4 public and 2 private universities located in the Klang Valley of Malaysia. This sample population is considered a "convenient sample", not representing the whole university population in Malaysia, but large enough and from diverse background, to generate data to achieve the objectives of the study, and to test the robustness of the instrument before it is used nationwide. A total of 1,100 responses are used for data analysis. Scores are assigned for identifying levels of competency as: 0 = wrong answer, 1 = beginner, 2 = intermediate, 3 = advanced. Data analysis using SPSS version 12.0 reveals the number of students at each level of IL competency. Cross tabulations are carried out to detect the relationship between competency levels and certain aspects in the respondents' background as well as information-related habits.

Respondents' Profiles

Fields of Study/Faculty

A total of 1,118 respondents from final year, six universities (four public and two private) in the Klang Valley of Malaysia were surveyed. Table 1 shows the highest number of respondents were from UiTM (362 or 32.4%) and the lowest were HELP Institute (51 or 4.6%). Four hundred and ninety-eight (498) or 44.5% of the respondents came from the field of Science and Technology, 401 or 35.9% from Social Science and Humanities while the field of Business, Economics and Finance made up of 219 or 19.6% of the total respondents. One-hundred and seventy-two (172) or 34.5% of respondents from the field of Science and Technology were from UPM while the lowest were from HELP Institute. In the field of Social Science and Humanity, the highest number of respondents came from UiTM (171 or 42.6%). About one-third of the respondents in the field of Business, Economics and Finance were also from UiTM (75 or 34.2%).

Table 1. Fields of Study/Faculty

University	Social Science & Humanities	Science & Technology	Business, Economics & Finance	Total
UiTM	171	116	75	362
UM	140	49	50	239
UKM	69	118	46	233
UPM	0	172	0	172
UNITEN	0	32	29	61
HELP Institute	21	11	19	51
Total	**401**	**498**	**219**	**1,118**

Gender

The majority of respondents were female (780 or 71.1%) while 317 or 28.9% were male. Among the 780 female students, 338 were in Science and Technology, 267 in the Social sciences/Humanities and 175 in Business and Finance. Out of the 317 male students, 156 were in Science and Technology, followed by 120 in Social Sciences/Humanities, and 41 in the Business and Finance field.

Language Used and Reading Materials

At home, Bahasa Melayu is the most frequently used language (713 or 64.8%) followed by Chinese (210 or 19.1%). On campus, Bahasa Melayu is also the most frequently used (624 or 56.6%) followed by English (170 or 15.4%). Where reading materials are concerned, almost half (540 or 49.3%) of the respondents mentioned that their reading materials are in English.

Things Respondents Do Frequently on the Internet

When asked about three things they frequently do on the Internet, listed highest to the lowest in the order of frequency are: use e-mail (966 or 86.4%), search databases for academic materials (790 or 70.7%), and check latest news (699 or 62.5%). It is interesting to note that "communicate with my lecturer" is one of the least frequent activities of respondents (164 or 14.7%).

Things Respondents Do Frequently at the Library

Results show that "borrowing books" is the most frequent activity of respondents at the library (875 or 78.3%) followed by "search for material" (799 or 71.5%) and "study" (720 or 64.4%). However, when asked to specify "others", respondents mentioned "sleep" (3 or 0.3%).

Attending Information Skills Program

Slightly more than half (612 or 54.7%) of the respondents had attended library orientation programs when they were new students. About one-third of the respondents had attended one-semester compulsory information skills course when they were first year students (310 or 27.7%) and slightly more than a quarter of the respondents had attended compulsory information skills course for final year students (286 or 25.6%).

Writing Thesis, Term Paper and Assignments

Almost half of the respondents have written assignments in essay format (547 or 48.9%) and are in the process of writing a thesis for their final year (533 or 47.7%) respectively. Another 271 or 24.2% reported that they have written a term paper/project.

Results of Data Analysis

For this first part of the study, information literacy (IL) skill is measured by the ability to access, identify, retrieve, search, evaluate, organise, and select suitable sources and certain information for specific purposes.

A total of ten questions were asked and the scores assigned for the responses are as follows: 0 (wrong answer), 1 (beginner), 2 (intermediate) and 3 (advanced). The total score is then used to indicate the level of IL competency. Eight out of the ten questions have at least one wrong answer (score = 0), the remaining two have no wrong answers, while all ten questions have at least one advanced answer (score = 3). This means that the total possible scores range from two to thirty (all advanced). For ease of interpretation, the scores are then converted to percentages.

I.   *Overall Competency Levels of Respondents*

For further analysis on the determinants of IL competency, the total scores are used while for the purpose of categorization of the respondents in terms of IL competency, they are grouped based on the total scores as follows:

Less than 60%	:	Beginner
Between 60% to less than 75%	:	Intermediate
75% or higher	:	Advanced

Based on this grouping of scores, the survey found that half (50.1%) of the students surveyed are those with intermediate level of IL competency while more than one-third (38.4%) is beginners (Figure 1). Only slightly more than ten percent (11.5%) can be categorized as having advanced competency.
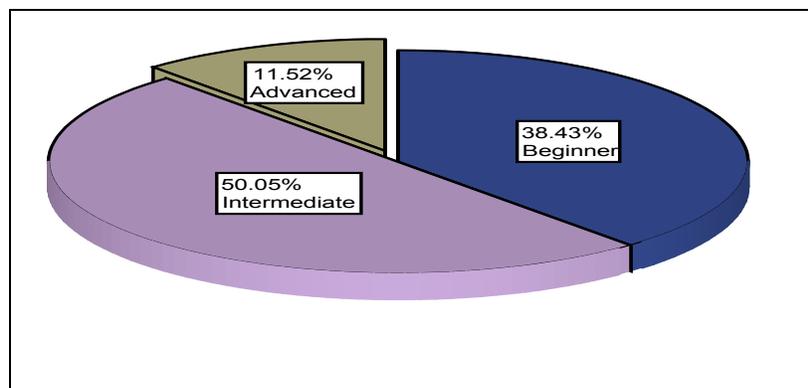

Figure 1. Categories of respondents by the level of IL competency

The distribution of the competency scores is slightly skewed with some extreme low values due to non-responses. For further analysis, these extreme low values are eliminated from the sample. The IL competency scores for the remaining 1,100 respondents range from 30.0% (10 out of 30) to 93.3% (28 out of 30) with a mean of 61.5% and a median of 63.3% (Table 2).

Table 2. IL Competency Total and Percentage Scores

Statistic	Total Score	Percentage Score
1. Minimum	9	30.0
2. Maximum	28	93.3
3. Median	19	63.3
4. Mean	18.4	61.5
5. Standard. Deviation	3.5	11.6
6. Sample size	1100	

II. *Specific Knowledge and IL Skills*

The percentage of respondents with advanced competency for searching and evaluating information by task are summarized in Table 3. The majority (86.3%) knows that the only way to get the up-to-date information on computer viruses is by searching the web and the most relevant journal articles can be identified by reading the abstracts and reviewing the subjects/descriptors (73.9%). More than half are also able to organize information efficiently for preparing a paper (58.1%) and identify the most reliable published source of information in the library (56.6%). However, the majority lacks the skills to use the Internet efficiently to search for and evaluate information. In particular, less than fifteen percent were able to: identify the most efficient search engine (14.5%); to determine on how to narrow a search based on keywords (13.8%); and to identify the most reliable published source of information on the Internet.

Table 3. Percent of respondents at the advanced level of specific IL knowledge and skills

Knowledge on	Respondents with the most appropriate answer
1. Getting an up-to-date information on computer virus	86.3
2. Selecting relevant journal articles from an electronic database	73.9
3. Organizing information efficiently for preparing a paper	58.1
4. Identifying the most reliable source of information in the library	56.6
5. Differentiating facts from opinion	49.4
6. Choice of reliable information source for a research paper	44.9
7. Search engine	31.0
8. The most efficient search technique	14.5
9. Narrowing a search based on keywords	13.8
10. The most reliable published source of information on the Internet	12.7

III.   *Relationship between IL Competency and Respondents' Background*

In order to compare the level of competency by selected background characteristics, the appropriate nonparametric methods are carried out. The results are summarized in Table 4. On average, the competency level of the science and technology students is slightly higher compared to those from other fields, but the difference is not statistically significant. There is also no evidence of gender difference or whether or not English is used at home or on campus. However, those who read English materials are found to have a higher competency than those who read in other languages.

Table 4. Comparison of IL Competency Score by Selected Demographic Characteristics

Characteristic	Mean Percentage Score		Test Statistic	p-value
1. Gender	Male = 61.7		0.637	0.755
	Female = 61.4			
2. Field of Study	S&T = 61.8			
	SS&H = 61.2		0.901	0.637
	B&Fin = 61.1			
3. Frequently used English at home	Yes = 62.4		-1.754	0.079
	No = 60.8			
4. Frequently used English on campus	Yes = 61.8		-0.955	0.340
	No = 60.7			
5. Frequently read English materials	Yes = 61.9		-3.203	0.001**
	No = 58.8			

*** Significant difference at the 0.01 level of significance*

IV.   *Relationship between IL Competency and Respondents' Information-Related Activities*

It is also of interest to find out whether IL competency is associated with activities carried out by students in the library, activities on the Internet and their course requirements in terms of assignments and projects. Table 4 presents the activities that have significant relationship with the IL competency. The data show that those who use the Internet to download programs/software and search databases for academic materials frequently are more competent in searching and evaluating information than those who do not. Similarly, those who use the library to read academic journals and discuss academic mat-

ters are found to have a higher competency level compared with those who go to the library for other reasons, such as to borrow books, meet friends or study. Attending either voluntary or compulsory information courses is found to be associated with higher competency level, but this relationship is not statistically significant. Also, there is no significant difference in the competency level between those who are currently writing a thesis and those who are not (p-value <0.05).

However, a significant difference is apparent between respondents who have written assignments in an essay format and those who have not.

Table 5. Comparison of IL Competency Score by Selected Activities Related to the Library, Internet and Course Requirements

Information-related Activities	Mean Percentage Score	Test Statistic	p-value
1. Use the Internet frequently to check the latest news	Yes = 62.3 No = 60.1	-2.977	0.004**
2. Use the Internet frequently to download programs/ software	Yes = 62.6 No = 60.5	-3.093	0.002**
3. Use the Internet frequently to search data bases for academic materials	Yes = 62.0 No = 60.2	-2.284	0.022*
4. Use the library frequently to discuss academic matters	Yes = 62.7 No = 60.7	-2.823	0.005**
5. Use the library frequently to read academic journals	Yes = 62.5 No = 60.8	-2.357	0.018*
6. Have attended a voluntary information skills course for undergraduates	Yes = 60.9 No = 61.5	-0.731	0.465
7. Have attended one semester compulsory information skills course for first year students	Yes = 62.3 No = 61.0	-1.618	0.106
8. Have written assignments in essay format	Yes = 62.7 No = 60.0	-3.657	<0.001**

Items 6 & 7 show no significant difference.
Significant difference at the 0.05 level of significance.
** *Significant difference at the 0.01 level of significance.*

Discussion

Based on the above results which are not yet comprehensive, nor complete, we hesitate to suggest any concrete implications on findings. We can only highlight certain issues that emerge which may be of interest to educators and librarians involved in measuring IL competency among students.

Firstly, the instrument for measuring various IL abilities need to vary according to each specific ability. It is certain that perception survey asking respondents to give opinion about the IL course they have attended does not measure respondents' abilities and knowledge. For each ability that needs to be measured, it must be expressed in a specific behaviour or outcomes that are measurable. Such outcomes must also be tied in with the expected outcomes of the IL courses designed for students. The entire exercise can be very tedious, lengthy, and become a demotivating factor for students. As has been observed during the data collection process, some students did not want to exercise their thinking in filling in the questionnaire. Some gave playful answers which were not related to the questions. As far as the instrument is concerned, we hope to improve its validity, robustness and reliability while keeping it simple, precise, and short, before we move on to the next stage of conducting the survey nationwide.

Secondly, results of respondents' competency indicate areas for improvements as follows:
1. ability to organise information for future use,
2. ability to differentiate (evaluate and select) reliable sources of printed information,

3. ability to differentiate facts from opinion,
4. ability to conduct search and select the most appropriate search engine for locating information.

Thirdly, the relationship between competency and respondents' background has implications for designing the IL program. The fact that higher competency levels are related to reading English materials, using the library to read academic journals, using the Internet to search academic databases, and writing essay assignments, provide useful inputs for librarians and educators in terms of selecting content and contexts that are conducive for building IL competency.

The Next Stages

The immediate next stage of the study will report on students' awareness on the ethical aspect of information use and the ability to identify information components. Yet another yet future study intends to measure students' ability to incorporate selected information into one's knowledge base, and to use information effectively to achieve specific purposes.

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