Adoption of Open Educational Resources in Taiwan

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ABSTRACT :

This study introduced the open educational resources (OER) aided learning in a computer-aided classroom. The course materials included the OER, composed in English, and a textbook translated into Taiwan's traditional Chinese. The classroom was equipped with a system that could broadcast the instructor's computer screen to the students' monitors. The results from 16 valid samples of the questionnaire indicated that the classroom could provide students a good learning experience. Furthermore, the OER did improve students' conceptual understanding of both language and professional knowledge. Finally, the conceptual color plate analysis employed to evaluate the related factors among universities, students, and teachers. Based on the statistics of the previous OER studies, it is predictable that OER-aided learning may be popular in the future. Besides, the library plays a very important role in life-long learning, and will be more crucial in the future, because the advanced guides and indexing of digital contents and OERs can give the self-learner a better tool for life-long learning.

1. INTRODUCTION :

Although students have different individual talents, instructors always want to introduce them to as much information as they can. The concept is delivered from the era of Plato to nowadays. A low student-faculty ratio (SFR) may satisfy the needs of different students through student-faculty interaction. However, not every institute can achieve the target of low SFR for some specific reasons. SFRs of universities are from 7:1 to 25:1 in North America and Western Europe (Digest of Educational Statistics, National Center for Educational Statistics, USA, 2003), but the ratio can be very high in some specific regions or some countries. A high SFR might improve the educational resource aided teaching (Owston, 1997), whereas other literatures (Bullen, 1998; Bullen, 1998; Devitt & Palmer, 1999; Downes, 2007) discussed the advantages and disadvantages of distance education applications. In addition, the open educational resources (OER) easily found in the web become indispensable as the usage of internet has been essential in our daily life (Johnstone, 2005). These studies pointed out that there are more and more publications, discussing the issues related to OERs. Due to the improvement of interactive web technology, OERs provide further options of knowledge communications by information services. The OERs of developed countries usually provided the professional and technical knowledge, but those of other countries generally introduced culture-specific materials. Websites such as the OpenCourseWare by Massachusetts Institute of Technology, Wikipedia, WolframMathWorld, United National Educational, Scientific, and Cultural Organization (UNESCO) Virtual University even welcome readers' comments. Most of the feedback has to be written in English, and therefore knowledge exchange from non-native English speakers is limited. In

this study, we propose a mechanism to compensate for the lack of the content in other languages in the internet.

Dettori and Persico (2008) have studied on detecting self-regulated learning in online communities by means of interaction analysis. The study is a crucial research on the creative virtual Lab. The on-line materials for learning are convenient, but not suitable to every student, if the environment of on-line regular self-learning is not well built. Because some of the students are not educated as an active self-learner, the real classroom learning may be a good place for learning. Therefore, building an environment for self-regulated online learning is a very important issue for distance learning. The OERs can be transferred in many forms might be such as papers, files, PowerPoint, CD-ROM, DVD, and Video, and so on. Therefore, the school libraries might manage the OERs for the convenience of teaching and learning. This study proposed a computer aided classroom to store the OERs, and present the materials to the screens of students' computers to guide them towards better learning achievements. Furthermore, Khelifi *et al.* (2009) pointed out the importance of OER for the higher education from the point of economic view, especially for the countries of lower development.

The materials of textbooks and OERs are presented in the next section, which also discloses the environment of the computer-aided classroom for the interactive learning as well as the questionnaires. Furthermore, the method of original colors of red, green and blue (RGB) quantization for quality analysis of the OER is employed to find the relationship of students, instructors, and universities. Next we present the factor analysis of the questionnaire that integrates into a conceptual color plate analysis. The materials obtained from MIT OCW, WolframMathWorld, and Wikipedia were discussed from the points of the students' views. In the last section, the interactive relationship of OER is discussed by the individual systematic analysis of universities *v.s.* instructors, university *v.s.* students, and instructors *v.s.* students. In addition, combination of traditional teaching

and distance education of this study is examined to show the benefit of the learning mode. In this section, we extend the thinking from the perspectives on life-long learning through the OERs, and on educational globalization. In conclusion, the enhancement and encouragement of utilizing OERs can accelerate students' knowledge communication, and the globalizing pace of universities.

2. METHODS :

The main textbook printed in Taiwan's traditional Chinese (TTC) was a translated version of "Signals and Systems". This book was originally authored by Haykin & Van Veen (2005). Another referred textbook for use in the course was written by Oppenheim & Willsky (1997). "Signals and Systems" is known as one of the most frequently visited courses on MIT OCW. The core lecture notes were presented by Professor Gray *et al.* (Course description of "Signals and Systems" in MIT OpenCourseWare), accessible from MIT OCW. Besides, the instructor introduced the materials from Wikipedia, and WolframMathWorld in the class for students' mathematical reviews.

Next we describe some main points about our textbooks and their use.

a) OERs

"Signals and Systems" is a course that covers the fundamentals of signal and system analysis with engineering and commercial applications in mathematical models. Some basic mathematical topics, such as unit circle, Euler's identity, and phasor, are the fundamentals of this course. Computer-aided materials from OERs like MIT OCW, Wikipedia, Wikiversity, and WolframMathWorld which can be accessed in the Internet easily and conveniently are used to refresh students' memory on these topics. With different presentations and explanations on the same topics from different websites, the OERs fulfilled the needs of the various talented students for mathematical knowledge.

b) Computer-aided classroom

The computer-aided classroom was equipped with a broadcasting system at the Department of Electronic Engineering, at Tungnan University (TNU). The system broadcasted the instructor's screen to students' monitors, and displayed the image onto a large screen synchronously using a projector, or the system also included a handwriting board. Instructors could use a simple mouse-click to point out the areas of interest, and handwriting to add supplements. The design helped students clearly read the content of the lecture notes in an interactive setting.

c) Integrative teaching

The instructor employed the lecture notes and materials in English from OERs, and a textbook in TTC to improve students' English ability in the class. This arrangement was aimed to enhance student's English ability through the instructor's explanation and translation of English vocabularies and sentences.

d) Questionnaire

A five-point scale questionnaire (Table 1) with questions of four parts as follows: (1) general comments on the aforementioned OERs and the integrated teaching, as well as students' learning responses to the basic concepts of signals and systems; (2) the lecture notes of MIT OCW; (3) the mathematical reviews of the website of WolframMathWorld; and (4) that of Wikipedia. The questionnaire also asked students to give comments and suggestions on the OERs course material. The brief questionnaire took place in class. While the students were filling out the questionnaire, the OERs were broadcasted to students' monitors to stimulate their recall about the contents of the websites.

Twenty-three part-time students aged between 20 and 30 filled the questionnaires. The sixteen of returned answers were entirely complete. The students studied in department of electronic engineering of the Weekend School at TNU. Most of them are working in electrical, electronic or computer companies, and have never studied "Signal and System" before.

e) Color plate analysis

The color plate analysis was performed and demonstrated the conceptual factor analysis of the questions. The color plate, which combines the red, green, and blue (RGB) colors, is very popular in editorial and image software. It is analogous to a 3-D Cartesian coordinate for quantified presentation, which can clearly display the relationships of the factors when their conceptual relationships are well-established, but hard to quantify. Researchers can easily fill the RGB color of various factors to present their ideas clearly. This study presented the figure of analysis with hyperlinks to present the descriptions, pictures, and accounts, which easily added and constructed systematically.

3. RESULTS :

The results presented the analysis of the questionnaire that integrated into a conceptual color plate analysis.

a) Generality

The answers of the second question has a mean 3.7, which indicates that OERs do elevate students' learning achievement. Because the OERs were frequently presented in English, vocabulary and sentence translation in the class was important to students. The mean answer of the fourth question was 3.6, which gives a hint that teaching a professional course in English or a mixture of English and their mother tongue to the non-native English speakers can strengthen students' language ability.

The first question, "I have surfed on the aforementioned websites for self-learning" got a mean of 2.9. It shows that most of the students only study the material from the websites in class under the instructor's guide, and thus that students usually need some encouragements to learn. Another explanation for the lower average score of the first question may be found from the lower average score of the third question, "In general, the aided content of the websites is helpful to evaluate the ability for job". The reason is that the material of the

Table 1 : The Questionnaire on OER Usage and Value

	Question Item	mean	s.d.
I	Generality		
1	I have surfed on the aforementioned websites for self-learning.	2.9	0.7
2	In general, the aided content of the websites is helpful to learn this course.	3.7	0.6
3	In general, the aided content of the websites is helpful to elevate the ability for job.	3.1	1.4
4	In general, the aided content of the websites is helpful to elevate the English ability.	3.6	0.8
II	MIT OpenCourseWare		
5	The teacher explained the content of the textbook combined with the lecture notes of MIT OpenCourseWare is good to understand the topics in the course.	3.5	0.9
6	The content composition of the lecture notes in MIT OpenCoureWare is good to understand the topics in the course.	3.3	0.8
7	The teacher explained the concept of Linear Time Invariant System with the material in MIT OpenCoureWare is good to understand the topic.	3.4	0.8
8	The teacher explained the concept of Fourier Series with the material in MIT OpenCoureWare is good to understand the topic.	3.1	0.6
9	The teacher explained the concept of Fourier Transform with the material in MIT OpenCoureWare is good to understand the topic.	3.1	0.7
III	WolframMathWorld		
10	The teacher explained the concept of Euler's Identify with the material in WolframMathWorld is helpful to understand the topic.	3.6	0.7
11	The teacher explained the concept of Fourier Series with the material in WolframMathWorld is helpful to understand the topic.	3.3	0.8
12	The teacher explained the concept of Convolution with the material in WolframMathWorld is helpful to understand the topic.	3.3	0.7
13	The teacher explained the basic concepts of Mathematic formulas, such as unit circle, complex, phasor, with the material in WolframMathWorld is helpful to understand the topic.	3.5	0.6
IV	Wikipedia		
14	The teacher explained the concept of Euler's Identify with the material in Wikipedia is helpful to understand the topic.	3.5	0.5
15	The teacher explained the concept of Fourier Series with the material in Wikipedia is helpful to understand the topic.	3.5	0.6
16	The teacher explained the concept of Convolution with the material in Wikipedia is helpful to understand the topic.	3.3	0.7
17	The teacher explained the basic concepts of Mathematic formulas, such as unit circle, complex, phasor, with the material in Wikipedia is helpful to understand the topic.	3.5	0.7

course was almost mathematical models, but the part-time students working in companies did not usually use mathematics to solve problems in their jobs.

b) MIT OpenCourseWare (MIT OCW)

The core materials of the course were downloaded from MIT OCW, a free OER that contains course material used in MIT. The website provides lecture notes and aided materials for educators, students, and self-learners. MIT OCW also empowers their material to translate into the languages by educators in non-native English speaking nations. Now, the learning materials for "Signals and Systems" are presented only in English and Spanish in MIT OCW. Therefore, the class employed the English lecture notes with instructor's translations and explanations. The average scores of the fifth question and the sixth question indicate that the materials from the websites yield the students felt easier to understand the topics in the course easier.

c) WolframMathWorld

The WolframMathWorld is a free resource built with mathematical knowledge from Wolfram Research. The website focuses on the presentation of mathematical concepts through plots and videos. The clear plots and videos, which enlivened instructor's demonstrations, did give the students a deep impression. Responses of the students are presented in the third part of Table 1. Students responded with the means of 3.3 to 3.6, and the stand deviations (SD) of 0.6 to 0.8, which indicate that the mathematical fundamentals of the OERs yielded better learning achievement of the students.

d). Wikipedia

Wikipedia collects knowledge sponsored by volunteers. Everyone can edit the material and post changes on the website after passing the review process. Furthermore, the contents are opened to readers to translate into any language and the translated material will be posted after the review. In this class, we used Wikipedia to teach students some basic mathematical concepts, such as unit cycle, complex, and

phasor for the fundamentals of the course. Some simple concept of signals and systems were demonstrated by some easy and clear examples of Euler's Identity, Convolution, and Fourier series on the website. The fourth part of Table 1 analyzed the students' responses to the material of Wikipedia. The mean of 3.3 to 3.5 with SD of 0.5 to 0.7 indicate that the demonstrations aided students in catching on the course easily.

The mean scores of the questions from part II to part IV were between 3.1 and 3.6. The scores depended on the difficulty of the contents; i.e., the more difficult the content is, the lower the mean score gets. The most basic concepts of formulas, such as unit circle, complex, and phasor got the highest mean score (3.6), followed by Euler's Identity (3.5), linear time invariant system (3.4), convolution (3.3), Fourier series (3.1 to 3.3), and Fourier transformation (3.1). Generally, students agreed that the content of OERs is helpful to understand this course. The 3.7 average score of the second question validates the reliability of the scores for the questions specifically pointing out the effects of OER aided learning.

e) Students' comments

The general comment was "It was a little bit difficult to understand the contents of the lecture notes because of the OER were written in English", but a few students gave very positive comments. The demonstrations of the plots and videos actually aided the students catch on the key points. With the limitation of language abilities, instructors' extended explanation of the course material and English terms was the key to students' comprehension. Dictionaries, machine translators, translation websites such as dictionary.com and AltaVista gave students the opportunity to conquer the difficulty of reading.

f) The supplements

Most textbooks presented the theories with the formulized form to explain the concept of the theories. The quality and quantity of the selected supplements from OERs aided students in learning the concept better. Instructors were able to explain the

concepts with diversity, which made it easier for students to understand some abstract theories in the textbooks.

g) Conceptual color plate analysis

Conceptual color plate analysis was performed and discovered the factors related to OER-aided teaching and the relationship among universities, teachers and students. The model and hyperlinks with descriptions of the factors can be displayed by clicking on the codes of the factors. The hyperlink objects can be added as any objects in Microsoft Office, and are easy to implement. With this advantage, the conceptual color plate analysis could be employed in many fields, such as commercial applications of analysis, and presentation to display the results of factor analysis in an interactive way.

4. DISCUSSION :

Foreman (2003) has pointed out that the information technology (IT) changes the lectures in the higher education system. E-learning emphasizes the conveniences of anytime and anywhere to learn. Khelifi et al. indicated that most of the universities are concerned about the cost and performance of commercial software products. Our study demonstrates a simple model of integrated teaching with textbooks and aided OERs in a traditional classroom which is equipped with computer aided tools to obtain the benefits of e-learning, and hence the students gave positive comments in the questionnaire. All students in this study were part-time students, and working in electronic and computer companies. OERs may become one of the resources for their daily life and open a window to the Palace of Knowledge. Figure 2 displayed the results of factors in color plate analysis, and further descriptions are presented as follows:

a) University *v.s.* instructors

Educational management is an art to support and lead the instructors who introduce the "matched knowledge" depending on a student's interest and talent.

It includes curriculum design, course material, instructors' experience, lectures, students' learning ability, equipment, and other factors. Contents of the OERs provided an international standard for lecture material, and enhanced the instructors in universities with a high SFR to improve the quality of course material. Even though the e-learning platform is highly dependent on the instructor's IT ability, most instructors are should be familiar with searching references on the web. Therefore, surfing OERs for course material is easier than building a platform or uploading material to the platform for E-learning. The OER aided learning can be widely implemented in universities and colleges around the world.

Instructors at universities usually have the obligation to teach students, and conduct research in their professional fields. Preparing material for teaching is very time consuming. Some free blog on the web such as the Blogger of Google is a useful tool. The blog allows instructors to put material on through simple processes without spending much time on server settings. The figures, plots, photos, voices, and videos can be uploaded to the blog with simple procedures as well. It simplifies the process of building an open educational resource. Clarke *et al.* (2004) indicated that one of the lessons they learned from their experience at Brunel University is that "distance education programs must be based on existing programs". OERs balance the time between teaching and research by providing free support for course material. Besides, most OERs provide the capacity of readers' feedback. By communicating with other professionals, instructors can get the newest and most refined information. Therefore, it is a wise choice to employ OERs for learning.

b) University *v.s.* students

Schrum & Ohler (2005) pointed out that distance delivery techniques would make learning available anywhere without any geographic limitations. Furthermore, globalization is a hot topic in many universities, especially in some NNESNs. Students with proficiency skills in English

can receive higher standings in communities like international entertainments and academic institutions. In a computer-aided classroom, integrated teaching can be accomplished with minimum equipment and cost. Course materials originally developed in English from MIT OCW, Wikipedia, and Wikiversity easily and clearly displayed on the students' individual monitors and controlled by the instructor. In addition, many free tools is very convenient for learning, such as the evaluation versions of software or free educational resources which include National Instruments LabVIEW, Mathwork MatLab, Microsoft Visual Studio, COMSOL Multiphysics, Altera Quartus II and others, as well as additional CD ROMs in textbooks. An important example of the software improves the students' understanding of the course. The benefits of OER integrative teaching in the computer-aided classroom are much more valuable than the cost of constructing the classroom.

c) Instructors *v.s.* students

The textbook selection is an important factor for teaching, and will be crucial in OER aided learning in the future. Associating the materials between the OER and the textbook will be one of the essential tasks of the instructors. While CD-ROMs containing computer aided course materials enclosed in some textbooks may reduce the instructor's effort on coming by the connections of different materials, information from OERs summarizes the content of many textbooks; It ameliorates the quality and quantity of the supplements of the course. Because of discrepancies in the topic sequences between the selected lecture notes and the translated textbook, association with the contents of lecture notes is important and indispensable to the educators and textbook publishers. Nevertheless, the conjunction of the slightly different lecture notes between MIT OCW and the translated textbook reinforce students' learning. The students' response to the second part of the questionnaire clearly indicate that the course material of MIT OCW shows a good influence on both students' learning and the instructors' teaching.

d) Combination of traditional teaching and distance education

Anisetti *et al.* (2007) developed the open virtual laboratories (OVL), and showed that on-line learning students had more time to design, implement, and test their program, which earned a better learning achievement than traditional teaching.

In our study, instructors e-mailed students the web addresses of the OERs introduced in class every week, so students got the ease of reviewing the topics from various types of presentation by surfing through the OERs. The statistics of the questionnaire show that students gave positive response to most OERs, and agreed with Anisetti Bellandi, Colombo, Cremonini, Damiani, Frati, Hounsou, & Rebeccani. However, E-learning relies on learners' self-motivation. Furthermore, some teachers indicated that it was hard to supervise the classroom conditions in distance education (Tao & Yeh, 2008). A study indicated that the classroom energy depends on teacher's enthusiasm (Metcalfe & Game, 2006). In this study, the authors think that listening and questioning makes the learning processes mature. In this point, the computer aided broadcasting classroom combined the two types of learning methods to present the advantages in learning.

Because some of the students may not have the ability to search through the web in English smoothly, it is very important for instructors to give students the correct website addresses of the OERs. For example, giving the website in the form of "http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-003Fall-2003/CourseHome/index.htm" is absolutely better than just giving the address in "http://ocw.mit.edu/". Although students should immediately write down the website address in their textbook or lecture notes, the e-mail reminder ensures that the web addresses are delivered to students. Kalochristianakis, Paraskevas, Varvarigos, & Xypolitos (2007) showed that e-mail was the most popular way of communication in the Greece School Network (GSN). Email is

the most convenient communication tool to question, add, and revise the contents of OERs. For example, Wikipedia, and MIT OCW allow educators and students to submit comments to the editorial groups.

e) Factor analysis

Using the color plate analysis, our study presents a deeper and clearer decomposition of the factors related to OER aided learning. The color plate is intuitively easy to show the relationships of many factors, and enhances the layout of the questions. The graphical analysis is presented in some studies to systematically display the factors of the issues (Lee, 2001 ; Sinlarat, 2002). The factor analysis we proposed has the characteristics of multiple factors combination, and hyperlinks for deeper descriptions of the factor.

f) Life-Long Learning

Jiusto & DiBiasio (2006) investigated the self-directed learning (SDL), and the life-long learning (LLL). The study was executed in the Global Studies Program, the Worcester Polytechnic Institute. The results showed that the raising interesting issues regarding alternative methods of the measuring potential benefit is the one of the keys to promote SDL/LLL. The governing system of LLL in the Asian countries such as Japan, Korea, Hong Kong, Singapore, Thailand, and Philippines has compared in Han's (2001) study. The main strategies of the countries were:

"The promotion of lifelong learning in the selected Asian countries was proclaimed in the form of laws or government declarations, which implied major educational system changes. In terms of legislation, only Korea and Japan had explicit laws on lifelong learning. Other countries like Hong Kong and Singapore, raise national strategic banners like "Manpower 21 (Singapore)", "Education Blueprint" (Hong Kong) as policy bandwagons. Meanwhile, Thailand and the Philippines are still heavily reliant upon restricted local networks of non-formal education systems. However, the last two countries also began fundamental reformation in adapting lifelong learning

systems into the body of legislation. Thailand began to reform the education law and its administrative structure by The New Education Law, passed in 1999 and planed to be implemented from 2002. In the Philippines, the Bureau of Non-formal Education is mainly working for the implementation of the Constitution's spirit of lifelong learning."(pp. 89-90)

Therefore, the OER becomes a very well aided tool for the SDL/LLL, because of the convenience of resource access for instructors, and learners. The combination of traditional classroom, and computer aided OER access overcomes the weakness of self-learning, and increases the diversity of LLL. This supports the government to modify the strategy of the LLL. Furthermore, Kalochristianakis *et al.'s* study on the GSN in Greece provided the reference to the LLL. Anyway, the importance of E-learning depends on the areas, resources, information infrastructure, and so on of the country. Certainly, the psychological factors of the self-learners might be taken into considerations. The persons in the countries of Eastern Asia usually believe in the ethical leadership, dependence of group, and teamwork. That long list of couthos in the papers discloses the truth. Therefore, the traditional classroom learning with computer-aided tools seems to be better to the most of the persons in Eastern Asia. LLL is semi-formal education. It needs some impacts from the school, the classmate, and even the government to meet the important psychological factors of most persons in Eastern Asia.

Kärger Olmedilla, Abel, Herder & Siberski (2008) have developed a learning technology for personalization of online learning which is based on learners' individual goals, preferences, interests, and knowledge, and thus the interaction with the learners can be adapted to their individual needs. The free type of learning is very good for the self-learners. The LLL is a very wide range of education. Some personalization settings or reading guides for beginners, experienced persons or experts of the OERs can aid self-learners to absorb the knowledge smoothly. The type of

learning for regular students might be evaluated, because most educators think the common and basic knowledge is the capstone for the students' further development. One of the duties for the university educators is to push the students learning the knowledge well.

g) Educational globalization

Modern engineering and technology have been well developing in Western countries and most of the current OERs are in English. Although the technological and commercial improvements in some NNESNs are obvious, the cultural, legal, public policy, and information communication in English from NNESNs have not been widely published in the Internet. Therefore, if OERs such as MIT OCW, Wikipedia, and Wikiversity have the functions of reverse translation processes, diversification of the knowledge database of OERs will be expectable.

The resources on the Internet are very rich. People obtain interesting information by using popular search engines. Wikipedia and MIT OCW present a higher level of search engines for knowledge learning. Wikipedia provides students a convenient tool to find references systematically and easily. MIT OCW provides free and formal formal educational resources of many courses to universities, educators, students, and self-learners. It also allows associated universities to translate the material into other languages. However, the amount of translated material is still limited. In Wikipedia the number of words for the same content of "Fourier Series" was 3368 words in English, 1368 in Chinese, 3578 in Japanese, 1097 in German, 5137 in French, and 1342 words in Italian. The meaningful statistics suggest that English reading ability is important in learning from resources on the Internet. Similar statistics for material related to "Fourier Series and transform" with different languages translation provided on MIT OCW are shown in Table 2. For the interesting courses in various science and engineering domains, the translated material makes the students' learning better in NNESNs; however, students with better English ability can easier to get resources from the Internet. Some studies focused on better ways to deliver the ideas by using Power Point, videos, multimedia, and textbooks (Melsa, 2007; Pomales-Garcia & Liu, 2006). Not surprisingly, the contents are usually presented in English. Therefore, the advantages of Internet learning in English are not only in quantity but also in quality.

Table 2 : Languages in Courses that include the Concept of "Fourier Series" in MIT OCW

Course	Department	Versions of the languages
Signals and Systems	Electrical Engineering and Computer Science	English Spanish Thai
Optics	Mechanical Engineering	English Chinese (Simplified) Portuguese Spanish
Electrical, Optical, Magnetic Material, and Devices	Material Science and Engineering	English Chinese (Simplified)
Wave Propagation	Civil Engineering	English Portuguese Spanish

Pomales-Carcía *et al.* (2007) pointed out that an English communication skill is one of the essentials in engineering education. The refined materials of OERs help the students to get on the content well, and the instructor's explanation and translation of English vocabularies enhance the student's English communicating ability on Science and Engineering (EST). Therefore, OERs in English is a good tool to practice the

English language, especially for students with self-discipline in NNESNs. Lu *et al.* (2004) indicated that 1500 frequent appearance vocabulary (FAV) fill almost 90% words of the two textbooks of "Computer Organization and Architecture" in electrical engineering. Therefore, it is possible for anyone who keeps the memory of the mere 1500 vocabulary to read a technological document in foreign language by his working experience and logical thinking. Many scholars claim that people intending to improve the ability of foreign language should read newspapers which give multitudinous materials of readings. It is natural that one will find the most suitable materials to read, and expand to the other fields. Therefore, keeping the FAV of foreign language in mind is the key to learn the foreign language.

Based on the rapid development of digital content in the internet, globalization is unavoidable in the 21st Century. Therefore, educators need to make some change to meet the requirement of the trend (Karsten *et al.*, 2002). It will never be easy to develop international knowledge communication for science and technology if educators do not incorporate this component in curriculum (Miciano, 2002). From the points of engineering management view, educators who address the concept and give training on globalization in some courses will naturally enlighten the undergraduate students to develop their careers not only in fields related to their professional skills, such as research, design, and manufacturing, but also in fields related to management and international trade such as marketing, sale, and management. Students will broaden their path to success. Furthermore, employers' human resources will increase due to educators' contributions

to universities. The leaders of schools need to consider the political and economic factors. In another words, the leaders always focus on finding the balance or the optimal point from the considerations of the factors. A conceptual model has been built to analyze layered leadership framework (Wyatt-Smith *et al.*, 2008). The fundamental study supported the school leaders to make a right decision. Therefore, following the previous studies, we proposed the OER can be the most optimal option of the leaders, because it can be shared the educational sources in both local and global network frames. In particular, most OERs with the rich content are often composed in English. The applications of OERs are very good for the nations of native English speakers.

5. CONCLUSION :

The enhancement and encouragement of utilizing OERs can accelerate students' knowledge communication, and the globalizing pace of universities. The presentations of computer graphics on OERs website and software can better make the students' conceptual understanding of professional knowledge. Instructors in NNESNs can achieve the improvement of students' communication ability in the English through the usage of the OER as well. By the same way, students in NESN are able to understand the knowledge and cultures of NNESNs through OERs. This study presented the practice of the OER integrated teaching in a computer-aided classroom and students gave positive comments in the questionnaire. This integrative teaching may require some changes from students, instructors, and universities. The association of content between OERs and the textbook will be one of the most important activities for the instructors. The handout with correct website addresses of the referred OERs is very important to students. Free blogs on the web may be another useful tool for the instructors; they can easily post course material through processes as simple as using Microsoft Word, and do not need to

spend time for any settings of the server. The application of the conceptual color plate analysis is good in qualitative and quantitative views of different factors such as the applications of analysis and the introduction of presentation.

The library is always lack of a certain book. Therefore, the OERs might reduce the lack of literatures. The digital content is good to students' learning, but will cause many difficulties to students, such as the language abilities, the hardware of computer network, the communication framework, the searching habits and skills of the usages of search engines, and so forth. The crucial work of library and information services might arise in the meanwhile, because the teachers and students, and self-learners need the kind guides from libraries to ease the processes of on-line learning. Furthermore, the library plays a very important role of LLL now, and will be more crucial in the future, because the advanced guides and indexing of digital contents and OERs which are the opening window of knowledge and will absolutely give the self-learner a better tool for LLL.

The functions of libraries are traditionally defined as passive resources for academic usages, and are now expanded by the active resources to introduce the media by internet and other channels to the audience. The rich materials of OERs are good teaching materials, if the arrangements of the contents are adequate. Therefore, the librarians, the teachers, and the teaching assistants may adopt the OERs and compose them to suit the student's talents.

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