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AN INTERACTIVE E-LEARNING SYSTEM FOR IMPROVING STUDENTS MOTIVATION AND SELF-LEARNING BY USING SMARTPHONES

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In this paper, we present an interactive learning system, which uses a method of acquiring / utilizing the study records for improving the students learning motivation for learning. During the lecture, the students use the smartphone for learning. The results showed that the proposed study record system has a good effect for improving students' motivation for learning. For the professors of the university, it is difficult to offer all necessary information to the students. In addition, they cannot provide the information to satisfy all students because the quantity of knowledge of each student attending a lecture is different. Therefore, for higher level lectures than intermediate level, the students should study by themselves the learning materials. In this study, we show that our method of acquiring / utilizing the study record promotes the self-learning of the student. In this research, we carried experiments during real lectures at the intermediate level. The results showed that the proposed study record system can improve the degree of self-learning after the lecture.

Key words: e-Learning System, Learning Log, Smartphone, Learning Motivation, Self-Learning.

1 Introduction

Recently, in many universities the information terminals such as note PC, workstations, servers and mobile phones are used successfully during the lectures. Also, there are many e-learning systems [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14] that use these devices. The amount of information that a lecturer transmits to the participant during the lecture can be improved by using different information terminals. However, in a lecture, if participants' motivation for learning is low, the learning results are not good. However, in universities is required to increase the learning motivation using information terminals.

Usage of the desk-top computers and notebook PCs for lecture may be inconvenient and they occupy a lot of space. Therefore, it will be better that students use small and lightweight terminals like Personal Digital Assistant (PDA) devices. Also, because of wireless networks are spread over university campuses, it is easy to connect mobile terminals to the Internet and now the students can use mobile terminals in many lecture rooms, without needing a large-scale network facility.

In this paper, we considered a method of acquiring / utilizing the study record using smartphone in order to improve the students learning motivation [15]. During the lecture the students use the smartphone for learning. The results showed that the proposed study record system has a good effect for improving students' motivation for learning.

For the professors of the university, it is difficult to offer all necessary information to the students. In addition, they cannot provide the information to satisfy all students because the quantity of knowledge of each student attending a lecture is different. Therefore, for the lectures of a higher level than intermediate level, the students should study the learning materials by themselves.

In this study, we show that our method of acquiring / utilizing the study record promotes the self-learning.

The paper structure is as follows. In Section II, we present the learning system. In Section III, we introduce the network environment. In Section IV, we present the smartphone application for lectures. In Section V, we discuss the experimental results. Finally, in Section VI, we give some conclusions and future work.

2 Learning System

In this section, we consider the learning systems in universities and investigate the problems they have during the lectures. As solution of these problems, we proposed the use of lecture study records (logs) [10]. In addition, we propose the method for self-learning using lecture logs.

2.1. Learning at Universities

In the conventional lecture style, the knowledge was transmitted from a lecturer to a student using one-way communication (see Figure 1). During lectures in university, very often are used information terminals such as computers and projectors to display the distributed data in the Web and present the power point files or PDF files. Thus, the amount of information that a lecturer transmits to the participant in a lecture is improving by use of information terminals. In a lecture, if students' motivation for learning is low, their knowledge and learning ability will not be improved [8, 9]. However, in universities is required to increase the learning motivation using information terminals.

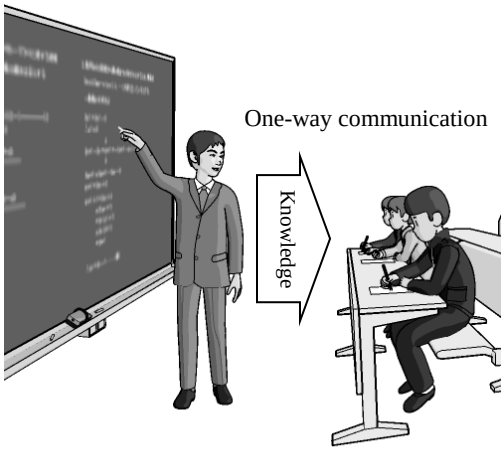

Figure 1. Old lecture style.

2.2. e-Learning System

In order to check the students' concentration, the lecturer carries out periodical tests. The lecturer can control the lecture by checking the tests results. These methods have been used in conventional learning systems, but we can also use them in e-Learning systems [1, 2, 3, 4, 5]. In fact, the tests do not require time and effort for implementation and processing of the results is easy. With the spread and miniaturization of an information terminal, the students can learn anywhere and anytime using smartphones [6, 7]. If a student utilizes an e-learning system positively, it will have a high learning efficiency. However, an e-learning system can't increase the learners' motivation. Also, it is necessary that the students after the lecture is recorded study the learning materials by themselves.

2.3. Learning-Logs (Lecture Logs) and Self-learning

In order that students can use the lecture content for learning in the future, the lectures are recorded. However, it is very important that the contents of a lecture are saved correctly. Also, an efficient mechanism for distribution of the lecture record is required. Thus using this kind of system, the student motivation will influence the learning efficiency.

In this paper, we consider an interactive learning process in order to increase the learning motivation and the self-learning time of the students (see Figure 2). Therefore, we save the students' active actions as study records. A student is enforced to be in interactive learning status because the lecturer performs frequently actions during the lecture. Also, by using the recorded information, the lecturer can adjust the speed of a lecture. As a result, the learning process is more efficient. There is, as yet, little assistance from the research literature to be gained in addressing these issues.

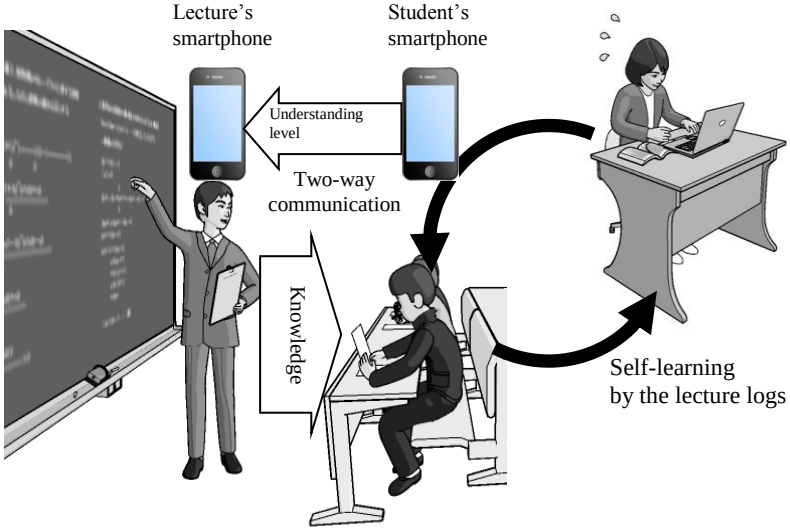

Figure 2. Interactive learning system

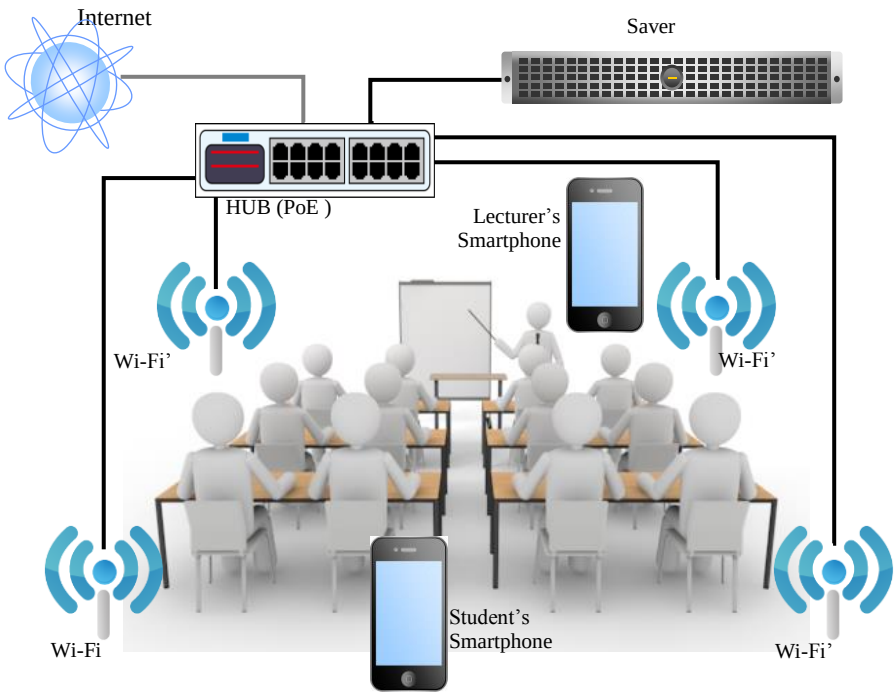

Figure 3. Network environment

3 Network Environment

In order to perform the study records, all students' smartphones need to connect to the network. In order to connect the smartphones to the network, the information outlet for each seat is required. It is difficult to install the information outlets in all lecture rooms. Moreover, maintenance and deployment of many information outlets require a lot of expenses.

However, now it is easy to make Wi-Fi connection with mobile terminals such as smartphones. We installed the terminal adopter for Wi-Fi connection to improve the network environment for the lecture room. It should be noted that many devices can make Wi-Fi connection simultaneous during the lecture. Figure 3 shows the network environment for the learning recorder system.

4 Smartphone Application for Lectures

In this section, we present the software configuration for lecture record. We install the server for performing the lecture records in a LAN environment. The data are recorded on the server database. Each student and the lecturer use their smartphones to connect with the server through the wireless network during the lecture and the lecturer can check the records and take appropriate actions.

4.1. Lecturer's smartphone application

The application software in the lecturer's smartphone terminal consists of the lecture control program that controls the lecture and the study record display program that displays the student's study record.

We show the function of a lecture control program below.

(T1) The progress of a lecture can be checked by a "Study Point", an "Examination" and a "Self-learning Point". The "Study Point" describes the main point of the contents of a lecture. The "Examination" is a selection type examination about its "Study Point" for lecturer to confirm an understanding degree of the student. The "Self-learning Point" describes the item in conjunction with a learning point that a student learns by oneself after a lecture.

(T2) A lecturer can progress the lecture by moving the "Study Point" or "Examination" to the next part. The lecturer can ask students about the lecture difficulty and speed of progress at the time of progress of the "Study Point." The replies of the students for the lecture difficulty and lecture speed are recorded in the server as study records.

The study record display program consists of the following functions.

(T3) The lecture difficulty and lecture speed of progress that the students select and the accuracy rate of the "Examination" are displayed on the screen of a lecturer's smartphone terminal in real time.

4.2. Students' smartphone application

Using their smartphone terminals, the student can actively participate in the lecture by simple operations. The functions of the students' smartphone applications are as follows.

(S1) The students login to the server through a wireless network at the time when the lecture starts.

(S2) At the time when the lecture moves the "Study Point" by his application to progress the lecture, the students reply for the lecture difficulty and the lecture speed of progress. The students can choose a reply operation at the time of selection test for making questions for the exam.

(S3) After the end of a lecture, the displays of (T3) and the "Self-learning Point" can be accessed by students.

4.3. Lecture flow

The flow of the lecturer's application, student's application, and the study record server described above are shown below.

(Flow 01) The lecturer uses his smartphone application to connect to the server. [Teacher 01]

(Flow 02) The attendance registration for a student is started. [Server 01]

(Flow 03) The students use smartphone application and login to a server. [Student 01]

(Flow 04) A server notifies the attendance situation to the lecturer's smartphone application. [Server 02]

(Flow 05) After that the lecturer pushes the start button to start the lecture. [Teacher 02]

(Flow 06) The "point" shift to a student who makes questions for the exam of a selection type problem is directed to a server. [Teacher 03]

(Flow 07) Next "point" or selection type examination is transmitted to a student. Then, the "point" or a selection type examination is recorded. [Server 03]

(Flow 08) At the moment of "point" shift, for a defined period of time the student replies the lecture difficulty and lecture speed of progress. When a selection type examination is decided, the student answers in a defined period of time. [Student 02]

(Flow 09) The server collects the information of (Flow 08) and sends it to the lecturer's smartphone terminal application. The total information is saved as study record in the server. [Server 04]

(Flow 10) The total data of lecture difficulty and lecture speed of progress that the student answered is displayed. Then when the selection type examination is set by (Flow 06), the problem answer rate is displayed. [Teacher 04]

(Flow 11) When shifting to the next "point", it returns to (Flow 06). [Teacher 05]

(Flow 12) In order to end the lecture, the lecturer connects to the server. [Teacher 06]

(Flow 13) The end of a lecture is transmitted to student application and the recording process is ended. [Server 05]

(Flow 14) Logoff. The end of a lecture is displayed. [Student 03]

4.4. Self-learning after the lecture

After the end of a lecture, a student can access the “Study Point”, the displays of (T3) and the “Self-learning Point” for his/her learning after the lecture.

5 Experimental Results

We performed experimental evaluation of the study record system. In the evaluation experiment, we used the lecture room with a capacity of 100 seats. We carried out two programing lectures at the intermediate level for two classes and the number of students was about 70. We compared the learning effect for two cases: when using and not using the study record system.

One of the lectures was performed for 90 minutes. We investigated the self-learning time for every lecture. We performed 12 times of lectures. Table 1 shows the self-learning time after a lecture and the Examination Pass Rate (EPR). The class B has a higher EPR than class A. In addition, at the self-learning time per lecture, the class B has a longer self-learning time approximately double than the class A. This result shows that the students of class B were able to learn better than the students of class A.

Figure 4 shows the graph of the self-learning time per lecture, that we performed 12 times. Also, in this graph, we see that the students of class B were able to learn more efficiently than the students of class A. From the figure, we can see that with the increasing of lecture number the self-learning time is increased for the students who passed the examination. This means that the system increased the learning motivation, so the self-learning time is increased.

6 Conclusions

In this paper, we presented an interactive learning process in order to increase the students learning motivation and the self-learning time. As information terminals, we used the smartphones. We carried experiments during real lectures at the intermediate level. The results showed that the proposed study record system can improve the self-learning time after the lecture. Therefore, the study record system has a good effect for improving students' motivation for learning and the understanding of the lecture.

In the future work, we will carry out extensive experiments to evaluate the proposed system for different lectures.

Table 1. Self-learning time after a lecture

Class (Programing Lecture at the Intermediate Level)	*Self-learning time / lecture*		*Examination Pass Rate*
	Total	*Only Successful Students*	
Not Used the Study Logs Class A (68 persons)	28min.	47min.	43%
Used the Study Logs Class B (72 persons)	64min.	97min.	58%

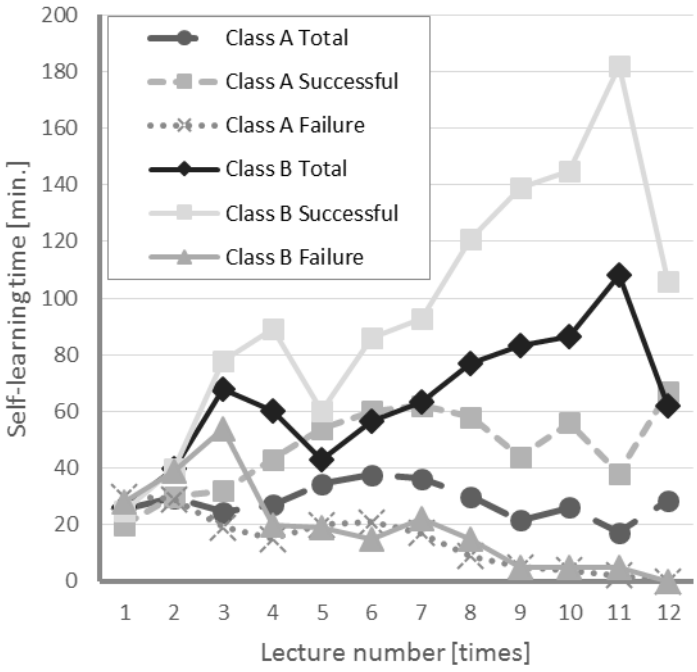

Figure 4. Self-learning time for a lecture

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