

Measuring Information Skills among Malaysian Youth Students: An Instrument Development

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Abstract

This article described the development and testing of a research instrument, known as Information Skills Instrument which was designed to measure youth students' abilities to search, access and use information from multiple sources in the context of academic works. The instrument was inductively developed from a literature review and tested with a sample of Malaysian school and college students. Principal Component Analysis was used to examine the dimensionality and Cronbach's alpha was employed to estimate internal consistency of the developed instrument. The final instrument consists of 22 items and reveals five factors; identifying potential information sources; using information from multiple sources; identifying information needs, and identifying types of information sources. Cronbach's alpha was .871 for the total instrument and .806 to .463 for subscales. The study showed that Principal Component Analysis could assist the development and refinement process of final information skills instrument which requires further testing with other youth students.

Keywords: information skills, instrument development, principal component analysis, youth students, Malaysia

1. Introduction

Information skills are defined as a series of abilities of identifying the need for information; locating, accessing and organizing information and its sources; evaluating and selecting information and its sources; analyzing and synthesizing information from different sources to create new understandings; using the understanding to accomplish a specific purpose; and accessing and using information and its sources ethically and legally (Association of College and Research Libraries, 2000; Bundy, 2004; Society of College National & University Libraries, 1999). While, UNESCO (2006) identified the skills as an extension of reading and arithmetic abilities necessary for individuals and their communities to function and progress, Bundy (2004) associated the skills with the attributes of the 21st century skills and lifelong learning skills. Sometimes the terms 'information skills' and 'information literacy' are used interchangeably in the literature, with "information literacy" being often used in the United States and "information skills" in the Great Britain, Australia, and New Zealand (Joint Information Systems Committee, 2002). Alternatively, the Society of College National and University Libraries (1999) and the Chartered Institute of Library and Information Professionals (2004) suggested that information literacy is the goal of information literate individuals, while information skills are the means for achieving that goal. Using this perspective, information literacy is a state of "knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner" (Chartered Institute of Library and Information Professionals, 2004) while information-related skills, such as abilities to identify information need and resources available, and find, evaluate, use or exploit, communicate, and manage information in ethical and responsible manners are means to attain the information literacy state.

In the context of Malaysia, youth students' acquisition of information skills in schools has begun with the introduction of "Smart School" in 1999. Identified as one of the national flagship in the Multimedia Super Corridor, the schools aim to develop workforces who are technologically literate (Smart School Project Team, 1997) via engaging students with various applications of information communication and technologies during their classroom learning. Similarly, to support the development of knowledge economy and society, higher education institutions in Malaysia have introduced various information skills programs to their students (Chan, 2003; Edzan & Mohd Saad, 2005; Mohd Saad & Awang Ngah, 2002). The programmes were part of the Malaysian National Information Technology Agenda established in 1996 that aimed to facilitate the development

of a knowledge society via ensuring the development of human capital who would be information literate by the year 2020 (Chan, 2003). Specifically the programs aimed to develop knowledge workers who will run the economy and society; characterised their abilities to “acquire, apply, synthesize and create knowledge” (Economic Planning Unit, 2001, p. 112). The introduction of the Malaysian Qualification Framework (Malaysian Qualifications Agency, 2007) in the national education system in late 2007 has further reinforced youth students’ mastery of information skills across classroom learning, academic programs and institutional settings.

2. Statement of the Problem

The implementation of the Malaysian Qualification Framework in the national education system highlighted that information skills are no longer peripheral issues for youth students in Malaysia. The skills are not only essential for their learning but also to ensure the national recruitment of knowledgeable workers who are able to use information technology competently, and access, use, synthesise and construct information (Economic Planning Unit, 2006). To attain the outcomes of both national education and economy framework, there is a need to conceptualize information skills into explicit and observable attributes and develop valid and reliable instruments to measure the skills among Malaysian youth students.

Although a few existing studies worldwide have developed information skills instruments for students in multiple education settings, only a handful of them focused on the validation process of the developed instruments (e.g., Cameron, Wise, & Lottridge, 2007; Mery, Newby, & Peng, 2011). A similar trend has also been observed in Malaysia in which a few studies had developed information skills instruments to measure the levels of information skills among Malaysian university students (e.g., Abang Ismail & Pui, 2006). However, these studies focused on students’ perceived performance of information skills. Following literature from multiple education settings that have stated that students’ perceived performance does not necessarily correlate with their measured performance (e.g., Grant, Malloy, & Murphy, 2009; Sarrico, 2010), there is a need to also examine students’ measured information skills performance. Lately a few studies have developed instruments to assess measured-performance of information skills among university students in Malaysia (e.g., Abdullah, Ahmad Kassim, Mohd Saad, Tarmuchi, & Aripin, 2006; Edzan, 2007). However, these studies did not focus on the psychometric properties of the developed instruments which could help us to assess the validity and reliability of the instruments, and thus the usability of the instruments in measuring information skills of specific target groups, such as Malaysian youth students.

3. Purpose of the Study

The purpose of this study was to develop an instrument to measure information skills among Malaysian youth students and test its psychometric properties.

4. Method

4.1 Construction of the Instrument

The process of constructing information skills instrument was guided by multiple standards of information skills available worldwide, developed items and scaling responses, selected items, reorganized items and followed by several panel reviews with teachers, librarians and students in one university in Malaysia in order to establish content validity. Based on an analysis of three standards of information skills that was developed by the Australian and New Zealand Institute of Information Literacy (Bundy, 2004), Association of College and Research Libraries (2000), and Society of College National & University Libraries (1999), this study found that there were six constructs underpinning the features of information skills. The constructs comprised of students’ ability to identify information need; search, evaluate, organise, and ethically use information and its sources; and develop and communicate personal understanding. Similar constructs also emerged in studies that investigate information skills learning in higher education in Malaysia (Aidah Abdul Karim, Din, & Osman, 2004; Aidah Abdul Karim, Din, & Razak, 2011; Aidah Abdul Karim, Din, Razak, Abdullah, & Hussin, 2010; Aidah Abdul Karim, Nordin, Din, & Embi, 2011; Aidah Abdul Karim, Puteh, Din, & Rahamat, 2010). Except for the construct of ethical use of information and its sources, other constructs were featured in previous studies that measured university students’ information skills in Malaysia (e.g., Abang Ismail & Pui, 2006; Abdullah, et al., 2006; Edzan, 2007).

The constructs were used to develop the initial 30 items of the first draft of the instrument that consisted of structure and multiple choice items. Seven teachers, librarians and four postgraduate students were invited to review the items. As a result some items were excluded either because their meanings were ambiguous, difficult to understand, or redundant with each other. Identical items were also reconstructed to make them less ambiguous which resulted to 24-item instrument. A rubric was also prepared by the researchers to facilitate the

grading process of students' responses. Depending on students' written answers, the rubric stated that each student has a possibility to score from 0 marks (wrong answer) to 4 marks (correct answer) for each item. The interval scaling was chosen because the researchers aimed to identify multiple levels of students' abilities to search and use information from multiple sources, and develop and communicate their understanding.

The second version of the instrument was later critically appraised and discussed during separate meetings with two teachers, two librarians, and three students in one Malaysian university (some of whom were present at the first meeting), and who provided content validity for both the items and rubric. All of them agreed that the items of the instrument were relevant to measure students' abilities to search and use information from multiple sources, and develop and communicate personal understanding. From their critique of the items, the items' numbering and wording were revised to reflect a coherent process of searching and using information from multiple sources, and developing and communicating personal understanding. Table 1 illustrates the constructs and number of items of the developed instrument.

Table 1. Information skills' constructs and item number

No	Constructs	Items
1	Identify information need	Items 1–5
2	Search information and its sources	Items 6–9
3	Evaluate information and its sources	Items 10–13
4	Organize information and its sources	Items 14–17
5	Develop and communicate personal understanding	Items 18–20
6	Ethical use information and its sources	Items 21–24

4.2 Data Collection and Analysis

This preliminary study employed a survey research design in which the developed instrument was administered to high school and college students in one boarding school in Malacca and technical college in Kuala Lumpur respectively. Descriptive statistics were used to analyze the demographic characteristics of the respondents while two statistical measures, i.e., Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy were used to assess the factor-ability of the available data set. Factor analysis requires the Bartlett's Test of Sphericity to be significant ($p < .05$) and the KMO index is greater or equal to 0.6 (Pallant, 2007).

The analysis of the psychometric properties of the developed instrument was carried out further using item analysis and principal component analysis (PCA) to develop an internally consistent scale and reduce items. Item-total correlations adjusted below $r < 0.3$ were used to reduce items in the first item analysis. Also items that increase Cronbach's alpha if deleted were excluded from the scale. Items with weak factor loading (< 0.4) and communality values (< 0.3) in the first principal component analysis were also checked and deleted. The final version of the instrument was validated using a second principal component analysis in order to analyze the dimensionality of the scales that was used for testing the construct validity of the scale.

The study employed principal component analysis because it provides a means to identify the most meaningful basis of a data set via filtering out the noise and revealing hidden structure of the data set (Shlens, 2009). PCA is known as a method of data reduction that reduce dozens of measures to a few principal components or to explore at the dimensionality of data via identifying patterns in data, and expressing the data in such a way as to highlight their similarities and differences (Smith, 2002). Since patterns in data can be hard to find in data of high dimension, PCA is one of the tools that could be used to analyze such data. When these patterns are identified, PCA allowed for the data to be compressed via reducing the numbers of dimensions, without much loss of information. A primary benefit of PCA arises from quantifying the importance of each dimension that could describe the variability of a data set. In particular, the measurement of the variance along each principle component provides a means for comparing the relative importance of each dimension which is based on the assumption that the variance along a small number of principal components (i.e. less than the number of measurement types) provides a reasonable characterization of the available data set (Shlens, 2009).

5. Results

5.1 Profile of Respondents

Data was collected from 145 upper secondary students in a boarding school in Melaka and 78 students from a private technical college in Kuala Lumpur. As illustrated in Table 2, the majority of the respondents were high school students (65%), male (57.4%), 1% with cumulative grade point average of 3.00 to 3.59 (37.2%) and age from 15-18 years old (67.7%).

Table 2. Profile of respondents

	N	Demography	Frequency	Percentage (%)
Setting	223	High school	145	65
		College	78	35
Gender	223	Male	128	57.4
		Female	95	42.6
CGPA	223	1.99-2.59	26	11.7
		2.60-2.99	45	20.2
		3.00-3.59	83	37.2
		3.60-4.00	69	30.9
Age	233	15-18 years old	151	67.7
		19-22 years old	46	20.6
		23-26 years old	21	9.4
		27-30 years old	2	0.9
		31 years above	3	1.3

5.2 Normality and Sample Adequacy Test

A normality test was conducted on the available data and then compared to the statistics for descriptive analysis, outliers and percentiles. The descriptive analysis indicated that the ratio of Skewness /Std. Error of skewness for all the items were within the range of -2 and +2, suggesting the data has a normal distribution. As shown in Table 2, the Bartlett's Test of Sphericity yielded statistically significant intercorrelation $\chi^2(276) = 1851.957$, $p = .000$ with an overall Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA) of .878, which exceeds the value of .60. This finding indicated that the available data set fulfilled the sampling adequacy requirement for factor analysis. Anderson et al. (2010) further also noted that PCA requires partial correlation between items to be more than .7. Respectively, the anti-image correlation values of the developed items are greater than 0.8, except for item S10 which has a correlation coefficient value of 0.582. However, this value is above 0.5 which is a minimum requirement for MSA (Anderson, Hair, Black & Babin, 2010).

Table 3. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.878
Bartlett's Test of Sphericity	Approx. Chi-Square	1851.957
	Df	276
	Sig.	.000

5.3 Underlying Dimensions

An examination on the Cronbach's Alpha value of the 24 item-instrument showed that an overall reliability coefficient of the instrument was .885; indicating that the developed instrument has a good internal consistency. A further examination of the corrected item-total correlation values for all item are greater than 0.3, except for item S10 that has a low value of .126 which suggested that the item might be measuring something different

from the whole scale. However, the researchers decided to maintain the item for the next analysis because the overall Cronbach's alpha value is high, plus there was as no increment in the overall value observed if the item was deleted. Later using Kaiser criteria, Principal Component Analysis (PCA) with varimax rotation was performed on the 24 developed items by setting the Eigenvalue more than 1. The varimax rotation was applied in the analysis because the analysis assists an interpretation for components that would be used in the study as dependent variables (Tabachnick & Fidell, 2008). As shown in Table 3, the analysis revealed the presence of six components with eigenvalues exceeding 1; explaining 28.7%, 10.7%, 5.7%, 5.2%, 5.0% and 4.5% of the 60% variance respectively.

Table 4. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.869	28.621	28.621	6.869	28.621	28.621	3.640	15.168	15.168
2	2.578	10.741	39.362	2.578	10.741	39.362	3.424	14.267	29.435
3	1.365	5.687	45.049	1.365	5.687	45.049	2.624	10.935	40.370
4	1.254	5.224	50.273	1.254	5.224	50.273	1.758	7.324	47.694
5	1.195	4.980	55.253	1.195	4.980	55.253	1.628	6.784	54.478
6	1.069	4.453	59.705	1.069	4.453	59.705	1.255	5.227	59.705
7	.939	3.911	63.616						
8	.805	3.355	66.972						
9	.783	3.264	70.236						
10	.753	3.136	73.372						
11	.673	2.806	76.178						
12	.631	2.628	78.806						
13	.604	2.516	81.322						
14	.550	2.291	83.613						
15	.531	2.214	85.827						
16	.485	2.022	87.849						
17	.472	1.968	89.817						
18	.456	1.900	91.717						
19	.384	1.601	93.318						
20	.382	1.591	94.909						
21	.350	1.459	96.368						
22	.319	1.327	97.695						
23	.291	1.214	98.909						
24	.262	1.091	100.000						

Moreover, this procedure required that any item must be loaded at least at .45 on one of the identified components, with no complex loadings were observed on the components. Any complex loading items (i.e., those that loaded on more than one component) and items that did not load $> .32$ on any of the components would be deleted. Table 4 shows loadings values of the 24 items and their respective components. Based on the findings, the researchers decided the sixth component was unreliable to maintain because only one item, S10.Eval_Search, loaded on the component. Accordingly the researchers also deleted item S10.Eval_Search from further analysis. The study also deleted items S1.G.explore, S12. Refine_Search and S24.Security from further analysis because they have loading values of greater than 0.45 in two components.

5.4 Item Analysis

For after the deletion of items S12 and S10, overall reliability coefficient for the 22 items-instrument was .876, indicating the revised instrument has an internal consistency. Table 5 indicates individual reliability coefficients of the identified components ranging from 0.463 (identifying types of information sources) to 0.806 (identifying potential information sources) respectively. It was found that the respondents in this study on the average exhibited the highest score in identifying types of information sources (third dimension) with a mean item score of 2.377 which was significantly higher than 2, the mid-point of 0 to 4 marks that were allocated for each item. On the other hand, respondents in the study exhibited the lowest score in using and communicating information (fifth dimension) with a mean item score of 1.482.

Table 5. Rotated component matrix

	Component					
	1	2	3	4	5	6
S5.Differentiate	.791					
S7.Eval_Method	.782					
S8.Confer_Method	.634		.348			
S4.Disseminate	.625					
S6.Investigation	.601		.330			
S19.Synthesis_info		.721				
S21.Ethics		.718				
S18.Analyse_info		.655				
S20.Comm_Understd		.630	.349			
S22.Believe		.606				
S24.Security	.429	.587				
S23.Plagarisme		.559				
S11.Refine_Sources			.742			
S14.Org_idea			.710			
S12.Refine_Search	.478		.632			
S9.Ident_Kword	.319		.468		.354	
S13.Recogn_bias		.386	.457			
S17.Record_Orgn	.355	.365	.402			
S2.GKeyConcept				.676		
S3.Confer_Topic	.444			.626		
S1.Gexplore	.446			.467		
S15.Source_Type.G					.732	
S16.Source_Type.S					.696	
S10.Eval_Search						.875

5.5 Other Statistical Tests

An independent-sample t-test was conducted to compare youth students' information skills between males and females. There was a significant difference in information skills score between females ($M=47.458$, $SD=12.467$) and males ($M=37.0859$, $SD=14.219$); $t(221)=5.673$, $p=0.00$ (two-tailed). A similar test was also conducted to compare the youth students' information skills according to their education setting, i.e. school versus college. The test showed there was a significant difference in information skills score between school students ($M=46.872$, $SD=12.798$) and college students ($M=31.526$, $SD=11.747$); $t(221)=8.785$, $p=0.00$ (two-tailed). The relationship between information skills and academic achievement was also examined in this study using

Pearson product-moment correlation (PPMC). The test indicated that there was a strong positive correlation between the two variables, $r=.472$, $n=223$, $p<0.0005$; the higher the level of youth students' academic achievement the higher was the level of information skills. This study also tested the relationship between information skills and students' age using PPMC. The analysis showed that there was a strong negative correlation between the two variables, $r=-.370$, $n=223$, $p<0.0005$; the older the students the lower was the level of their information skills.

Table 6. Item analysis after item deletion

Results	Dimensions of the Instrument				
	1	2	3	4	5
	Identifying information needs	Identifying potential information sources	Identifying types of information sources	Searching, evaluating and organizing information	Using and communicating information
Items	S2, S3,	S4, S5, S6, S7, S8	S15, S16	S9,S11, S13,S14,S17	S18, S19, S20, S21, S22, S23
Mean Item Score	2.357	2.163	2.377	1.698	1.482
Min	1.863	1.612	1.852	.993	.865
Max	3.175	2.812	2.901	2.027	2.157
Variance (SD)	.509	.205	.551	.164	.187
Statistics for scale (Mean,SD)	7.07 (2.742)	10.82 (4.492)	4.75 (2.105)	8.49 (4.51)	10.37 (5.796)
Inter-item correlation mean	.419	.456	.303	.363	.367
Min inter-item correlation	.325	.357	.303	.240	.275
Max inter-item correlation	.496	.620	.303	.463	.470
Cronbach's Alpha	0.684	0.806	0.465	0.740	0.802

6. Discussion

Following the explorative nature of the analysis, the researchers further conducted a review of related literature, as well as consulted a few experts to address the issues related to items in the developed instrument. Similar to the experts, the literature review indicated that identifying types of information sources is part of information skills. Accordingly, instead of deleting the construct of identifying types of information sources due to their low reliability coefficient value, the study decided to maintain the construct in the revised instrument, as well as adding new items and refine the existing items. The experts' review also indicated that two items in the instrument (items S15.Source_Type.G and S16.Source_Type.S) comprised of multiple sub-items that could stand on their own. In this light, the study would include and treat the sub-item as individual items in the revision of the instrument. As more items are available to measure the construct of students identifying types of information sources, the study would expect that the reliability coefficient of the construct would increase in the next round of data collection analysis.

The study also re-examined the sixth construct that was previously deleted because it has only one item (S10.Eval_Search). The re-examination indicated that the item requires students to evaluate the credibility and authority of multiple information sources. Similar to the experts, the literature review highlighted that the construct is an essential part of information skills. The experts also reported that S10.Eval_Search constituted of multiple sub-items that could stand on their own. Accordingly, the study decided to include and treat all S10.Eval_Search sub-items as individual items in the next round of data collection and analysis. With more

items available to measure the construct, the researchers would expect to attain better psychometric properties for the final instrument. The study also noted that item S1.G.explore was loaded in both constructs of identifying information needs and potential information sources, while item S24.Security was loaded in both constructs of identifying potential information sources and using and communicating information cross loading. Following the literature, items S1.G.explore and S24.Security are important items to measure the construct of identifying potential information sources and using and communicating respectively, the study will refine the wording of the items to better reflect the construct in the final instrument.

The results revealed that school and college students in this study on the average have relatively moderate information skills. On the average, the respondents are strongest in the area of identifying types of information sources while lowest in using and communicating information. The finding is in line with the nature of information skills programs run in the Malaysian school and university library that expose students to various types of information sources that are available or subscribed by the library. However, the area of using and communicating information is mainly acquired and applied by students within their classroom learning particularly while they are completing their classroom assignments or independent studies. Similarly, the study argues that other areas of information skills that are found weak in the study, i.e. searching, evaluating and organizing information also could be located within the classroom learning. These findings were a good indication that youth students in schools and colleges have various levels of information skills; ranging from moderate to weak in different areas of information skills that could be acquired within the context of information skills programs and classroom learning. Should schools and colleges consider assisting youth students to acquire and apply information skills, the institutions could focus on the areas of searching, evaluating, organizing, using, and communicating information from multiple sources within classroom learning.

The study also found that information skills significantly differ according to youth students' gender and institution (school versus college). Similar to Bitso and Tella (2007), the study found that academic achievement is positively correlated to information skills among students. Likewise, the study supported Deursen (2008) that found students' age is negatively correlated to their information skills. This study argued further that youth students' academic achievement could be the underlying factor that explains these findings. For example on the average female students in the study attained higher cumulative grade point average (CGPA) than male students across institutions. Likewise, on the average school students whose aged mainly around 15-18 years old attained higher cumulative grade point average (CGPA) than college student respondents whose aged mainly around 19-26 years. Accordingly, the study suggested that across education institutions, youth students with a low academic achievement require an extra assistance in acquiring and applying information skills in comparison to students with a high academic achievement.

7. Conclusion

This preliminary study aims to test the psychometric soundness of an instrument that was developed to measure Malaysian youth students' information skills in the context of academic works. Data analysis revealed that the developed instrument has a high overall internal consistency with reliability coefficient was more than 0.8. There were five underlying components to youth students' information skills that were measured in this instrument; they were identifying information need, identifying potential information sources, identifying types of information sources, searching, evaluating and organizing information, and using and communicating information that replicates and complements existing information skills standards and models. On the average, youth students' information skills are highest in identifying types of information sources, information needs, and potential information sources respectively. This may due to the active implementation of information skills programs in school or college library that focused on these areas. Hence, schools and colleges may consider ways to expose youth students to different components of information skills, particularly to the areas of searching, evaluating, organizing, using and communicating information from multiple information sources that they had successfully accessed, which had been identified as the lowest areas of information skills for youth students. The study further found that there was a significant difference in information skills between female and male students and between school and college students. Moreover, the finding established a positive and negative correlation between information skills and youth students' academic achievement and age respectively.

The developed instrument may be useful in conducting need analysis among youth students in high school and higher education institutions for the purpose of designing and implementing information skills programs that could be specially tailored to students' needs. The instrument may help schools and higher education institutions to strengthen their strategies in developing suitable human capital that are able to search and use information from multiple sources to generate new knowledge. However, as explained in the results and discussion sections, it is recommended that the developed instrument is tested further for its psychometric soundness with a larger

sample size across multiple education institutions.

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