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An Approach for Pre-Diagnosis Information Literacy Level by Using Expert System

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Abstract— *Communication and information technology has been equipped almost human lives sector. Inevitably, in spite of its positive impacts, this advance opens to vulnerable things, even dangerous to human generation. Pornography, violence and immoral activities, get advantages from global net between people Therefore, it is necessary for anybody to possess filter about what is, from where, when and how much information that he/she needs, which is information literacy. Students are not different with that fact. It is not only for filtering information, but this capability is also for creating a human learner who is self-directed, active learner, dynamic, and innovative. Whereas, indeed, these aspects are crucial in student centered learning which is commonly adapted in university.*

This paper gives an introduction for pre-diagnosis level of information literacy by designing and implementing rule-based expert system. This system mimics expertise of one expert by formulating knowledge as rules. Knowledge which is intended in this proposed system is information literacy for higher education in science and technology/engineering field.

Keywords-component; information literacy; student centered learning; rule-based expert system

I. INTRODUCTION

This paper is an extended version of [1]. There are several contents that are added on this paper. We give more explanation on every section, and change rules of firing decision, interval of scores, and interval of level.

Communication and information technology has been equipped almost human lives sector. Inevitably, in spite of its positive impacts, this advance opens to vulnerable things to human generation. Pornography, violence and immoral activities, get advantages from global net between people. Shenk called it *Data Smog*, which means abundant information that results problems into our lives [2].

Therefore, it is necessary for anybody to possess filter about what is, from where, when and how much information that he/she needs. If he/she has such capability, then it means that he/she has good capability of information literacy, in other word he/she is information literate. Information literacy is a set of capabilities which obligates anybody to recognize when information is needed and to locate, evaluate and also to use effectively information which is needed [3].

Students are not different with that fact. It is not only for filtering information, but this capability is also for creating a human learner who is self-directed, active learner, dynamic, and innovative. These aspects, indeed, are crucial in student centered learning (SCL) which is commonly implemented in university [4].

Furthermore, there is a requirement about measurement of information literacy. By doing that, we can identify and know how many people are information literates. This number is necessity to prepare people for life in information society and society knowledge [5]. In addition, there were several meeting conducted to discuss about that problem, such as in world information summit in Geneva, 2003 and Tunis, 2005.

Meanwhile, we found that there was no research in UIN Sunan Kalijaga that measures level of information literacy of students in this university. Therefore, here, we proposed a research that can measure such thing. However, our proposed research offered a pre diagnosis of information literacy because for real measurement needs long time research and accompanied by other tools.

Measuring level of information literacy can be conducted by designing and implementing Rule-Based Expert System. This system mimics expertise of one expert by formulating knowledge as rules. Knowledge that is intended in this proposed system is information literacy for higher education in science and technology/engineering field which is proposed by American Library Association.

System which is implemented in this research is software for decision making which can achieve

[1] Based on our works presented on ICID2011 *Center of Research, UIN Sunan Kalijaga*
[2] Achmad, 2007
[3] ALA, 2000
[4] Anonim, 2010
[5] Gendina, N., 2008

performance of an expert in special and narrow field of problem. That system, likes a human expert, will interact with user (students) to collect facts which relate to information literacy of user and use these to measure level of information literacy of user. Next, there will be analyzed factors which affect more on that measuring.

Although learning process in UIN Sunan Kalijaga, particularly in Faculty of Science and Technology, is rather effective based on our early observation, this proposed research is still required for it can offer information about level of information literacy of students in that faculty. Moreover, such information is worthwhile for leaders of this university in making decision.

II. LITERATURE STUDY

A. *Information Literacy*

Term of information literacy has several definitions, one of which is a capability to recognize when such information is needed, to locate, evaluate and to use effectively information which is needed, as said by Library Congress Subject Headings (LCSH). In that point of view, information literate is a base for lifelong learning. Other definition is a set of capabilities which obligates anybody to recognize when such information is needed, to locate, evaluate and use effectively information which is needed [3].

Information literacy was first introduced by Paul Zurkowski in 1974 [6]. According to source of references of information literate standards which is adapted in this research, there exists a definition, "A set of abilities to identify the need for information, procure the information, evaluate the information and subsequently revise the strategy for obtaining the information, to use the information and to use it in an ethical and legal manner, and to engage in lifelong learning. Information literacy is a crucial thing for students while pursuing their study which should access varies sources and forms of information which deliver knowledge in their fields. In other hand, science, engineering and technology are kinds of fields changing rapidly and it is vital for scientists and engineers to keep up date with development and sources of data for experiment/research.

The concept of information literacy becomes known in US and Australian education theory and librarianship [7]. Information Literacy directly deals with competency level of using set of information skills and therefore, it is an essential requirement for every citizen, including student as a small part of it, to be a 'rightful and informed' citizen , which is a 'information literate' citizen.

Information literacy is essential to most of the other skills and it is not a not an isolated concept, but it is developed by other supporting skills [7]. As cited from [7], it is information skills, computer literacy, IT literacy, library skills and learning to learn which contributes to information literacy. Based on that paradigm, an information literate student inevitably is literate on such those skills.

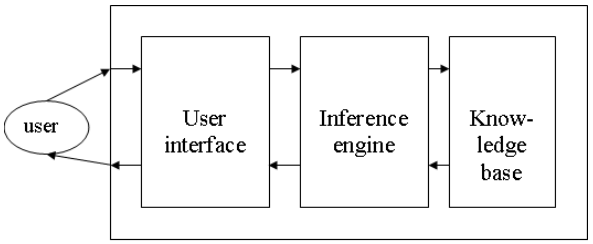

Figure 1 Architecture of expert system

B. *Rule-Based Expert System*

Expert systems are a branch of artificial intelligence. It simulates human reasoning in some domain of problems. Reasoning could be done by using heuristic or approximate methods. Moreover, it uses user-friendly terms for explaining and justifying solutions.

Architecture of an expert system in general is depicted in fig. 1 above. User interface provides media for communication between users and an expert system. Better communication uses natural language which usually is presented in question-answer form and graphs. Advance user interface is equipped with voice. Output of expert system is also delivered using user interface. This output is a solution to such problems, which is accompanied by explanations.

Inference engine is a brain of an expert system which is known as rule interpreter. Inference engine is a computer program which provides a method for reasoning and formulating decision.

In its processes, inference engine uses strategy of reasoning and strategy of controlling. Strategy of reasoning consists of exact reasoning and inexact reasoning. Strategy of controlling is as guidance direction for reasoning. There are three strategies of controlling, which are forward chaining, backward chaining, and combination of both of strategies.

Knowledge base is a source of knowledge for such expert system. It is developed from knowledge or expertise of expert of that system.

There are several types of Expert Systems [8]:

- Neural Networks
- Blackboard Systems
- Belief (Bayesian) Networks
- Case-Based Reasoning
- Rule-Based Systems

[6] Nasution, L.F.R.

[7] Seneviratne, W., 2007

[8] Morris, J., 2003

Rule-Based Expert Systems originated from AI research in the 70s and 80s. Rule-Based Expert System mimics expertise of an expert by formulating knowledge as rules [9] and problem data as facts [8]. Here, reason uses IF … THEN … ELSE rules which could be deductively (forward-chaining) or inductively (backward-chaining).

We can use Rule-Based Systems for obtaining solution for certain problems [8] where it have domain which is narrow and well-understood. Furthermore, its knowledge could be represented with facts and rules, and its solution is a recommendation. Next, it could explain how does such solution be achieved by tracing rule firing, and it generally could not learn.

C. Previous Researches

There were several researches relating to information literacy. First, reference [10] measured levels of media literacy of students in Paramadina University. She used standard from European Commission 2009 for measuring such thing and applied that standards in form of questionnaire.

Next, a research in North Sumatera University, [6] which was accomplished to measure information literacy of students in department of library science in certain semester. Reference [6] used standard from Association of College and Research (ACRL) and obtained results from questionnaire.

Reference [11] found that Internet can be utilized to develop capability of information literate. Reference [12] and [13], each with separated researches, concluded that capability of computer technology gave significant influences for performances of people, especially lecturer and employer of Samsat.

Achmad, a librarian in ITS, in 2007 [2], observed that in the global era, people will be flooded by information, either positive or negative. Therefore, people should be understood to information for they can use it effectively and correctly.

Reference [14] conducted research to identify awareness of information literate, level of information literacy, obstacles in information literate, and works for increasing information literacy among officials learner in DKI Jakarta. This research was done by using questionnaire followed then with interview. Results showed that almost all officials learner said that they understood with information literacy, even though their understanding may not accurate perfectly.

Researches written earlier were conducted in Indonesia, whereas there are more researches outside Indonesia which related with this topic. We give some examples as followed.

Reference [5] gives a full explanation about research that has been taken for a long time by R&D Institution of Information Technologies of Social Sphere within the Kemerovo State University of Culture and Arts. They diagnose information literacy level for different categories of learners, such as schoolchildren, students, and teachers. They provided three versions of test which were in 1999, 2002-2003 and 2007. Processing it, they found that some parameters of test can be measured, while the others cannot or impossible to test. Parameters such as access to information which includes definition and articulation of the information need and location of information, evaluation of information which includes assessment of information, organization information, generalization and interpretation were measurable. Meanwhile use of information, including application the retrieval information, development of information product, and communication and ethical use of information with acknowledgement of intellectual property rules were not.

Reference [7] attempts to identify components of information literacy and tries to model literacy information which relates to rural communities. This research found that competency in information literacy did not come only from either literacy word or education system, but also from social environments.

Reference [15] defined that information literacy is an important skill that all citizens are expected to possess in the current era, which is knowledge-based global economy. It provided brief overview of established information literacy standards and guidelines in education across the world. Furthermore, criteria for an information literacy evaluation instrument were then proposed.

III. METHODS

Methods of the research consisted of several phases, as described below:

A. Data gathering/acquisition

This step was done to collect data, such as standard of information literacy, and data of students of Faculty of Science and Technology whom they are taking final project. Standard that was applied was from [3], focused in standard for science and technology/engineering field. It consists of five standards, each of which contains indicators for total 24 items, yet each of indicators has outcomes. Meanwhile, searching from SIA, it was found that 565 students were taking final project in previous semester. Furthermore, by using method of minimum sampling, it should be as many as 171 students as respondent.

[9] Surbakti, I., 2002
[10] Lutviah, 2011
[11] Porboyekti, U., 2008
[12] Widhiarso, W., 2010
[13] Setiawan, A., Nurazi, R., and Praningrum, 2008
[14] Djatin, J., et al., 2007
[15] Mokhtar, I.A., Majid, S., and Foo, S., 2004

B. System Development

Next, we analyzed system that was intended to develop, and what were its requirements. This system would able to pre-diagnose information literacy of students where system acted as expert in information literacy, whereas students were users. Interaction between them was characterized by question-answer session.

From standard of information literacy which is adapted, we developed questions (in Indonesia language) from indicators, so there were 24 questions, each accompanied by their outcomes. Students answered by choosing one option, either Selalu (always), Kadang-kadang (sometimes), Jarang (seldom) and Tidak Pernah (never).

We defined percentages for each option, 100, 75, 50 and 0 respectively. For diagnosing, we collected each percentage and applying rules predefined to calculate final score. After that, we do conversion for acquiring level of information literacy from such score. There were three levels, which are A, B, and C, where A was excellent, B was good and satisfactory for C. Their range of values were 100 – 86, 85 – 65, and less than 65, in ordered predicates.

In this rule-based expert system, we implemented forward chaining as inference engine. There were 6 production rules, as showed by table 1 below.

Table 1 Production Rules

Rule
if indicator1==100% **and** indicator2==100% **and** indicator3==100% **and** indicator4==100% **then** standard1=100%
if indicator1 <100% **or** indicator2<100% **or** indicator3<100% **or** indicator4<100% **then** standard1=(indicator1+indicator2+indicator3+indicator4)/4*100%

if standard1>=65% **then**
if indicator5>=65% **then**
if indicator7 >=65% **then**
if indicator8>=65% **then** standard2= (indicator5+indicator7+indicator8+indicator9)/4*100%
else standard2=(indicator5+indicator7+indicator8)/3*100%
else standard2= (indicator5+indicator7)/2*100%
else if indicator6 >=65% **then**
if indicator8 >=65% **then** standard2= (indicator6+indicator8+indicator9)/3*100%
else standard2= (indicator6+indicator8)/2*100%
else standard2=indicator5
else standard2=standard1

if standard2>=65% **then**
if indicator10>=65% **then**
if indicator11>=65% **then**
if indicator13>=65% **then**
if indicator14>=65% **then**
if indicator15>=65% **then**
standard3= (indicator10+indicator11+indicator13+indicator14+indicator15+indicator16)/6*100%
else standard3=(indicator10+indicator11+indicator13+indicator14+indicator15)/5*100%
else standard3=(indicator10+indicator11+indicator13+indicator14)/4*100%
else standard3=(indicator10+indicator11+indicator13)/3*100%
else standard3= (indicator10+indicator11)/2*100%
else if indicator12 >=65% **then**
if indicator11>=65% **then**
if indicator13>=65% **then**
if indicator14>=65% **then**
if indicator15>=65% **then**
standard3= (indicator12+indicator11+indicator13+indicator14+indicator15+indicator16)/6*100%
else standard3=(indicator12+indicator11+indicator13+indicator14+indicator15)/5*100%
else standard3=(indicator12+indicator11+indicator13+indicator14)/4*100%
else standard3=(indicator12+indicator11+indicator13)/3*100%
else standard3= (indicator12+indicator11)/2*100%
else standard3= standard2

if indicator17>=65% **then** standard4= (indicator17+indicator18)/2*100% **else if** indicator19>=65% **then** **if** indicator20>=65% **then** **if** indicator21>=65% **then** standard4= (indicator19+indicator20+indicator21+indicator22)/4*100% **else** standard4= (indicator19+indicator20+indicator21)/3*100% **else** standard4= (indicator19+indicator20)/2*100% **else** standard4= (indicator17+indicator19)/2*100%
if indicator23>=65% **then**

standard5=(indicator23+indicator24)/2*100% **else** standard5=indicator23
if standard1>=65 **and** standard2>=65 **and** standard3>**50 and** standard4>=65 **and** standard5>=65 **then** IL=(standard1+ standard2+ standard3+ standard4+ standard5)/5*100% **else** IL=64%

There are only two entities in this system, System of Information Literacy Measurement, as showed in fig. 2. As admin, he/she can login and do several data management, where data could be data admin, users, standards, indicators, and production rules. Meanwhile, user can only register, login and answering questions in consultation session.

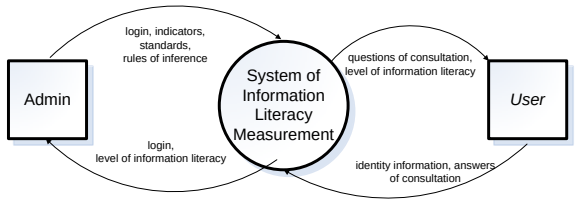

Figure 2 DFD context diagram (level 0)

From fig. 3, we can determine that as a user, he/she has information literacy, where it consists of five standards, and each of standards consists of several indicators.

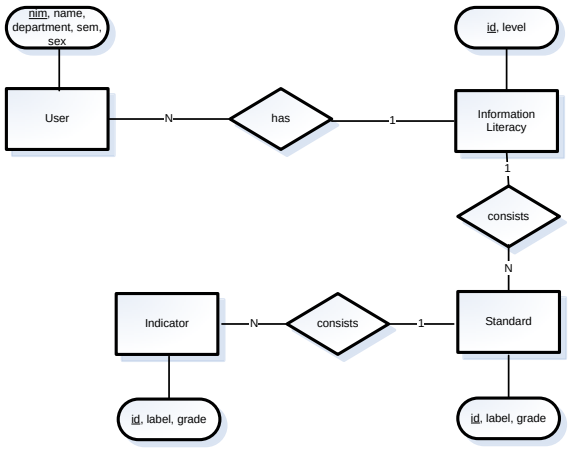

Figure 3 ERD of system of information literacy measurement

Referring to same figure, knowledge base of this system is knowledge of information literacy. As mentioned earlier, we adapted standard from [3].

Consultation session in this proposed system was developed by forming several questions which were taken from indicators and outcomes of [3]. Each of questions was accompanied by four choices: a. Selalu (Always), b. Kadang-kadang (Sometimes), c. Jarang (Seldom) and d. Tidak pernah (Never). We provide them here:

Standard #1

1. Do you define and articulate the need for information, such as:
   a) identify and/or paraphrase a research topic, or other information need such as that resulting from an assigned lab exercise or project **or**
   b) consult with instructor/advisor for appropriateness of topic, research project, or laboratory exercise question **or**
   c) develop a hypothesis or thesis statement and formulate questions based on the information need **or**
   d) explore general information sources to increase familiarity with current knowledge of the topic **or**
   e) define or modify the information need to achieve a manageable focus **or**
   f) identify key concepts and terms that describe the information need
2. Do you identify a variety of types and formats of potential sources for information, such as:
   a) identify the purpose and audience of potential resources **or**
   b) consider experts or other researchers as potential information resources **or**
   c) identify the value and differences of potential resources in a variety of formats **or**
   d) realize that information may need to be constructed with raw data from primary sources or by experimentation **or**
   e) recognize that potentially useful information or data in a variety of formats may be proprietary, have limited access, or may be freely available online **or**
   f) recognize that potentially useful information may require specific data management expertise and that an understanding of the structure of organizations involved in producing the information aids in the identification of that information
3. Do you have a working knowledge of the literature of the field and how it is produced, such as:
   a) know how scientific, technical, and related information is formally and informally produced, organized, and disseminated **or**

b) recognize that primary, secondary, and tertiary sources vary in importance and use with each discipline **or**

c) are aware of the professional associations of the field and their literature **or**

d) are knowledgeable of sources that are specific to the field **or**

e) recognize that knowledge can be organized into disciplines and combinations of disciplines (multidisciplinary) that influence the way information is accessed and considers the possibility that the literature of other disciplines may be relevant to the information need **or**

f) recognize the value of archival information, recognizes how its use and importance may vary with each discipline, and recognizes the importance of preservation of information

4. Do you consider the costs and benefits of acquiring the needed information, such as:

a) determine the availability of needed information and make decisions on broadening the information seeking process beyond locally held resources **or**

b) recognize that there may be a trade-off between the value of the information and the time and cost to obtain it **or**

c) formulate a realistic overall plan and timeline to acquire the needed information **or**

d) recognize the importance of a variety of information research areas that can be used to gain competitive advantage, track new products, improve processes, and monitor competitors and their marketing strategies **or**

e) recognize that information needed may be in a foreign language and that translation may be necessary

Standard #2

5. Do you select the most appropriate investigative methods or information retrieval systems for accessing the needed information, such as:

a) identify appropriate investigative methods **or**

b) investigate the scope, content, and organization of information retrieval systems **or**

c) select efficient and effective approaches for accessing the information needed from the investigative method or information retrieval system

6. Do you construct and implement effectively designed search strategies, such as:

a) develop a research plan appropriate to the investigative method **or**

b) identify keywords, synonyms and related terms for the information needed and selects an appropriate controlled vocabulary specific to the discipline or information retrieval system **or**

c) use other methods of search term input such as structure searching and image searching, specific to the discipline or information retrieval system **or**

d) construct a search strategy using appropriate commands for the information retrieval system selected **or**

e) implement the search strategy in various information retrieval systems using different user interfaces and search engines, with different command languages, protocols, and search parameters, while recognizing similar search features across the systems **or**

f) follow citations and cited references to identify additional, pertinent articles

7. Do you retrieve information using a variety of methods, such as:

a) use various relevant search systems to retrieve information in a variety of formats **or**

b) use various classification schemes and other systems to locate information resources within the library or to identify specific sites for physical exploration **or**

c) use specialized online or in person services as needed to retrieve information and whenever unable to identify or locate appropriate materials **or**

d) use surveys, letters, interviews, experiments, and other forms of inquiry to retrieve information or data, as appropriate for the research area or discipline

8. Do you refine the search strategy if necessary, such as:

a) assess the quantity, quality, accuracy, currency, and relevance of the search results and the limitations of the information retrieval systems or investigative methods to determine whether alternatives should be sought and used **or**

b) identify gaps in the information retrieved and determines if the search strategy should be revised **or**

c) repeat the search using the revised strategy or new systems or methods as necessary

9. Do you extract, record, transfer, and manage the information and its sources, such as:

a) select the most appropriate technology for the task of extracting the needed information **or**

b) create a system for organizing the information including tracking results of laboratory experiments, fieldwork, etc. **or**

c) differentiate between the types of sources cited and understands the elements and correct syntax of a citation for a wide range of resources **or**

d) record all pertinent citation information for future reference by downloading, printing, emailing, or manual notation

Standard #3

10. Do you summarize the main ideas to be extracted from the information gathered, such as:

    a) apply an understanding of the structure of a scientific paper and uses sections, such as the abstract or conclusion, to summarize the main ideas **or**

    b) select main ideas from the text **or**

    c) identify verbatim material that can then be appropriately quoted

11. Do you selects information by articulating and applying criteria for evaluating both the information and its sources, such as:

    a) distinguish between primary, secondary, and tertiary sources, and recognizes how location of the information source in the cycle of scientific information relates to the credibility of the information **or**

    b) distinguish among facts, points of view, and opinion **or**

    c) examine and compare information from various sources in order to evaluate reliability, validity, accuracy, authority, timeliness, and point of view or bias **or**

    d) analyze the structure and logic of supporting arguments or methods **or**

    e) understand and use statistical treatment of data as evaluative criteria **or**

    f) recognize prejudice, deception, or manipulation in the information or its use **or**

    g) recognize the cultural, physical, or other context within which the information was created, and understands the impact of context on interpreting the information

12. Do you synthesizes main ideas to construct new concepts, such as:

    a) recognize interrelationships among concepts and combines them into potentially useful primary statements and/or summary of findings with supporting evidence **or**

    b) extend initial synthesis, when possible, at a higher level of abstraction to construct new hypotheses that may require additional information **or**

    c) utilize computer and other technologies for studying the interaction of ideas and other phenomena

13. Do you compare new knowledge with prior knowledge to determine the value added contradictions, or other unique characteristics of the information, such as:

    a) determine whether information satisfies the research or other information need **or**

    b) use consciously selected criteria to determine whether the information contradicts or verifies information used from other sources **or**

    c) draw conclusions based upon information gathered; test theories with discipline-appropriate techniques **or**

    d) determine probable accuracy by questioning the source of the information, limitations of the information gathering tools or strategies, and the reasonableness of the conclusions **or**

    e) integrate new information with previous information or knowledge **or**

    f) determine whether information provides evidence relevant to the information need or research question **or**

    g) include information that is pertinent even when it contradicts the individual's value system, and includes it without skewing it

14. Do you validate understanding and interpretation of the information through discourse with other individuals, small groups or teams, subject-area experts, and/or practitioners, such as:

    a) participate in classroom and virtual/electronic discussions and uses discussions for validating understanding and interpretation of the information **or**

    b) work effectively in small groups or teams **or**

    c) seek expert opinion through a variety of mechanisms

15. Do you determine whether the initial query should be revised, such as:

    a) determine if original information need has been satisfied or if additional information is needed **or**

    b) review search strategy and incorporate additional concepts as necessary **or**

    c) review information retrieval sources used and expands to include others as needed

16. Do you evaluate the procured information and the entire process, such as:

a) review and assess the procured information and determine possible improvements in the information seeking process **or**

b) apply the improvements to subsequent projects

Standard #4

17. Do you understand many of the ethical, legal and socio-economic issues surrounding information and information technology, such as:

    a) identify and discuss issues related to privacy and security in both the print and electronic environments **or**

    b) identify and discuss issues related to free vs. fee-based access to information **or**

    c) identify and discuss issues related to censorship and freedom of speech **or**

    d) demonstrate an understanding of intellectual property, copyright, and fair use of copyrighted material and research data

18. Do you follow laws, regulations, institutional policies, and etiquette related to the access and use of information resources, such as:

    a) participate in electronic discussions following accepted practices **or**

    b) use approved passwords and other forms of ID for access to information resources ethically **or**

    c) comply with institutional policies on access to and distribution of information resources **or**

    d) preserve the integrity of information resources, equipment, systems and facilities **or**

    e) legally obtain, store, and disseminate text, data, images, or sounds **or**

    f) demonstrate an understanding of what constitutes plagiarism and does not represent work attributable to others as his/her own **or**

    g) demonstrate an understanding of federal, state, and institutional policies related to the use of human and animal subjects in research

19. Do you acknowledge the use of information sources in communicating the product or performance, such as:

    a) select an appropriate documentation style for each research project and uses it consistently to cite sources **or**

    b) post permission granted notices, as needed, for copyrighted material **or**

    c) acknowledge all contributors, funding sources, grants, etc.

20. Do you apply creativity in use of the information for a particular product or performance, such as:

    a) select, analyze, organize, summarize, and/or synthesize information from a variety of resources **or**

    b) explore the use of advanced information technologies, such as data mining and visualization to move beyond retrieval and identify trends and patterns within large sets of complex research data

21. Do you evaluate the final product or performance and revises the development process used as necessary, such as:

    a) maintain a journal or log of activities related to the information seeking, evaluating, and communicating process **or**

    b) reflect on past successes, failures, and alternative strategies **or**

    c) apply devised improvements to subsequent projects

22. Do you communicate the product or performance effectively to others, such as:

    a) choose a communication medium and format that best supports the purposes of the product or performance and the intended audience **or**

    b) use a range of information technology applications in creating the product or performance **or**

    c) incorporate principles of design in the product or performance **or**

    d) communicate clearly and succinctly, if appropriate, with a style that supports the purposes of the intended audience

Standard #5

23. Do you recognize the value of ongoing assimilation and preservation of knowledge in the field, such as:

    a) recognize that, for a professional, it is necessary to keep up with new developments that are published in the literature of the field **or**

    b) recognize that learning about information gathering is an on-going process as the source, format, software requirements, and delivery method of needed information changes and evolves with time **or**

    c) are able to apply information access skills learned in one subject area to another **or**

    d) understand the importance of archiving information so that it will survive company mergers, out-dated access technologies, personnel departures, etc.

24. Do you use a variety of methods and emerging technologies for keeping current in the field, such as:

    a) establish current awareness services and follows citation and cited references for pertinent articles **or**

    b) use online table of contents scanning, review journals, and other forms of rapid communication literature **or**

    c) manage files of citations of articles read or accessed **or**

    d) use bibliometric analysis tools to update knowledge of changing technology and product life cycles **or**

    e) recognize emerging forms and methods of scholarly publishing in the field

IV. RESULT AND ANALYSIS

A. *Results*

After system has been designed and implemented, next phase was to test the system. System was examined by asking respondent to interact with system, which were consultation session. Although we have been determined number of respondent for each department in Faculty of Science and Technology, in reality, there are a few respondents who interact with our system. However, here we give the result, as can be seen in table 2.

Table 2 Result of examination to system

NIM	Level of Information Literacy						Predicate
	Std1	Std2	Std3	Std4	Std5	Final	
06650084	100	95	100	100	100	99	A
07620013	94	95	96	79	88	90	A
06650034	81	90	75	79	88	83	B
06650067	94	95	96	100	100	97	A
07660012	88	90	75	71	63	64	C
07620023	88	90	88	79	75	84	B
07670044	69	90	75	83	100	83	B
07600005	94	90	89	92	88	91	A
07600054	88	80	82	58	38	64	C
07660002	81	75	64	75	63	64	C
07650086	81	80	86	79	63	64	C
07650066	88	80	75	75	75	79	B
07620029	81	75	68	71	50	69	B
07650069	93.75	75	82.14	79.17	25	64	C
07680012	87.5	95	85.71	79.17	87.5	86.98	A
07650045	31.25	31.25	31.25	50	75	64	C

NIM stands for Nomor Induk Mahasiswa (student identification number), Std stands for standard.

B. *Analysis*

Based on that result, we can analyze that, in average, level of information literacy of students of Faculty of Science and Technology is good (B). Moreover, if we focus on score of each standard, students have more difficulties to fulfill standard 5 since the worst score was given to this standard.

We can assume that some of student did not realize for the importance of information literacy to come to lifelong learning. Therefore, we recommend these suggestions for gaining better achievement on level of information literacy of students in Faculty of Science and Technology, with level of importance is in decreasing ordered.

1. To understand the students that information literacy is an on-going process and an important component of lifelong learning and recognizes the need to keep current regarding new developments in their fields (standard 5).
2. To help the students in determining the nature and extent of the information needed (standard 1).
3. To help the students in acquiring needed information effectively and efficiently (standard 2).
4. To understand the students that there are economic, ethical, legal social issues surrounding the use of information and its technologies (standard 4).
5. To support the students to critically evaluate the procured information and its sources (standard 3).

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