Potential of e-Learning for Enhancing Graduate and Undergraduate Education

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Abstract* – *Many educational institutes as well as governments focus on education utilize Information Communication Technology (ICT), and the word "e-Learning" is used in various contexts. There are many attractive aspects in e-Learning such as possibility to reduce the restriction due to spatial and temporal distance, possibility to improve the quality of education, and possibility to share educational resources among institutions. It is obvious to reduce the restriction by means of ICT such as mobile network. Also when a course is designed, the achievement level needs to be defined to satisfy the expected level of curriculum such as the diploma policy. In such a design process, it is possible to improve and sustain the achievement level of the course. In this paper, the principle motivation to utilize campus-wide e- Learning in Kumamoto University is explained as the background, then example courses of undergraduate and graduate programs are detailed to discuss the potential of e- Learning for enhancing education.

Index Terms* – *e-Learning, Blended Learning, On-line tests, undergraduate and graduate course.

INTRODUCTION

The nationwide Internet service for Japanese universities, named Science Information Network (SINET) [1], was established in 1992 by National Institute of Information (NII) [2]. SINET has expanded year by year and SINET4 which started in 2011 has 8 core and 45 edge data-centres. Through those centres, most national universities are connected to SINET at least 2.4 Gbps while backbone between Sapporo and Fukuoka is 40Gbps. As the expansion of SINET, the education on IT literacy became more and more important not only as technological issue but also legal and moral issue. In Kumamoto University, which has about 1800 fresh students every year, the education for IT literacy began before 1990, the SINET era, at some department in Faculty of Engineering, and spreads for all faculties in the middle of 1990's. Although the necessity of lecture was understood, there were several difficulties to deliver the lecture;

- Topics to be lectured are interdisciplinary; from technical issue to legal and moral issue
- Available lectures are very limited because of newer topics
- Facilities for education are not so well organized In order to overcome those difficulties, Kumamoto

University made continuous efforts over one decade. In this paper, we will discuss the some extend of detail of IT literacy courses for all fresh students across the disciplines; Education, Letter, Low, Medicine, Pharmacy, Science and Engineering. Since 2002, those courses have been delivered as blended-Learning Style; regular face-to- face meeting once a week, and homework on e-Learning system.

The effective oh the blended-learning style was widely understood in Kumamoto University through the IT literacy education, the board of university intensively promoted the e-Learning since 2004 and many lecturer in various faculties are transferred from conventional face-to-face only lecture style to blended learning style since then. One of examples is the "Digital Signal Processing I" (DSP-I hereafter) which is compulsory course in the fourth semester, fall semester of sophomore. There are two parallel classes to accommodate around 100 students for each. Authors deliver this course using the same e- Learning contents in blended learning style and evaluate the same crediting criteria using the same midterm and final examination.

For graduate courses, basic design concept of course is not the same for undergraduate course due to various aspects; number of students, elective courses, and focusing the communication skill as well as knowledge improvement. Typical seminar type course can be implemented on e-Learning system.

This paper shows two different type courses, an undergraduate level compulsory course and graduate level elective course in Kumamoto University from design concept as well as some outcomes. Also related activities including data mining of students' activities on the e- Learning system is also discussed.

MATERIALS AND METHODS

A. Campus-wide Learning Management System

In 1999, the first web-based School Information System (SIS) among Japanese national universities started its campus-wide services in Kumamoto University; syllabus registration by lecturers, course registration by students, credits registration by lectures, as well as reviewing the credits both by lecturers and students.

In 2002, the university start campus-wide e-Learning using a commercial Learning Management System (LMS), WebCT(RT). Students registration of LMS of all courses are synchronized with SIS as a daily batch process, thus any of lecturers can use e-Learning system without account management [3]. This account synchronization service lets lecturers to concentrate the contents developments and teaching processes. Currently there are more than 500 courses with "rich contents," i.e. not only static contents

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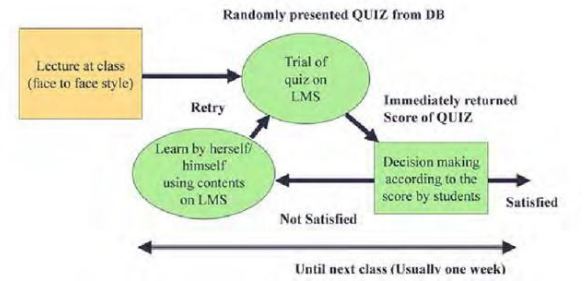

Figure. 1. Diagram of Chain of "Learn and Check" used in Quiz on LMS.

but also assessments, discussion, and other activities by students and interaction between lectures and students. Also out of 6000, around 1000 courses at least use LMS in some extend.

Since 2012, we started to shift the campus-wide LMS from WebCT to Moodle [4], and are planning to finish dual operation within a fiscal year of 2014. Among several reasons to change LMS from WebCT to Moodle, the most important one is the characteristics of open source which provide capability to develop additional modules to expand its function.

Based on those background, we decided to develop an original attendance management system as the add-on module for Moodle.

B. Experiences on IT-Literacy Courses for whole campus since 2004

When the concept of "IT literacy" course was designed, the analogy of driver's license is used. In order to get the driver's license in Japan, we need to pass the examination which consists of three category criteria; [A] driving skill, [B] knowledge of road traffic law, and [C] first-aid for traffic accident. Almost all who wish to get the driver's license can pass those examinations after sufficient practice; some may pass them right after practice, but some may take examination several times until they pass. From those point of view, Kumamoto University provides two compulsory courses for all 1800 fresh students across the disciplines. Those courses were designed based on the Instructional Design concept and use the blended- learning style with very rich quizzes and assessments.

Sets of online quizzes provide students with chance to confirm their understanding of the topics mentioned in the context at assigned week. Those sets are randomly generated from database by random selection of quizzes sufficiently large volume database of quizzes. Because of those treatments, students can try quiz as many times as they want until the specified deadline, which is usually set to the date of the next class, in other word, until next class. Figure 1 shows schematic diagram to show the process face-to-face lecture and online quiz. Students take a lecture by face-to-face style at class room. Students can try quiz as many times as they want, in other words, until they satisfied. When a student submit the answer of quiz, LMS system immediately feedback her/his rank in 1800 students as well as the score of submitted answer. Students are told a priori that the highest score of trials before deadline will be counted for the final evaluation. There is "loop" of trial of quiz, decision by student, and relearn about the online content, as shown in Figure 1. This loop is named as "Chain of Learn and Confirmation" [5].

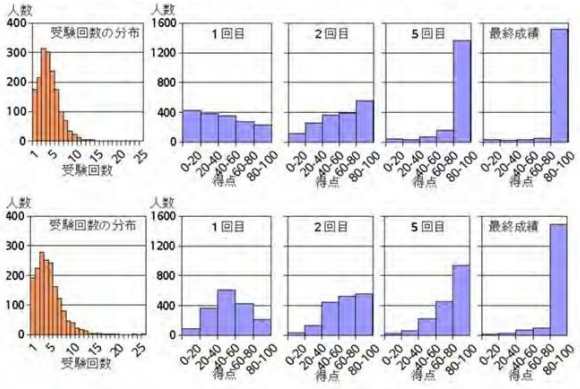

Figure. 2. Two examples of results of quiz. From left to right, distribution of number of trials, distribution of scores (highest one for each individual) at 1st, 2nd, 5th and last trial. Ordinate shows the number of students. Note that the total number of students is around 1800.

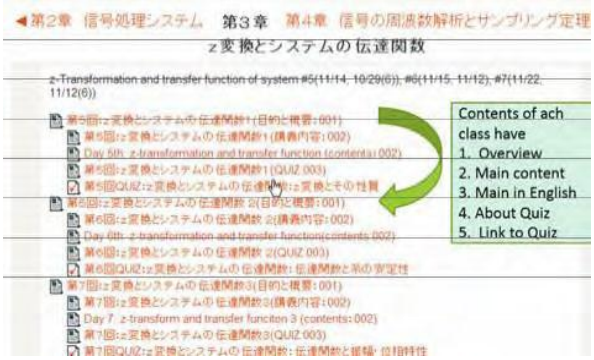

Figure. 3. Details of Chapter 2: Day 2-3 of DSP-I.

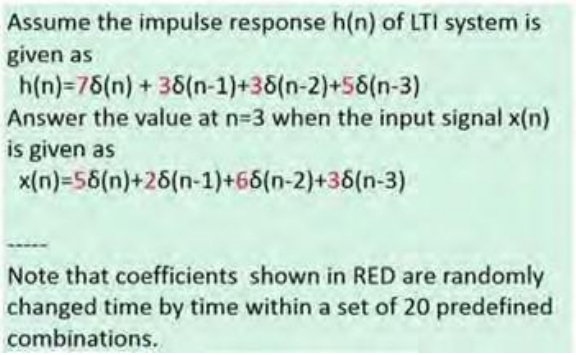

Figure. 4. Example of Quiz: Calculation type. Red numbers are randomly changed according the setting

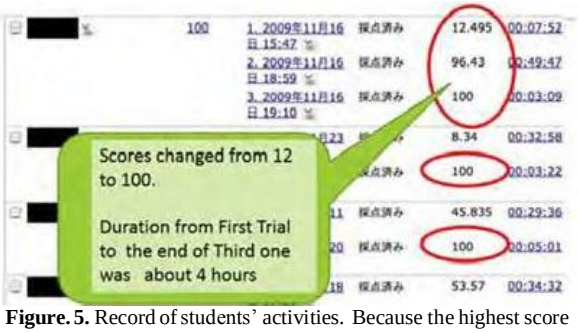

Figure. 5. Record of students' activities. Because the highest score within 5 trials are recorded, most of students try until they reach 100 or exceed the maximum trial times.

Figure 2 shows the two examples of results of quiz. Upper and lower graphs are corresponding to the two

examples. In each row, from the left to right, frequency distribution of number of trials, score distributions at the 1st, 2nd, 5th trials and at last. Allof ordinates show the number of students. Abscissa of left most graph is the number of trials. And abscissas of other graphs are scores of quiz where 100 is the top score. As shown in those examples, even if the initial distributions of score are varied, the final distributions are very similar; more than 90% of students made score equal or higher than 80. This tendency of score distributions is very similar for all sets of quiz. These data provide the assurance of learned level of students by quiz.

C. New organizations for e-Learning

Although the design of IT literacy course is stimulated by Instruction Design, it was necessary to make organizational activities to spread this movements. In 2006, we have established the first graduate school for e- Learning professional in Japan, namely Graduate School of Instructional System (GSIS) [4], then the Institute of e-Learning Promotion (IELD) in 2007[5]. Both of them promote e-Learning for all faculties especially in Faculty of Engineering and Medical School beside GSIS itself since then.

COURSE DESIGN

The design of IT literacy course seems to provide very strong tool for undergraduate fundamental courses because the expected knowledge level of most of students are very similar as the graduate of high schools. Thus ”Learn and Check” concept as shown in Fig.1 is accepted as the effective way.

For graduate school students, a prior knowledge and experiences of each student may not be the same. Thus a course for graduate school is designed for intensive discussion and the background knowledge is examined first then necessary contents are supplied only for the students who need to review. This ”Check first” concept is basically similar to TOTE (Test Operation Test Exit) model proposed by G A. Miller [6].

DETAIL OF TWO COURSE

A. Compulsory Course for Sephomore

Authors have started to deliver the course “DSP-I (Digital Signal Processing I)” by blended learning style using WebCT since 2007[7]. DSP- I is delivered in two classes, each of which has about 90-100 students.

The same syllabus, the same weekly contents with assessments, the same final examination, and the same evaluation criteria.

The same text book and the contents with various links and multimedia contents.

Since 2013, the course is delivered on Moodle, Open Source LMS. Figure 4 shows an example of calculation type quiz. Students are allowed to try each quiz session up to 5 times, but most of students can reach the 100% of source within 3 times as shown in Figure 5. This means at least once student was able to answer the quiz perfectly before moving to the next topics.

The results of grading of class A and B for DSP-I were almost the same. Also the anonymous questionnaire taken at the lecture day but before the final examination show the similar comments among in 2007, 2008, and 2009; more than 90% students evaluate the teaching material is effective, and almost 80% studied more than an hour per week. As the total, 85.5% students said the course as meaningful. Note that some of failed students said the course was meaningful. As the lecturers, authors wish to reduce the failure ratio so that there are many thing to do to encourage to study as well as to support necessary assistance using face-to-face session and e-Learning contents

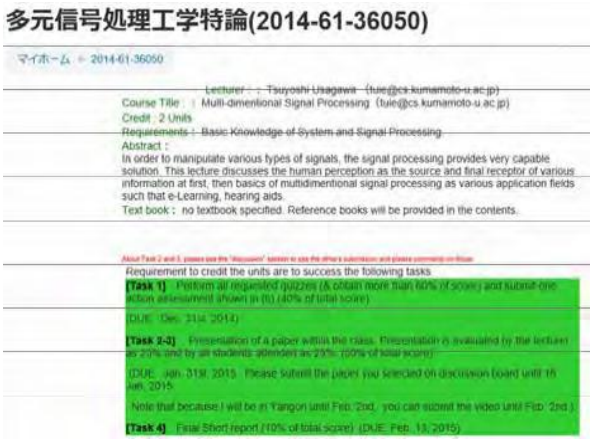

Figure. 6. Top page of “Multi-dimensional Signal Processing” with 3 tasks to complete this course.

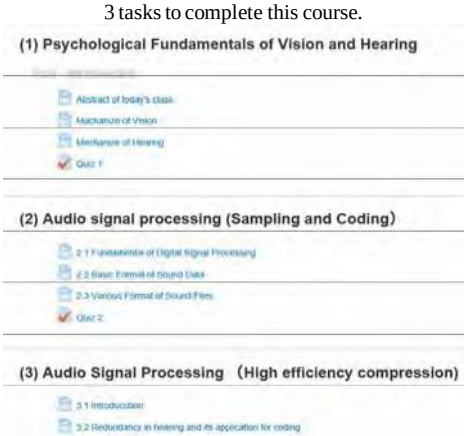

Figure. 7. Contents for Task 1. Each section consists of learning contents and quiz to assess the understanding. Although students can learn contents first, but they are recommended to take a quiz first then learn.

B. Elective Course for Master Degree Student

This course discusses the multi-dimensional and multi- module signal processing, and it is designed as 2 credits course delivered in English. In the top page of the course, students are asked to works on three tasks as shown in Figure 6.

Because the expected level of students’ knowledge to the topics discussed in the course, the lecturer encourages students to take a quiz first, then return to the contents. This scheme seems to be the similar to “Learn and Check” shown in Figure 1, but there are no face-to-face lecturing at a class room. Thus students may learn the contents first, then check their understandings by quiz, but they may learn the

contents after they find out the weakness by taking the corresponding quiz. There are necessary level to exceed in quiz session, i.e. more than 60% for every quiz session. Before moving to Task 2, all students must understand the course contents at least to get 60% of score in quiz.

Task 2-3 is designed to let all students make presentations and the evaluation will be made both by other students as well as lecturer. Portion of this presentation is 50% while the Task 1 corresponds to 40%. Last 10% is assigned to the final short report.

DISCUSSION - EXAMPLES OF OTHER INSTITUTES

Sary et al. implement the blended learning course at the Faculty of Engineering, the University of Sam Ratulangi (UNSRAT), Manado, Indonesia [9]. And they also reported the lecturers and students' readiness of e- Learning at UNSRAT, and concluded both have interests and desire to use e-Learning [10]. N. Jachin et al. implemented the blended-learning courses in Gurvan- Erdene Teacher's college (GETC), Ulaanbaatar, Mongolia. Although the students are not so familiar with ICT, they were quite positive to blended-learning style of lecturers [11]. Prasad et al. focused on the possibility of Open Textbooks and Open Educational Resources (OER), and made baseline survey of lecturers at the University of the South Pacific (USP) [12]. They concluded the lecturers in USP have willing to develop OER derived custom-built open textbooks to increase the affordability of the textbook.

CONCLUSION

This paper shows the potential of e-Learning for undergraduate and graduate level education as well as discusses the examples of blended learning in various institutes in Indonesia and Mongolia.

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