



**Embedding e-learning into Science and Engineering
Graduate IL course: A Case Study in Graduate University
Chinese Academy of Science**

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Abstract:

The purpose of this paper is a case study to explore academic library instruction for science and engineering graduates. By means of questionnaires survey online, the pre-IL course self-assessment is completed by 190 graduates enrolled in information literacy (IL) course in three science and engineering faculties. Based on statistical analysis of results, their currency situation and requirement of IL are revealed. An IL pedagogical practice is designed and implemented by subject librarians in two stages, which include a systemic IL course for classroom teaching and a online e-learning platform for interaction. It is showed that the results can provide a lot of useful information to improve graduates' IL by post-IL course self- evaluation. It is significant for future subject librarians' to make great improvement by embedding e-learning into IL course of science and engineering graduates

Keywords: *Graduates; Scientific Information Literacy; Survey; E-learning Instructional Design*

1. Introduction

As we all know, the term ‘information literacy’ to refer to what we now know as this concept was first used by Zurkowski (1974) in his paper “The information Service Environment Relationships and Priorities”^[1]. In 2000, the Association of College and Research Libraries (ACRL) has released Information Literacy Competency Standards for Higher Education^[2]. In 2002, Science & Technology Section (STS) of ACRL set up the special task force on information literacy for science and technology and started the preparation of Information Literacy Standards for Science and Technology. This document was first launched in 2004 and revised in 2006. Five standards, 24 performance indicators and one hundred and four outcomes for assessing were developed for information literacy of university students in science, engineering and technology (SET) disciplines, which fully reflected the capacity requirements of information literacy that SET students should have^[3].

Although the explosion of mass information and the emergence of information technologies, the skills and strategies to obtain and use information in internet world still be felt not easy for students, especially for graduate in science and engineering disciplines. They spend a considerable amount of time retrieving on wide variety information. Therefore over years, a variety of user instruction methods, involved in courses, specialized databases training etc. have been offered by many libraries^[4-9]. Also some case study about how academic library have been practiced in graduate instruction of knowledge and skills of information^[10-12].

The graduate students in GUCAS come from different universities or colleges of China with a good professional background. For their graduate education, there is a two-stage model. They spend their first-year on campus studying various courses necessary for their degrees, and then they pursue research projects for their dissertations at various CAS research institutes. When they begin their academic research, they still spend a considerable amount of time on retrieving and evaluating scientific information based on previous study^[13]. So, how to develop graduate students’ science information literacy skills for their future research appropriately is an issue of great concern to GUCAS and National Science Library (NSL).

National Science Library (NSL) is an academic library affiliated to Chinese Academy of Sciences (CAS). In the past year, NSL was initiated subject librarian system and set up full time subject librarian’s team with diverse subject background. One important aspect of subject librarians changing the traditional role of librarians is to expand library services, effectively discover and meet users’ needs including graduate students. Therefore, NSL cooperated with GUCAS by subject librarian teams who design information literacy courses and embed the related information literacy capabilities into the GUCAS curriculum. The information literacy course will help develop fundamental scientific information literacy skills for graduate students’ future research when they spend their first-year on campus.

So the objective of this study is to know about current situation and requirement of graduates’ IL in GUCAS, and to explore an IL pedagogical practice of Embedding e-learning into Science and Engineering Graduate IL curriculum by subject librarian of NSL, CAS.

2. Methodologies

2.1 Questionnaire of survey on graduates’ information literacy

The Information Literacy Standards for Science and Engineering/Technology is chose as a guide and also considerate in designing a survey questionnaire to learn more about the current situation of graduate in science and engineering faculty of GUCAS^[12,14-15]. Also, further consideration is given to the specific situation of GUCAS’s information environment and graduates education. The survey of science information literacy involves in two parts.

Part one is a survey of pre-IL course self-assessment. Five standards and 24 performance indicators and ways to improve information literacy are developed for the survey as shown in Fig.1. The details are in Appendix A.

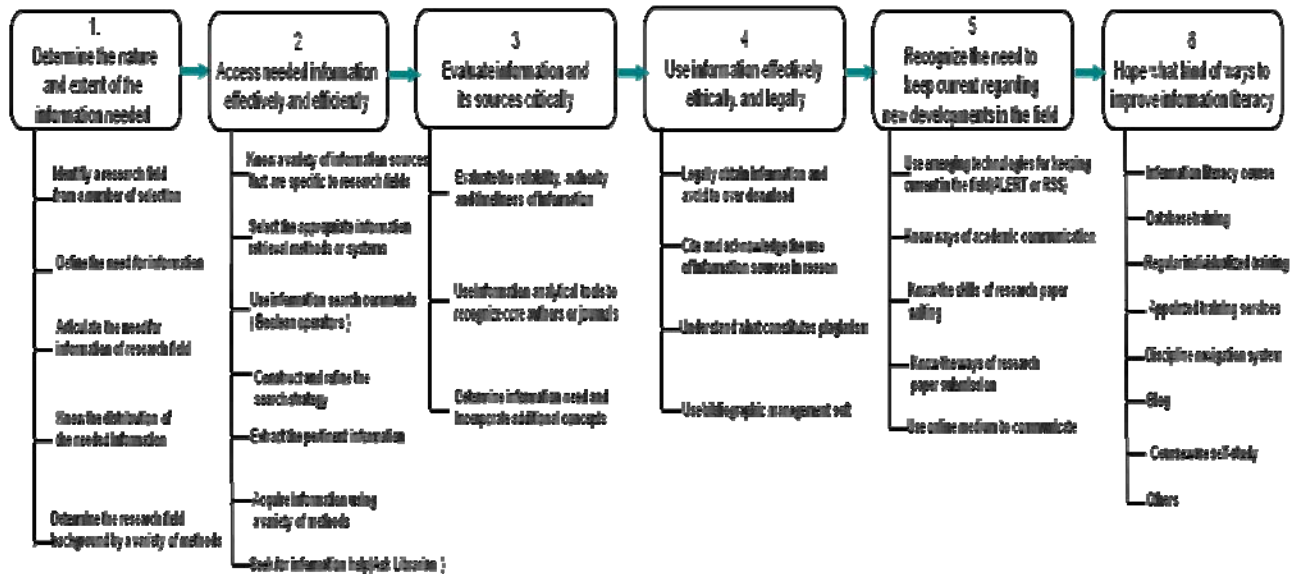


Fig.1 Outline of pre-IL course self-assessment.

Part two is a survey of post-IL course self-evaluation. During courses process, some performance indicators are familiar by most graduates through answer questions practice. So only Five standards and 13 performance indicators are left for the comparatively survey, it is shown in Fig.2. The details are in Appendix B.

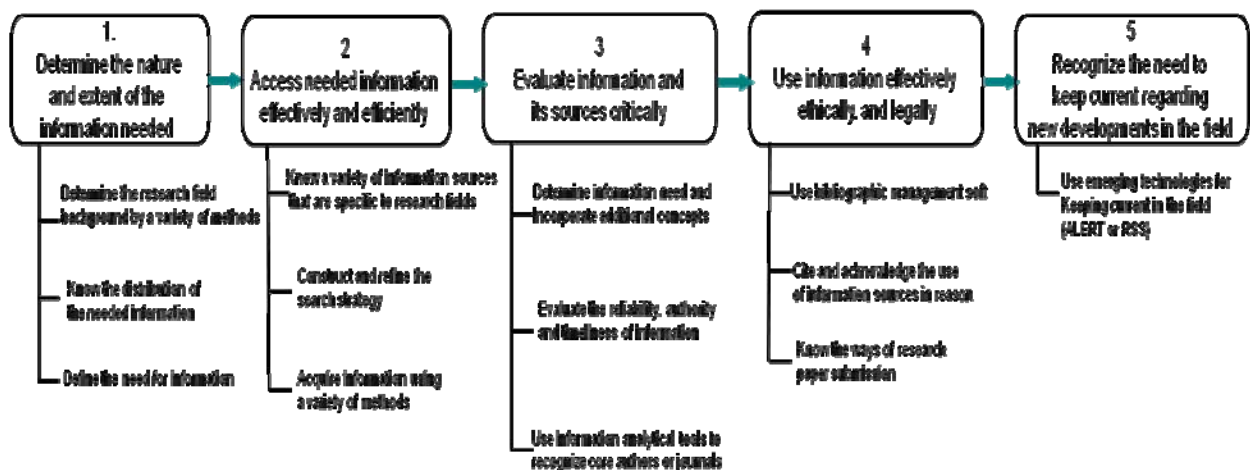


Fig.2: Outline of post-IL course self- evaluation

2.2 Participants of survey on graduates' information literacy

The survey was carried out on 190 graduate students in three faculties as follows. IL course is one of their required courses for master degree offered by GCCAS. These questionnaire release, response collection and data statistical analysis are completed by a free online questionnaire survey platform. The pre-IL course self-assessment and post-IL course self- evaluation are assigned for their homework in Sep. and Dec., 2011.

Table 1 Distribution faculty of participants

Faculty	No. graduates
Information science and engineering	79
Physical science	71
Material science and photo electricity	40

2.3 Statistical method of survey on graduates' information literacy

The questionnaire asked to rate their performance based on each performance indicator on a five-point level: Excellent, good, fair, poor and worse. The percentage is the number proportion of total participants. The pre-IL course self-assessment and post-IL course self-evaluation are implemented according to their own current situation and requirement in terms of information literacy.

3. Statistical analysis of pre-IL course self-assessment results

3.1 Survey results of 5 performance indicators in Standard One

The statistical results of 5 performance indicators in Standard One (determine the nature and extent of the information needed) are shown in Table 2 and Fig. 3.

- Indicator 1: Identifies a research field from a number of selection
- Indicator 2: Defines the need for information
- Indicator 3: Articulates the need for information of research field
- Indicator 4: Knows the distribution of the needed information
- Indicator 5: Determines the research field background by a variety of methods

Table 2 Survey results of 5 performance indicators in Standard One

Performance indicators	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Worse (%)	Null (%)
Indicator 1	6.8	50.5	33.2	7.4	0.0	1.1
Indicator 2	1.6	16.8	45.3	32.1	1.6	1.6
Indicator 3	2.1	39.0	39.5	16.3	0.0	2.1
Indicator 4	4.7	19.0	43.2	27.4	3.7	3.2
Indicator 5	2.1	41.6	46.3	8.4	0.0	1.6

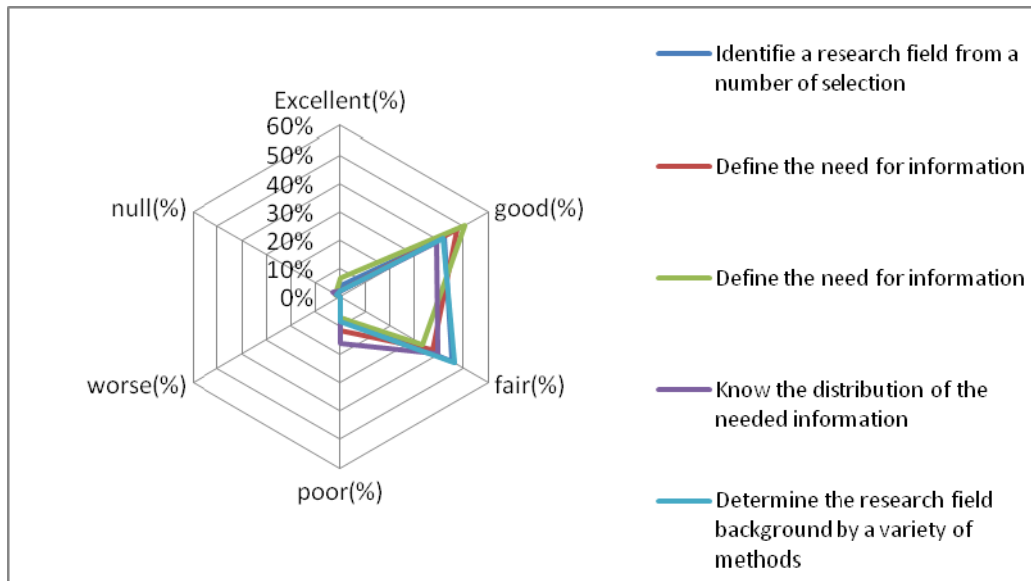


Fig. 3 Survey results of 5 performance indicators in Standard One

From Table 2 and Fig. 3 show that the graduates make better achievements with regards to the performance indicator “identify a research field from a number of selections” and up to 57.3% of participants choose their ratings either “excellent” or “good”. However with regards to the performance indicators are not satisfied and up to 33.7% and 31.1% of participants choose their ratings as “poor” or “worst”, respectively.

According to these situations, when the instructor designed the course contents, two main aspects should be emphasized more by both of instruction and practice ways. One is to introduce scientific information and identify key research terms that can describe graduates’ information needs. The other is to introduce a variety of scientific sources, including formats and characteristics of general and scholarly resources, both library and integrated internet.

3.2 Survey results of 7 performance indicators in Standard Two

The statistical results of 7 performance indicators in Standard Two (access needed information effectively and efficiently) are shown in Table 3 and Fig. 4.

- Indicator 1: Know a variety of information sources that are specific to research fields
- Indicator 2: Selects the appropriate information retrieval methods or systems
- Indicator 3: Use information search commands(Boolean operators)
- Indicator 4: Construct and refine the search strategy
- Indicator 5: Extract the pertinent information
- Indicator 6: Acquire information using a variety of methods
- Indicator 7: Seek for information help (Ask Librarian)

Table 3 Survey results of 7 performance indicators in Standard Two

Performance indicators	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Worse (%)	Null (%)
Indicator 1	1.6	16.8	45.3	32.1	1.6	2.6
Indicator 2	1.6	17.4	43.2	35.8	0.5	1.6
Indicator 3	6.8	17.9	26.8	35.8	10.0	2.6
Indicator 4	0.5	19.5	39.0	34.7	4.2	2.1
Indicator 5	2.6	29.0	51.1	15.3	0.5	1.6
Indicator 6	4.7	19.0	43.2	27.4	3.7	2.1
Indicator 7	3.7	25.8	37.4	25.3	6.3	1.6

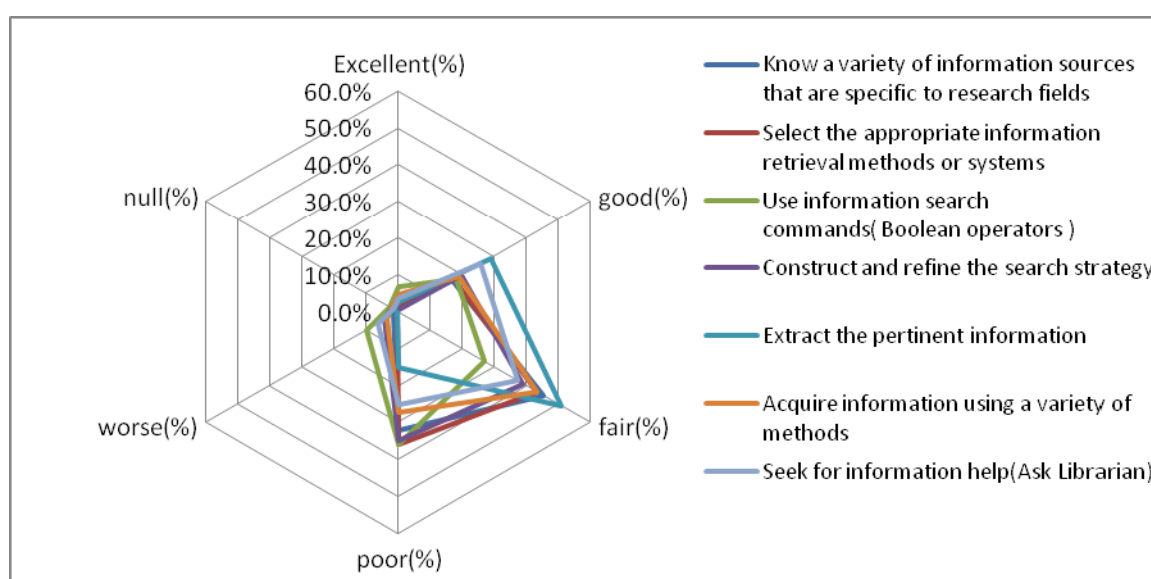


Fig. 4 Survey results of 7 performance indicators in Standard Two

Table 2 and Fig. 4 show that more graduates choose their ratings “poor” or “worst” with regards to all the six performance indicators except “Extract the pertinent information” and the numbers of participants are up to 31.1%-45.8%.

Therefore instructional contents should provide integrated library information instructions (search tips, use-guides etc.), practical skills (information-chain recognition, search strategy, etc.), and multidimensional reference services (blog, MSN, etc.), in order to help them acquire scientific literature needed.

3. 3 Survey results of 3 performance indicators in Standard Three

The statistical results of 3 performance indicators in Standard Three (evaluate information and its sources critically and incorporates selected information into his or her knowledge base and value system) are shown in Table 4 and Fig. 5.

- Indicator 1: Evaluate the reliability, authority and timeliness of information
- Indicator 2: Use information analytical tools to recognize core authors or journals
- Indicator 3: Determine information need and incorporates additional concepts

Table 4 Survey results of 3 performance indicators in Standard Three

Performance indicators	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Worse (%)	Null (%)
Indicator 1	3.2	31.1	44.7	17.4	2.6	1.05
Indicator 2	2.6	25.8	39.0	24.7	5.8	2.1
Indicator 3	3.2	39.5	39.5	13.7	1.1	3.2

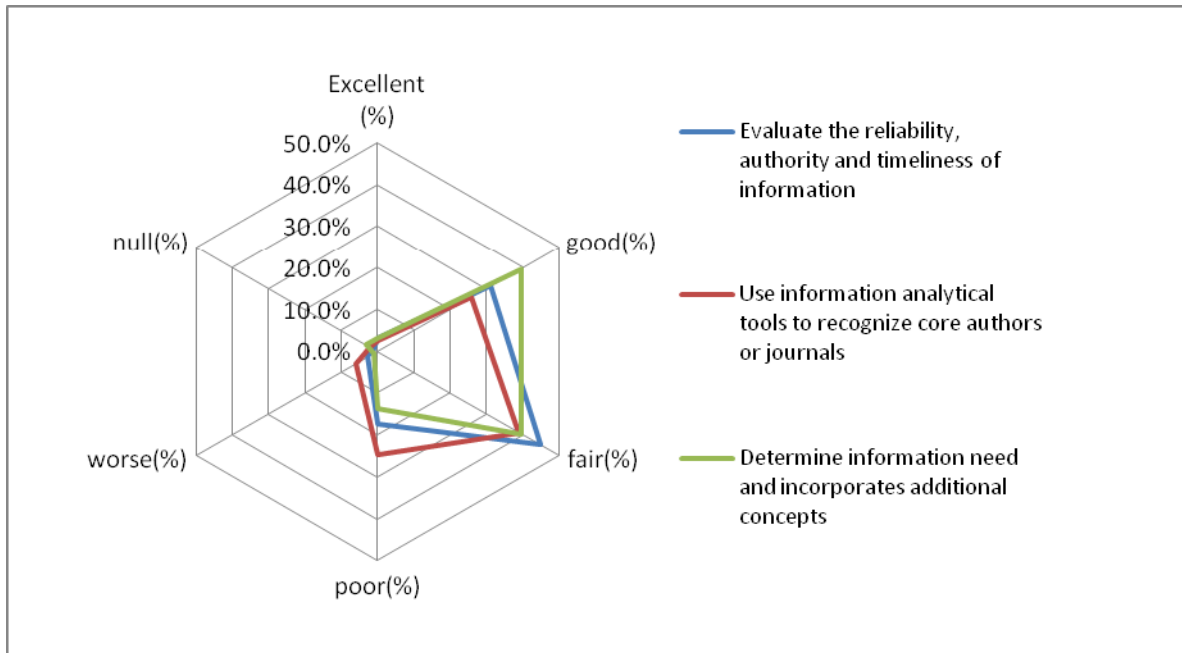


Fig. 5 Survey results of 3 performance indicators in Standard Three

From Table 4 and Fig. 5, it can be seen that the graduates' self-assessment is better with their performance indicators of "Determine information need and incorporates additional concepts" and up to 42.7% of participants choose their ratings either "excellent" or "good". Meanwhile with regards to the performance indicators "Evaluate the reliability, authority and timeliness of information" and "Use information analytical tools to recognize core authors or journals" are both fair ratings in the range of 39.0%-44.7%.

They felt difficult in applying criteria for to make a decision. Therefore instructional contents should introduce the analysis function of core databases to assure reliability and authority of information acquired for their needs, and helps them make a decision to evaluating both the information and its sources.

3. 4 Survey results of 4 performance indicators in Standard Four

The statistical results of 4 performance indicators in Standard Four "use information effectively, ethically, and legally to accomplish a specific purpose" are shown in Table 5 and Fig. 6.

- Indicator 1: Legally obtains information and avoids to over download
- Indicator 2: Cite and acknowledges the use of information sources in reason
- Indicator 3: Understand what constitutes plagiarism
- Indicator 4: Use bibliographic management soft

Table 5 Survey results of 4 performance indicators in Standard Four

Performance indicators	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Worse (%)	Null (%)
Indicator 1	9.5	32.1	27.9	28.4	1.1	1.05
Indicator 2	9.0	39.5	37.9	10.5	1.1	2.11
Indicator 3	19.0	46.8	25.8	6.3	0.0	2.11
Indicator 4	2.1	16.3	45.3	28.4	6.8	1.05

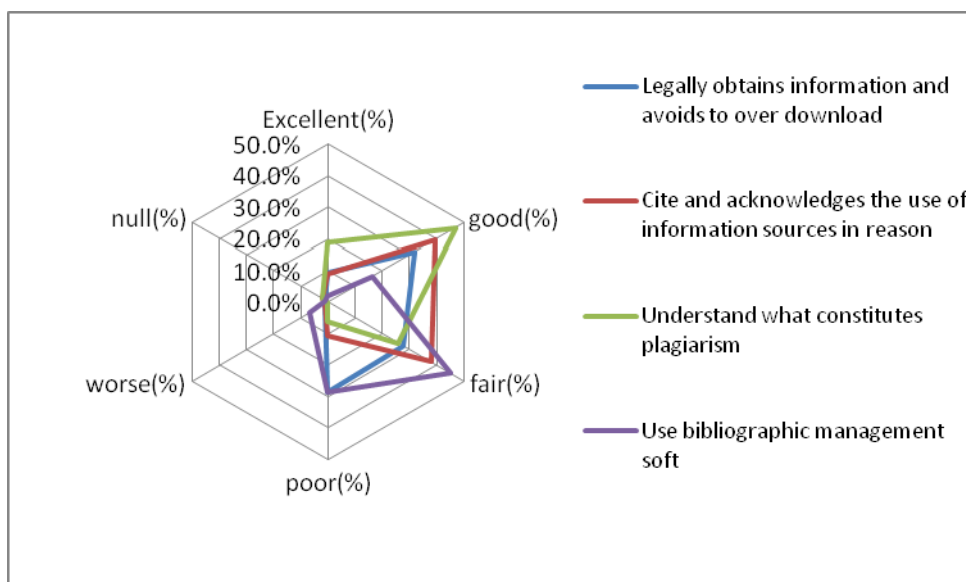


Fig. 6 Survey results of 4 performance indicators in Standard Four

From Table 5 and Fig. 6 it can be seen that participants are content with their performances of “Legally obtain information and avoids to over download”, “Cite and acknowledges the use of information sources in reason” and “Understand what constitutes plagiarism”. Especially, in the range of 41.6%-65.8% respondents rank their skills as “excellent” or “good”. However graduate students give themselves lower ranking in the performance indicators “Use bibliographic management soft”, in which the ratio of participants who chose “excellent” or “good” is only 18.4%.

That means these graduates are familiar with economic, ethical, legal, and social issues surrounding the use of information. Meanwhile they lack the ability to manage their collection of references effectively. Therefore an introduction of a good tool for reference management should be included in instructional contents.

3.5 Survey results of 5 performance indicator in Standard Five

The statistical results of 5 performance indicators in Standard Five “Recognize the need to keep current regarding new developments in the field” are shown in Table 5 and Fig. 6. T

- Indicator 1: Use emerging technologies for keeping current in the field(ALERT or RSS)
- Indicator 2: Know ways of academic communication
- Indicator 3: Know the skills of research paper writing
- Indicator 4: Know the ways of research paper submission
- Indicator 5: Use online medium to communicate

Table 6 Survey results of 5 performance indicators in Standard Five

Performance indicators	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Worse (%)	Null (%)
Indicator 1	1.1	12.6	29.5	41.6	13.7	1.6
Indicator 2	2.1	18.4	37.4	35.8	4.2	2.1
Indicator 3	4.7	22.6	46.3	21.1	3.7	1.6
Indicator 4	1.6	10.0	22.1	51.1	13.2	2.1
Indicator 5	1.6	16.8	33.7	39.0	6.3	2.6

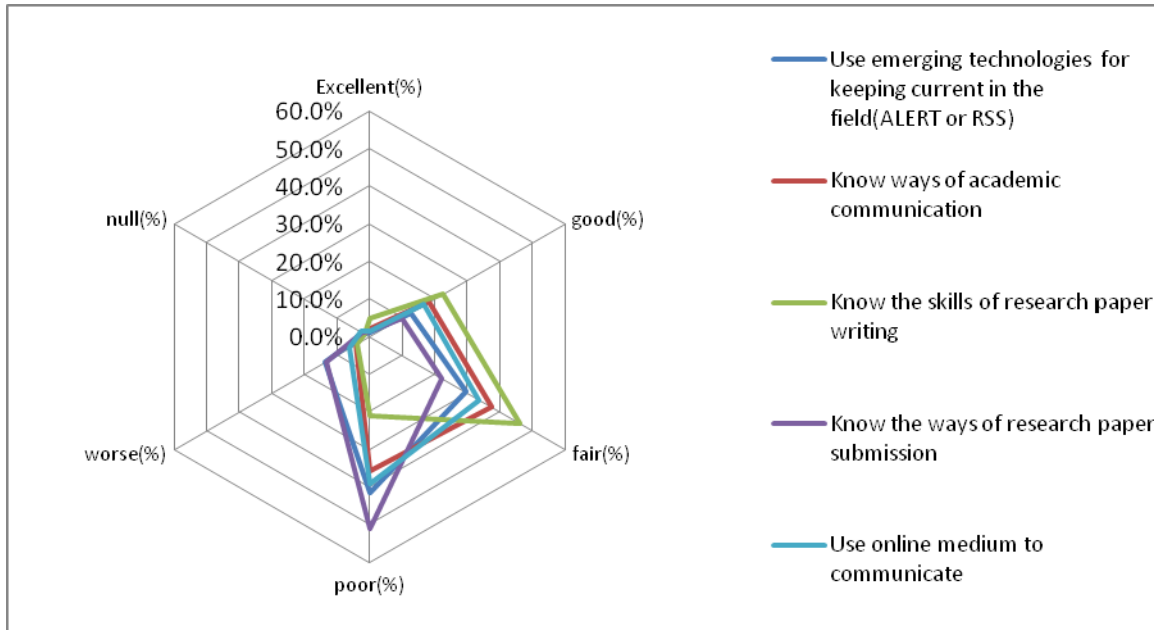


Fig. 7 Survey results of 5 performance indicators in Standard Five

Table 6 and Fig.7 show that graduate students agreed that they fared poorly with respect to 4 performance indicators in Standard Five (Recognize the need to keep current regarding new developments in the field) except “Know the skills of research paper writing”. Especially, the total ratio of participants who choose “poor” or “worse” are in the range of 40.0%-64.5%.

Therefore the patterns on tracking the development trend of science and technology, tracing top research organizations and top researchers in your interested study field, chasing core journals and conferences and so on were also passed on to the graduate students.

3.6 Survey results of ways to improve information literacy

The graduates need what kind of ways to improve information literacy is also to be surveyed and statistical analysis. The results are shown in Fig 8.

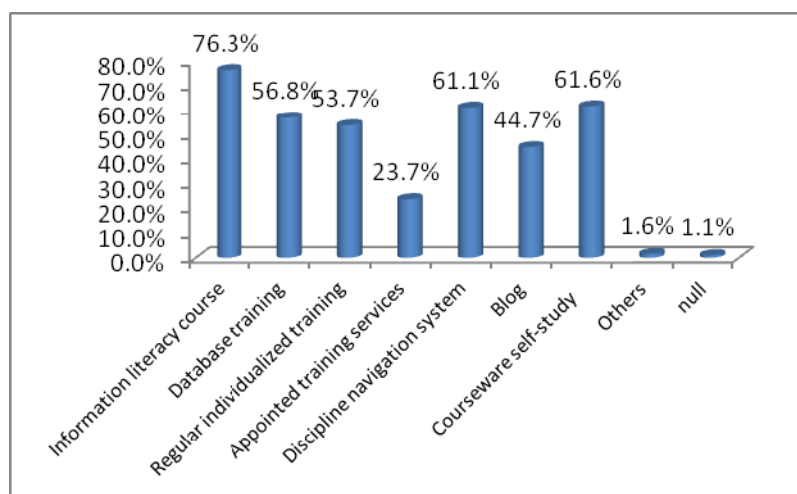


Fig. 8 Survey results of ways to improve information literacy

From Fig.8, it can be seen that the graduates really want improve their information literacy various ways. The ratio of graduates who choose the way of “IL course”, “Database training”, “Regular individualized training”, “Discipline navigation system” or “Courseware self-study” is far more than 50%. Especially, up to 76.3% of graduates are willing to choose IL course to improve their information literacy.

So Based on the survey results of ways to improve information literacy, IL course instruction can be one good choice to improve graduates’ information literacy.

4. Incorporation e-learning into information literacy (IL) course

According to the requirements of Information Literacy Standards for Science and Engineering/Technology(ALA/ACRL/STS), and combined with current situation of their scientific information literacy competencies, a science information literacy pedagogical practice by subject librarians is conducted in two stages, which include a systemic IL course for classroom teaching and a online e-learning platform for interaction.

4.1 Stage One involves embedded ability development and skills training into IL course for classroom teaching.

- The general picture on IL knowledge foundation is described for graduate. Some detailed, which include information awareness, information knowledge, information competence and information morality, are provided to help graduates to expand their knowledge on IL.
- The information resources and services provided by the National Science Library of CAS are introduced. The graduates learn how to describe information needs of the research effectively. The search tips, instructions, user-guides which includes database-oriented and network resources are also discussed through a series of practical example to help graduate access scientific literature.

- It is noteworthy that rich discussions and practices were provided about how to distinguish and utilize evaluate valuable information. The patterns on evaluating information veracity, tracking the development trend of science and technology, tracing top research top researchers in interested research field, chasing core journals and conferences, so on were also passed on to the graduate.
- The course instructor (subject librarian) takes the advantage of chemistry background to develop subject specialized skills for graduates to support the special needs in the three faculty subject area through the following training: the methods of collect research background information, the ways and techniques of quickly tracking and obtaining the integrated scientific literature, accessing laboratory data and patents, managing reference, writing mortality and submission skills (such as selection of journal submission and citation style etc.), share knowledge efficiently etc.

A workflow of IL course for classroom teaching designed is as shown in Fig.9 ^[16].

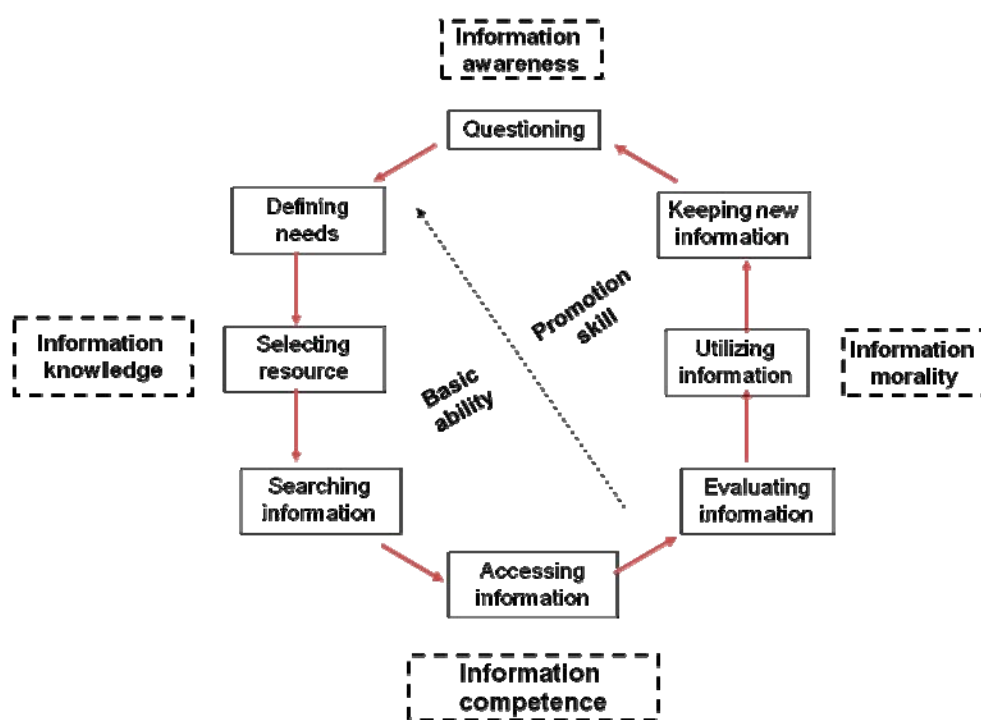


Fig. 9 A workflow of IL course for classroom teaching.

4.2 Stage Two involves embedded e-learning into web course space.

By using Collaborative Learning Platform of GUCAS, a web course space is constructed for self-aided learning and teaching interaction beyond classroom time in order to interact between instructor and graduates. The instructor and each graduate enrolled in the course have their own username and password to enter the web course space. There are seven modules in web course space. They are course general outline, schedule arrangement, Bulletin Board System (BBS), teaching resources, homework, answer to question and communication interaction. During course process, online course space is used to inspire students' enthusiasm to learn practical skills of professional information, and play an important role in help to upload/download courseware and reference, score and give guidance to exercise and task, share resources and information, promotes collaborative e-learning and communication interaction.

5. Comparative results of pre-IL course self-assessment and post-IL course evaluation

At the end of IL course, a post-IL course evaluation and suggestions for instruction are completed online. Some important performance indicators in Standard are chose to comparatively analysis of pre-IL course self-assessment and post-IL course evaluation. The elaboration of the results is as follows.

5.1 Comparative results of 3 performance indicators in Standard One

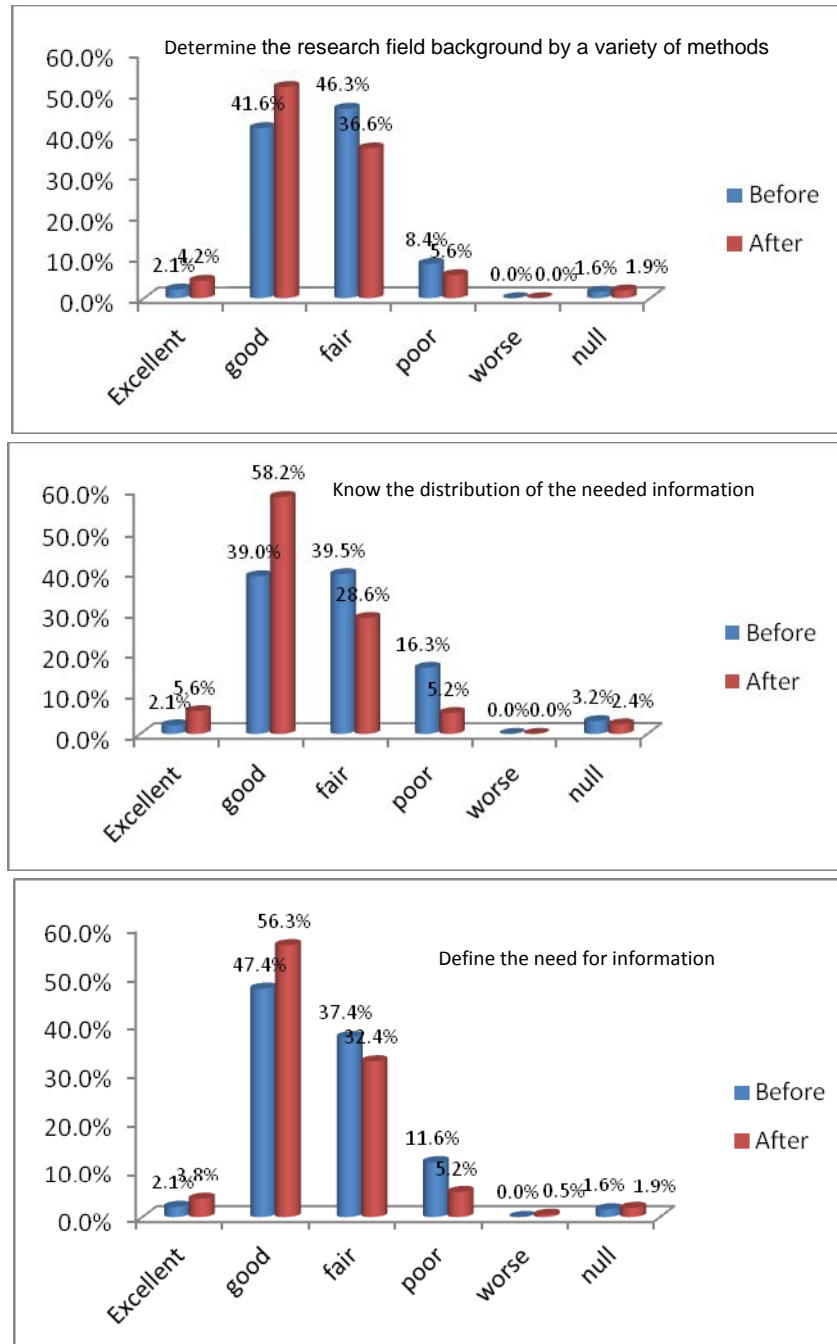


Fig. 10 Comparative results of 3 performance indicators in Standard One

From Fig.10, it can be concluded that the number of participants who are content with their performances of “Determine the research field background by a variety of methods”, “Know the distribution of the needed

information” and “Define the need for information” increase a lot. Especially, the total ratio of who choose “excellent” or “good” increase from 43.7% to 55.9%, 41.1% to 63.9%, and from 49.5% to 60.1% respectively.

5.2 Comparative results of 3 performance indicators in Standard Two

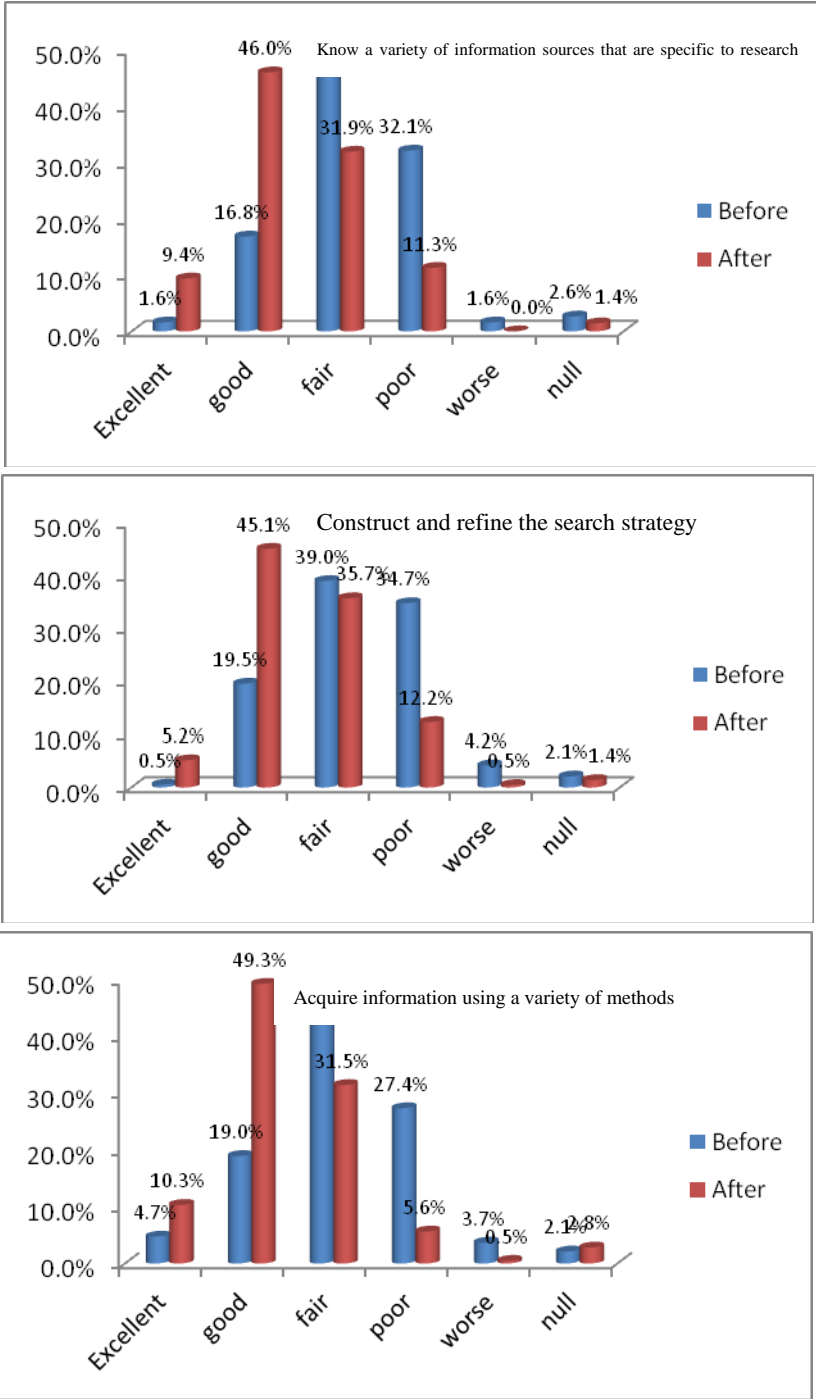


Fig. 11 Comparative results of 3 performance indicators in Standard Two

It can be seen from Fig.11 that above 55.4%, 50.2%, and 59.6% of participants choose “excellent” or “good” with regards to the performance indicators of “Know a variety of information sources that are specific to research fields”, “Construct and refine the search strategy” and “Acquire information using a variety of methods”.

5. 3 Comparative results of 3 performance indicators in Standard Three

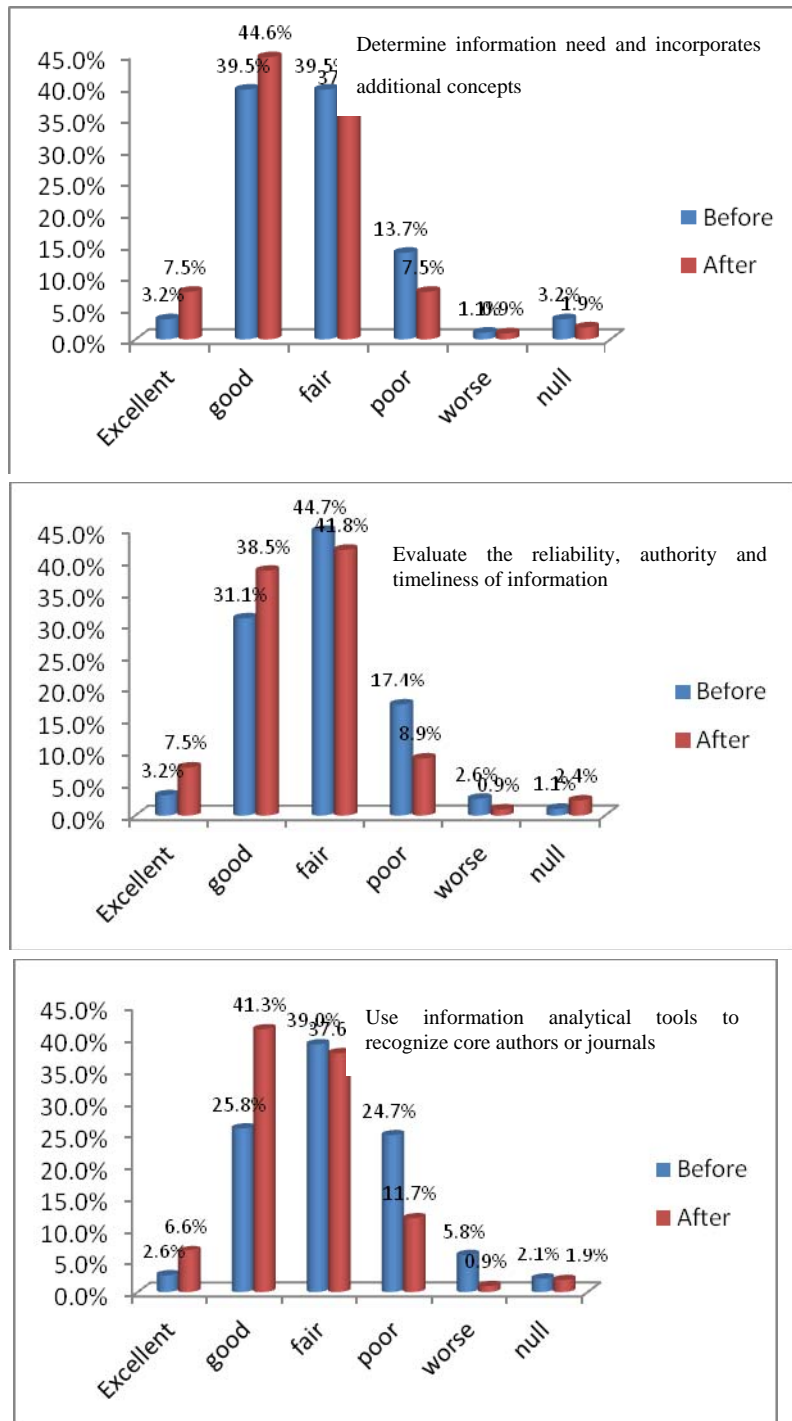


Fig. 12 Comparative results of 3 performance indicators in Standard Three

The comparative data suggested that more participants are satisfied with their performances of “Determine information need and incorporates additional concepts”, “Evaluate the reliability, authority and timeliness of information” and “Use information analytical tools to recognize core authors or journals”. The total ratio of who choose “excellent” or “good” increase up 52.1%, 46.0%, and 47.9% respectively.

5. 4 Comparative results of 3 performance indicators in Standard Four

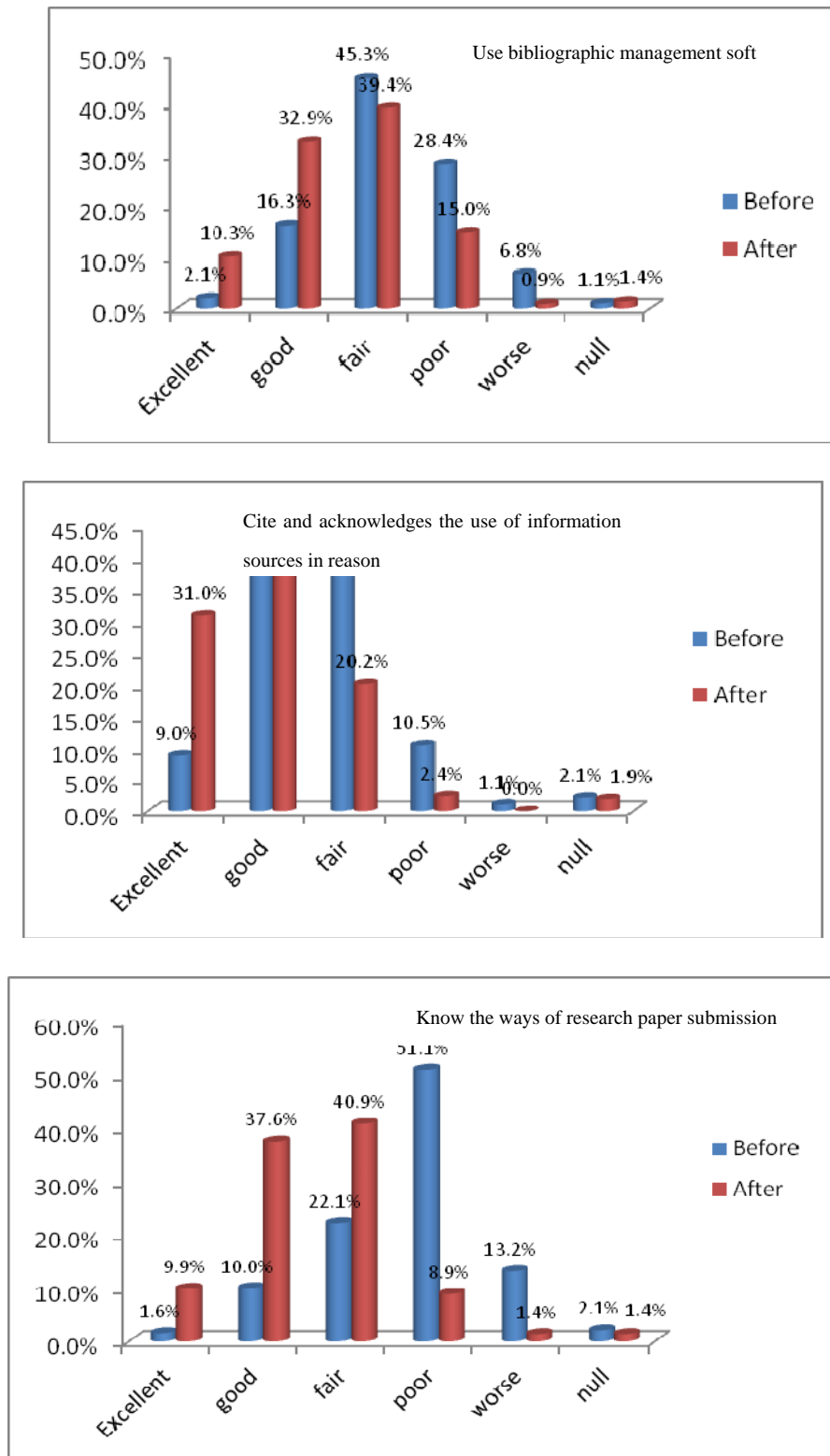


Fig. 13 Comparative results of 3 performance indicators in Standard Four

It can be concluded from Fig.13 that the graduates made better achievement with the performance indicators of “Use bibliographic management soft”, “Cite and acknowledges the use of information sources in reason” and “Know the ways of research paper submission”. The total ratio of who choose “excellent” or “good” increase magnificently.

5.5 Comparative results of 1 performance indicators in Standard Five

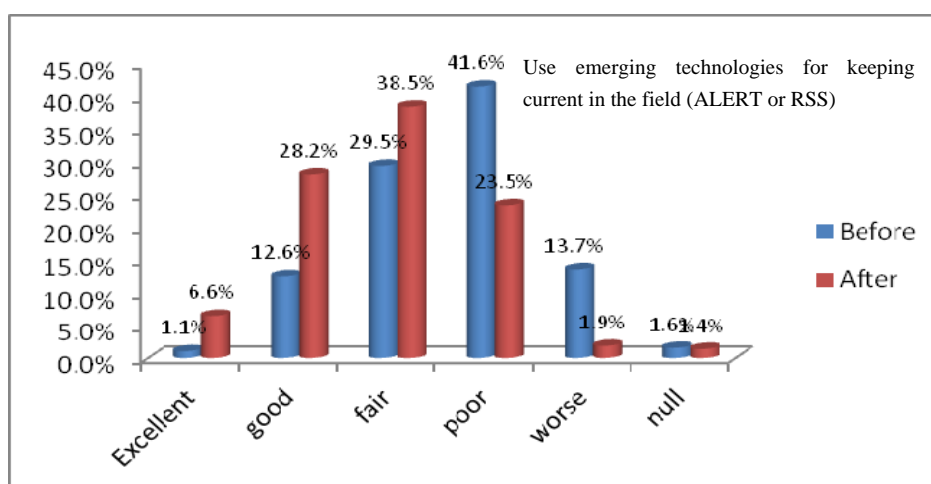


Fig. 14 Comparative results of 1 performance indicators in Standard Five

Fig.14 illustrates that the number of participants who are content with their performances of “Use emerging technologies for keeping current in the fields (ALERT or RSS)” increase a lot. The total ratio of who choose “excellent” or “good” increase from 13.7% to 34.7%.

6. Conclusions

In this study, based on analysis of graduates’ currency situation and requirement of IL, two stage of IL course for classroom teaching and e-learning space interaction are overall designed and processed. The results of graduates’ post-IL course self- evaluation show that a lot of useful information for improvement of information literacy competencies of graduates’ in science and technology disciplines is achieved. This case study explores a validity IL teaching practice by subject librarians. We hope that it would give beneficial assistance on promotion of graduates’ information literacy, GUCAS, and would be significant for subject librarians’ to design of embedding e-learning into IL course of science and engineering graduates.

Appendix A

The pre-IL course self-assessment survey questionnaire website is <http://www.sojump.com/jq/1007080.aspx>.
(Sep, 2011)

Written by Wu Ming and Wang Chun, Subject Librarian, NSL, CAS

Appendix B

The post-IL course self-evaluation survey questionnaire website is <http://www.sojump.com/jq/1057293.aspx>.
(Dec, 2011)

Written by Wu Ming and Wang Chun, Subject Librarian, NSL, CAS

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