DESIGNING A MODEL OF INFORMATION LITERACY EMBEDDED IN UNIVERSITY CURRICULUM
A Case Study of First Term Chemistry Major Program

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Abstrak

Makalah ini membahas tentang kemelekan informasi (information literacy) *sebagai salah satu bentuk multiliterasi yang menjadi tujuan pendidikan dewasa ini. Setelah meninjau ulang definisi, standar, arti penting* information literacy, *penulis menelaah bentuk-bentuk upaya peningkatan* information literacy *di kalangan mahasiswa di universitas-universitas lain serta mengevaluasi program-program yang sudah dilakukan di Universitas Islam Negeri (UIN) Sunan Kalijaga Yogyakarta. Pada bagian inti makalah ini, penulis mengusulkan sebuah program tambahan yaitu memasukkannya standar* Information Literacy *ke dalam kurikulum inti di semester pertama. Untuk memperjelas bagaimana hal ini dilakukan, penulis mengambil studi kasus kurikulum program studi kimia disertai evaluasi singkat mengenai potensi program dan hal-hal lain yang perlu dilakukan agar program dapat berjalan dengan baik.*

Keywords: Information Literacy, University Curriculum, State Islamic University, Sunan Kalijaga

A. INTRODUCTION

Twenty years ago if one were asked: "What is the goal of education?", the answer would be as simple as "to generate literate citizens". Similar responses might still be heard if the same question were asked today. If the query continues to "What does it mean to be literate?", however, the responses would very likely be different.

In its conventional way, literacy refers to "the ability to read and write"[1]. Correspondingly, to be literate means to be "able to read and write"[2]. Although it is still the case today that literacy is usually considered the ability to read and

[1] Anonymous, *Oxford Student's Dictionary* (Oxford, England: Oxford University Press, 1990), pp. 372.
[2] *Ibid.*

write, the definitions of literacy show a lot of variations. At minimum, it means being able to read. For instance, functional literacy, as coined by the U.S. Army, is "the ability to interpret and respond to written instruction"[3]. The more broadly received, contemporary definitions, however, are complex in nature, include various cultural competencies, and have evolved into the more recent multiliteracies.

The various, possible answers to the question, "What does it mean to be literate?" are perhaps helpful in explaining the complexity of the term literacy today. In one context, to be literate may mean having read and appreciated a literary piece written by highly recognized writers such as William Shakespeare, Charles Dickens, or Pramudya Ananta Toer. In another, it may mean "having the sufficient scribal skills to escape a Dickensian nightmare"[4]. In others, it could mean a means to empowerment and critical consciousness for individuals or communities as seen in the goal of education in Paulo Freire's grand idea of *Conscientizacao*[5], or "a child first day of reading"[6]. In this sense, two important points are worth noting. One is related to the term "illiterate". The latter definition shows that it would be rue to refer a pre-literate child as "illiterate". The other is related to the term literacy itself. Both *conscientizacao* and "a child first day of reading" show that literacy is obviously not a value-neutral term. Rather, while literacy may be a means to empowerment, it is also "a regulatory force, a marker of, and a means to, social status"[7].

Another mode of directing the contemporary definitions of literacy (and literacies) are more technical in that they respond to the question, "what competencies should one have in order to be a productive citizen?" These definitions are mostly driven by the fact that our life today is heavily technologically dependent. As new technologies require new literacies to

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[3] Michael Hoechsmann, *Meanings of Literacy* (Montreal: McGill University, 2005) pp. 1.

[4] *Ibid*.

[5] William A. Smith, *The Meaning of Conscientizacao – The Goal of Paulo Freire's Pedagogy* (Amherst, Massachusetts: Center for International Education, University of Massachusettes, 1987).

[6] Hoechsmann, *Meanings of Literacy*, pp. 1.

[7] *Ibid*.

effectively exploit human's potentials, many experts in education are now turning to new notions of literacies with emphases on technologies, particularly those related to communication and information.[8] Scientific literacy, technological literacy, media literacy, information literacy, and information technological literacy are among the many forms of new literacies derived from these notions of literacies.

This paper aims at discussing one of the technically-driven forms of new literacies, i.e. information literacy in university setting. In particular, it aims at examining how it could be embedded in the university curriculum at UIN Sunan Kalijaga context. In doing so, I will first present the definition of information literacy, its standards, and significance. After exploring some models of how to achieve information literacy in other universities, I will return to the context of UIN Sunan Kalijaga and evaluate some possible ways to achieve information literacy for students at this university. Finally, taking the first term curriculum of Chemistry major as a case study, I will propose a model of how information literacy can be embedded in the university curriculum.

B. INFORMATION LITERACY: DEFINITION, STANDARDS, AND SIGNIFICANCE

According to the Association of College and Research Libraries (ACRS), information literacy is "a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information".[9]

If we refer back to the previously cited definitions of literacy, it is clear that although information literacy may sound very contemporary and technical, it

[8] Leu, D.J., Jr., Kinzer, C.K., Coiro, J., & Cammack, D.W. (2004). Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In R.B. Ruddell, & N. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 1570-1613). Newark, DE: International Reading Association. Available: http://www.readingonline.org/newliteracies/lit_index.asp?HREF=leu/

[9] Jennifer Laherty, "Promoting Information Literacy for Science Education Programs: Correlating the National Science Education Content Standards with the Association of College and Research Libraries Information Competency Standards for Higher Education" in *Issues in Science and Technology Librarianship*. Fall 2000.

still shows a strong connection with literacy in its classic meaning. This is because reading and writing are the most fundamental skills that allow individuals to perform those activities showing that they are information literate. Moreover, it also relates to the empowerment-consciousness types of literacy definitions as the words “recognize”, “locate”, evaluate”, “involve”, and “effectively use” in its definition require one to be empowered and conscious in order to do so.

As for the standards of information literacy, ACRL further describes an information literate person as one with the ability to[10]:

a. determine the extent of information needed;
b. access the needed information effectively and efficiently;
c. evaluate information and its sources critically;
d. incorporate selected information into one's knowledge base;
e. use information effectively to accomplish a specific purpose;
f. understand the economic, legal, and social issues surrounding the use of information; and
g. access and use information ethically and legally.

While in a traditional sense, getting a basic education means learning to read and write, the above definition as well as the standards of information literacy indicates that information literacy is actually the basis for lifelong learning. Information literate individuals can effectively use what they have learned in formal education and more importantly only information literate individuals can continue to learn with or without a formal guidance.

Information literacy is also fundamental and generic in nature. Although it may vary from one discipline to another, one learning environment to another, one level of education to another, it is common in all disciplines, to all learning environments, and to all levels of education.[11]

The significance of information literacy to our present-day civilization is obvious in the final report of the High-Level Colloquium on Information Literacy and Lifelong Learning, held at the Bibliotheca Alexandrina, Alexandria, Egypt, 6-

[10] *Ibid*.
[11] *Ibid*.

9 November 2005, sponsored by the United Nations Education, Scientific, and Cultural Organization (UNESCO), the National Forum on Information Literacy (NFIL) and the International Federation of Library Associations and Institutions (IFLA). The report, released in 1 March 2006, challenges international, regional, and national organizations to move beyond an exclusive focus and concern for "Information for All" to "Information Literacy for All." It argues that "the existence of information holds little to no value to people who do not even know what information they need, much less whether it exists or not, or how to locate, evaluate and effectively use it".[12] It should be noted that a change in focus from "Information for All" to "Information Literacy for All" does not necessary mean ignoring the fact that information inequality is still a persistent problem as Schiller[13] pointed out. In the slogan "Information Literacy for All", information inequality is also part of the concerns. In fact, as the new slogan actually advocates both the technical and empowerment-consciousness aspects in gaining and using information, it automatically covers and even highlights the concerns on information inequality.

Although it is not explicitly stated, the United States' National Science Education Standard (NSES) also implies the importance of information literacy. NSES defines scientific literacy as "the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity."[14] Furthermore, according to the NSES, people who are scientifically literate can ask for, find, or determine answers to questions about everyday experiences. They are also able to describe, explain, and predict natural phenomena.[15]

Both "everyday experiences" and "natural phenomena" are nothing but forms of information. Therefore, to be scientifically literate, one needs to be

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[12] International Federation of Library Associations and Institutions, *Information Literacy for All*, http://www.ifla.org/Information, Latest Revision: 6 March 2006. Accessed: 2 February 2008.

[13] H. Schiller, *Information Inequality* (New York: Routledge, 1996), pp. 27-41.

[14] National Academy of Sciences, *National Science Education Standards* (Washington, DC: National Academy Press, 1996).

[15] *Ibid*.

information literate. This is true not only for science. In fact, to be civic literate, legally literate, technologically literate, and literate in general, one needs to be information literate, which again confirms how fundamental information literacy is in learning and in human's life generally.

The importance of information literacy can also be seen in the fact that it is a part of the general education requirements for all entering freshmen in many outstanding universities, for example State University of California.[16] In the following section, I will review some models of how to achieve information literacy for university students taken from the currently existing practices in other universities.

C. ROADS TO ACHIEVING INFORMATION LITERACY FOR UNIVERSITY STUDENTS: MODELS FROM OTHER UNIVERSITIES

There are basically three main "roads" to achieving information literacies for university students:

a. Requiring all students to take library user education sessions or providing them with library user education sessions
b. Requiring all students to take a course on information literacy as a part of their curriculum, usually as a part of their general education requirements or providing an elective course on information literacy.
c. Incorporating the content of information literacy into courses in their major (core curriculum)

The first mode is probably the most common road to ensure that all newly entering university students have adequate knowledge on how to gain and use necessary information for the success of their study. Many universities, for example *Universitas Islam Negeri* (State Islamic University) or UIN Sunan Kalijaga, Gadjah Mada University, and McGill University provide library user education sessions. In this mode, the information literacy content is normally

[16] Laherty, "Promoting Information Literacy for Science Education Programs: Correlating the National Science Education Content Standards with the Association of College and Research Libraries Information Competency Standards for Higher Education" in *Issues in Science and Technology Librarianship*. Fall 2000.

delivered in several library user education sessions. The most basic one, usually for the freshmen or new library users, is usually related to the locations, collections, services available at the library (libraries), and how to use library services. A more advance session may usually be on how to do library research for a specific purpose. An even more advance session, usually for graduate students, may cover how to do advance library research, including how to use interlibrary loan services and to efficiently use data bases.

An important note should be raised here. In the first mode, it is obvious that information literacy seems to be the responsibilities of individual students and library/librarians. Therefore, it is very likely that the library user education sessions are very general and not sufficiently linked with the students' specific needs. Here, in order to conduct a successful library user education session, librarians need to comprehend the theories, pedagogies, and standards that serve the discipline in addition to being somewhat literate in the discipline itself.[17] On the other hand, students need to always reflect the materials they receive in a library user education session and set them into their own contexts of disciplines.

This problem can be very serious, especially in universities that have central libraries – as opposed to departmental libraries – with no or insufficient liaison librarians for each field. Therefore, trainings for librarians should also include some discipline-specific approach to information literacy. Liaison librarians for science and technology faculty, for instance, need to be familiar with both science and technology curriculum standards as well as information literacy standards for science and technology university students. In this regards, work of Brown's[18] on *Information Literacy of Physical Science Graduate Students in the Information Age,* Miller's[19] on *The Measurement of Civic Scientific Literacy,*

[17] G. Sapp, "Science Literacy: A Discussion and Information-Based Definition" in *College and Research Libraries* 53 (1) (1992:21-30).

[18] C.M. Brown, 1999. "Information Literacy of Physical Science Graduate Students in the Information Age" in *College and Research Libraries* 60(5) (1999:426-438).

[19] J.D. Miller, "The Measurement of Civic Scientific Literacy" in *Public Understanding of Science* 7 (1998:203-223).

Peterson and Kajiwara's[20] on *Scientific Literacy Skills for Non-Science Librarians: Bootstrap Training* can be very helpful for liaison librarians.

Another important note is perhaps on the importance of information literacy itself. The fact that information literacy content is "only" provided as part of library user education sessions may send a wrong message to students that it is not important. This is especially true in cases where library user education sessions are provided but not obligatory.

The problem of sending the wrong message on the importance of information literacy can be eliminated in the second mode. As part of their general education requirements, usually taught by librarians, it is less likely that students would wrongly perceive information literacy as unimportant. It does not, however, automatically eliminate the first problem: the lack of connection between what is taught in an information literacy course and students' core curriculum. As Laherty noted:

> The course I teach [Information Literacy] articulates with two of the five science clusters offered. I have been trying to incorporate what is taught in the disciplinary classes (in my case, biology and chemistry) into what I teach in the information literacy course. One major difficulty I have encountered in accomplishing this is stimulating interest and assistance from the disciplinary faculty. My students and I find the information literacy class more relevant and productive when the material the students are learning in biology and chemistry is integrated with the concepts and sources I teach.[21]

Here, again, the responsibilities of contextualizing the content of an information literacy course and the rest of the curriculum rest on the librarians and the students, with little or even no support from the faculty or department. One way to overcome this problem is by exploring the correlations between the information literacy standards and those of a particular field, in Laherty case the

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[20] C. Peterson & S. Kajiwara, "Scientific Literacy Skills for Non-Science Librarians: Bootstrap Training" in *Issues in Science and Technology Librarianship* (1999) [Online]. Available: http://www.istl.org/99-fall/article3.html [October 8, 2000].

[21] Laherty, "Promoting Information Literacy for Science Education Programs: Correlating the National Science Education Content Standards with the Association of College and Research Libraries Information Competency Standards for Higher Education" in *Issues in Science and Technology Librarianship*. Fall 2000.

science field.[22] In this case, the standards of disciplinary curriculum serve as the spokespersons of the department or faculty with whom librarians teaching information literacy could have conversations on what they should teach in order to ensure students the best preparation for their information needs in their study, life, work, and even further study.

As the Institute for Information Literacy advocates, however, "Information literacy depends on cooperation among classroom faculty, academic administrators, librarians and other information professionals."[23] And therefore, to effectively implement a program, be it a library user education or a course on information literacy taught by a librarian, all parties must be actively involved.

But how can we get all parties actively involved? Or, to be more exact, how can we get disciplinary faculty actively involved in promoting information literacy? In the two previously mentioned modes, one way to achieve this is by requesting faculty members to review the curriculum of both library user education sessions and information literacy courses given by librarians. Another way is requesting faculty members to map their respective field's needs with respect to information literacy. Another more promising way is to conduct a dialog between librarians and faculty members on what should be included in both library user education sessions and information literacy courses.

The third road provides another, even more promising way to make sure that all parties are actively involved in promoting information literacy. In this mode, the content of information literacy is embedded into the core curriculum. As a result, not only does it eliminate the wrong notion of the importance of information literacy, it also allows for more contextualized information literacy content. Furthermore, it also leads to a more in depth and meaningful collaborations between faculty members and librarians as now faculty members need to "un-box" their curriculum to librarians as well as understand the work of librarians and the other way around. More importantly, it shifts, but not eliminates, the main responsibility of ensuring the students to have adequate

[22] *Ibid*.

[23] "Institute for Information Literacy" in http://www.ala.org/acrl/nili.whatis.htm. Accessed: 12 February 2008.

information literacy from librarians to faculty members. Information literacy is thus a truly essential part of the curriculum.

As a concluding note for this section, many universities employ more than one mode of achieving information literacy. At the very least, in addition to library user education sessions, information literacy content is also included in the curriculum as part of the Research Method course.

D. ROADS TO ACHIEVING INFORMATION LITERACY FOR UNIVERSITY STUDENTS AT UIN SUNAN KALIJAGA: EVALUATING SOME POSSIBILITIES

After briefly reviewing the three main models of how to achieve information literacy in other university, I will now evaluate some possibilities in the context of UIN Sunan Kalijaga. There are at least three currently existing programs that are potential to promote information literacy at this university:

a. *Sosialisasi Pembelajaran (SOSPEM)* or Study Skills for University Students
b. Library User Education Program
c. Research Method course

Sosialisasi Pembelajaran (SOSPEM) or Study Skills for University Students is a program especially designed for newly entering students to provide them with essential knowledge and skills to be successful in the university life. The materials covered in the four-day training include the fundamental knowledge about the university, the faculty, and the department in which the students enroll, essential study skills for university students such as listening skills, reading skills, and note taking skills, and some intrapersonal and interpersonal skills such as problem solving, motivation building, and understanding others.[24] This program is indeed very potential to promote information literacy among new students, especially as it *does* cover study skills and information literacy is fundamentally part of study skills. Moreover, the trainers are mostly the faculty members from

[24] Anonymous, *Sosialisasi Pembelajaran di Perguruan Tinggi*, CTSD UIN Sunan Kalijaga, 2007.

the same faculty as the students. Therefore, the study skills taught here are comparatively already contextualized and discipline-oriented. The time constraint and the already heavily loaded content, however, may reduce its potential. Thus, at best it can only serve as a good, brief introduction of information literacy.

The Library User Education Program organized by the Central Library of UIN Sunan Kalijaga is quite similar with library user programs in other universities. Therefore it has both the strengths and weaknesses of any library user education programs. It is a good means of acquiring information literacy in general, yet is likely to ignore information literacy for students' specific needs.

As part of the core curriculum, a course on Research Method seems to be the most promising way in enhancing the level of information literacy among university students. Here, information literacy content is usually embedded in the first or second part of the course syllabus, as part of literature review with which research normally starts.[25] As the course is already discipline-specific and in most cases taught by a department or faculty member, the problem of lack of connections to students' specific needs is certainly eliminated. However, it is up to the students to make the connections between information literacy content they receive in class and the actual settings in which they are required to search for information, which in most cases mean library. As Stoan put it, "Instruction in bibliographic resources is useless unless wedded to a course project in which students are simultaneously acquiring subject knowledge and direction from the professor and bibliographic skills from the librarian."[26]

Another issue also persists in relation to the time set for students to take a course on Research Method. As the course is primarily set to provide students with essential skills to conduct research for their final assignment, students would normally take this course towards the end of their program. It means that they may

[25] A common syllabus of a Research Method course comprises the following topics: Introduction (including Background Information), Literature Review, Problem Statement, Methods, Results and Discussions, and Conclusions. As setting up the research background also requires one to do some literature review, the course would unavoidingly starts with Literature Review.

[26] S.K. Stoan, "Research and Library Skills: an Analysis and Interpretation" in *College and Research Libraries* 45(2) (1984:99-109).

not be sufficiently equipped with information literacy necessary for their learning in previous courses.

Based on the above discussions, it would be fair to conclude that the currently existing programs to enhance students' information literacy at UIN Sunan Kalijaga are all very prospective. There is, however, still a lot room for improvement both in the designs and implementations of those programs as well as in filling the gaps in which those programs are still unable to cover. One possible way to do this is by incorporating information literacy content into the currently existing courses other than Research Methods.

There are many possible courses in which the information literacy content can be embedded. For the following reasons, however, I argue that 1st courses within the core curriculum of a certain program are the most promising ones:

a. They can be seen as a continuation of both study skills given in *Sosialisasi Pembelajaran* and library user education program supposedly taken before the freshmen start their first term. In this regards, most of the content may still be quite basic, yet already discipline-oriented.
b. As they are given in the very beginning of students' university learning, they can also be seen as part of general education requirements, which as I have explained earlier, confirms the message of the importance of information literacy.
c. Although they may be quite basic, if the information literacy content is incorporated in a few courses, it is possible to make it quite advance to cover most standards of information literacy. The key here is certainly how to design information literacy-embedded courses which allow the students to achieve both the standards of the courses and those of information literacy.

In the following section, I will propose a model of how this can be done for Chemistry Major Program as a case study.

E. Designing a Model of Information Literacy Embedded in the Curriculum of 1st Term Chemistry Major Program

In designing a model of information literacy embedded in the curriculum of 1st term Chemistry Major Program, I basically follow the method proposed by Laherty[27]. As a librarian responsible for teaching a course on information literacy as part of general education requirements for science-cluster students at the California State University, she correlates the National Science Education Content Standards with the Association of College and Research Libraries Information Competency Standards for Higher Education. Based on the evaluation from the students enrolling in her class, her approach seems to be a successful measure in making information literacy relevant to students' needs.

My approach may, however, somewhat be a little different because of the different position I have. As a faculty member, I would inevitably tend to see the information literacy standards as something from outside and the standards of the courses in my department as something from inside. In spite of this difference, I am confident that correlating the two sets of standards would be helpful in promoting information literacy, which in turn also supports students' learning in courses within their core curriculum.

The first step in designing a model of information literacy embedded in the curriculum of 1st term chemistry major program is to examine the curriculum and decide which courses are within the core curriculum of the program. Afterwards, I examine the standards of those courses and those of information literacy and see how the standards of information literacy can be incorporated into the standards of the courses.

Table 1 provides the curriculum of 1st term chemistry major program. As can be seen from Table 1, there are three courses which are within the core curriculum of chemistry major program. They are General Chemistry 1 (KIM 201-1-3), General Chemistry Laboratory Work 1 (KIM 203-1-1), and

[27] Laherty, "Promoting Information Literacy for Science Education Programs: Correlating the National Science Education Content Standards with the Association of College and Research Libraries Information Competency Standards for Higher Education" in *Issues in Science and Technology Librarianship*. Fall 2000.

Management of Chemistry Laboratory (KIM 305-1-2). The standards and topics covered for the three courses are given in Table 2.

Table 1
The Curriculum of 1st Term Chemistry Major Program
at UIN Sunan Kalijaga Yogyakarta[28]

No	Course Code	Course Title	Credit
1	KIM 201-1-3	General Chemistry 1	3
2	KIM 203-1-1	General Chemistry Laboratory Work 1	1
3	MAT 203-1-3	Calculus 1	3
4	FIS 201-1-3	Basic Physics	3
5	FIS 201-3-1	Basic Physics Laboratory Work 1	1
6	KIM 305-1-2	Management of Chemistry Laboratory	2
7	BIO 202-1-2	General Biology	2
8	USK 108-1-2	Introduction to Islamic Studies	2
9	PTI 208-1-2	History of Islamic Civilization	2
10	PTI 209-1-2	*Tauhid*	2
11	FST 101-1-0	Religious Supervision Program	0

Table 2
Standards and Topics Covered by the Three Core Curriculum Courses
of 1st Term Chemistry Major Program at UIN Sunan Kalijaga Yogyakarta[29]

No	Course Title	Standards	Topics Covered
1	General Chemistry 1	Students are able to understand and apply several fundamental aspects of chemistry, including classification of matter, atom and sub-atomic particles, stoichiometry, and chemical bonding, which are all the bases for more advance courses in chemistry	a. Introduction to chemistry: the scope of chemistry as a field in science, the scientific method, and classification of matter b. Atom and sub-atomic particles c. The mole concept and chemical reaction d. The periodic table of the elements e. Chemical reactions in aqueous solutions f. Electronic configuration g. Chemical bonding
2	General	Students are able to	a. Fundamentals of chemistry laboratory

[28] Anonymous, *Panduan Akademik Fakultas Sains dan Teknologi UIN Sunan Kalijaga*, (Yogyakarta: UIN Sunan Kalijaga, 2007).

[29] Anonymous, *Kumpulan Hasil Workshop Penyusunan Satuan Acara Pelajaran (SAP) dan Handout Mata Kuliah Program Studi Kimia*, (Yogyakarta: Fakultas Sains dan Teknologi UIN Sunan Kalijaga, 2007).

	Chemistry Laboratory Work 1	understand and apply several fundamental aspects of chemistry in laboratory situations (experiments and analyses)	techniques b. Molecule Models and Chemical Bonding c. Determination of in Market Acetic Acid Samples by Volumetric Method d. Quantitative Analyses of Pb(II) and Cu(II) in an Aqueous Solution e. Liquid-liquid Extraction
3	Management of Chemistry Laboratory	Students are able to understand and apply several fundamental concepts in management of chemistry laboratory, including techniques to use chemistry laboratory equipments, managements of chemistry laboratory equipments, chemicals, and laboratory activities, and laboratory safety	a. Overview of chemistry laboratory management b. Management of laboratory equipment, its importance, and its impacts on the performance as well as work safety. c. Management of chemicals, its importance, and its impacts on the performance as well as work safety d. Hazardous Chemicals e. Other possible hazards and dangers in laboratory (electricity, biological hazards, radiation, mechanical hazards, noise, etc.) f. Waste management g. Fire management h. Preparation techniques for solutions, liquids, solids, and gas. i. Separation and purification techniques j. Scopes of each chemistry laboratory work k. Management laboratory data and documents.

As Table 2 reveals, the three courses in the 1st term are really the foundations of chemistry major curriculum. Additionally, they are supplemental to one another. While General Chemistry 1 tends to focus more on the theoretical aspects of chemistry, Management of Chemistry Laboratory is more of the practical aspects of chemistry: the laboratory and how it works. Both courses, however, share the same feature: although it is very likely that the instructors would use models or some laboratory equipments, they are taught in classroom setting. General Chemistry Laboratory Work 1, on the other hand, is taught in a real laboratory setting. It is, therefore, where the streams from the other two courses meet.

The question remains for us now is "How can we embed the seven or at least several of standards of information literacy for higher education in section B?" The wide ranges of topics covered in all three courses allow us to modify the course presentation to also include the standards of information literacy step by step. The most obvious one is certainly the standard (a): to determine the extent

of information needed. As the first meeting is normally about the course overview, the instructor could highlight that the information literacy focus for that meeting is for students to determine the extent of information needed for each topics on that course based on the syllabus. Table 3 outlines possible ways to incorporate information literacy standards into the presentation of General Chemistry 1 and Management of Chemistry Laboratory from meeting #1 to

Table 3
A Model of How Information Literacy Standards Can Be Incorporated
in General Chemistry 1 and Management of Chemistry Laboratory

Meeting #	**Information Literacy Standard to be Incorporated**	**Possible Ways of Incorporation**
1	to determine the extent of information needed	▪ Students are asked (in group) to examine the course outline and standards, and then determine the extent of information needed for this course. This would be more obvious if they compare the standards for this course with those of more advance courses covering similar topics.
2, 3	to access the needed information effectively and efficiently	▪ Students are assigned to write a summary of the topic for this meeting from resources selected by the instructor. The resources should be at least in two forms: textbooks available in the University Library (title and authors given) and websites (the exact address given). Additionally, they need to report on how they gain the information, the relevance of the selected resources to the tasks, and how much time they spend on the task. They also need to reflect on how they could do better on this assignment in terms of efficiency and affectivity.
4, 5	to evaluate information and its sources critically	▪ Students are assigned to answer some concept-based questions for these meetings based on information available in 4 types of resources: a high school textbooks, a university textbook, an official website from an acknowledged organization (for example: www.chem-is-try.org), and an unofficial website students get by googling. They are required to compare the information from those resources. They also need to set the priorities based on the level of the resources' reliability and provide reasons for their choice.
6, 7	incorporate selected information into one's knowledge base	▪ For each topic and subtopic of these meetings, students are first asked to reflect on their prior knowledge on the topics, make a list of what additional knowledge they need to master the topics and possible resources to get the information, and then think of how the new

		knowledge can be incorporated into their prior knowledge.
8, 9, 10	use information effectively to accomplish a specific purpose	▪ Students are asked to do oral presentations on particular topics and submit written report of the presentations.
11, 12	access and use information ethically and legally	▪ Students are asked to examine some rules on citing and referencing based on the university/faculty standards and evaluate on how they have gained and used information for all previous assignments. They need to revise the written report of their presentations in accordance to the rules.

Table 4
A Model of How Information Literacy Standards Can Be Incorporated
in General Chemistry Laboratory Work 1

Meeting #	**Information Literacy Standard to be Incorporated**	**Possible Ways of Incorporation**
1	▪ to determine the extent of information needed	▪ Students are asked to examine the title and objective of the experiment they are about to do, and then determine the extent of information (theoretical framework, laboratory skills) needed for the success of both conducting the experiment and writing the laboratory report. The focus here is on determining the keywords (or key concepts) of the experiments.
2	▪ to access the needed information effectively and efficiently ▪ use information effectively to accomplish a specific purpose	▪ Students are assigned to provide their own theoretical framework for the laboratory report based on the resources selected by the instructor. The resources should be at least in two forms: textbooks available in the University Library (title and authors given) and websites (the exact address given). Additionally, they need to report on how they gain the information, the relevance of the selected resources to the tasks, and how much time they spend on the task. They also need to reflect on how they could do better on this assignment in terms of efficiency and affectivity.
3	to evaluate information and its sources critically	▪ Similar to meeting #2. The only different is now they have to deal with information available in 4 types of resources: a high school textbooks, a university textbook, an official website from an acknowledged organization (for example: www.chem-is-try.org), and an unofficial website students get by googling. They are required to compare the information from those resources. They also need to set the priorities based on the level of the resources' reliability and provide reasons for their choice.
4	to incorporate selected information into one's knowledge base	▪ For every concept used in this experiment, students are first asked to reflect on their prior knowledge on the topics/concepts, make a list of what additional knowledge they need to master the topics and possible resources to get the information, and then show how they incorporate new knowledge into their prior knowledge. In their

		laboratory report, they need to clearly show which concepts they have already learned in high school and which they receive in university.
5	to access and use information ethically and legally	▪ Students are asked to examine some rules on citing and referencing based on the university/faculty standards, evaluate on how they have gained and used information for all previous laboratory reports, and present their last laboratory report in accordance to those rules.

meeting #12[30]. As there are only 5 meetings in the General Chemistry Laboratory Work 1, the standards of information literacy incorporated in this course are distributed in 5 meetings (Table 4).

As both Table 3 and Table 4 show, the incorporation of information literacy standards into the presentations of those courses does not change the standards of the course. It does, however, enrich and give a new sense to the courses as they are now more information literacy-oriented.

F. CONCLUDING REMARKS

Despite of its potential to enhance students' information literacy and support students' learning of the content of the courses themselves, a barrier to the proposed program is that it certainly requires more work from both the instructors and the students. Therefore, promoting the importance of information literacy and its incorporation into the core curriculum is the first and foremost step. In addition to that, the model I propose here needs to be reviewed and sharpened by both experts in information literacy (or librarians) and other department members. Furthermore, as any new measures, the model needs to first be implemented in a pilot project.

[30] Based on the minimum number of meetings for each course at UIN. Laboratory-based courses are exceptions.

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