Implementing a Web-Based Peer grading System and Experiment the Learning Effect

Il-Min Kim¹, Sae-Hong Cho² and Jong wook Kim³

¹ Department of Computer Engineering, Hansung University, 389 Samsun-Dong 3-Ga, Sungbuk-Gu, Seoul, South Korea ikim@hansung.ac.kr
² Department of Multimedia Engineering, Hansung University, 389 Samsun-Dong 3-Ga, Sungbuk-Gu, Seoul, South Korea chosh@hansung.ac.kr
³ Department of Multimedia Software, Hansung University, 389 Samsun-Dong 3-Ga, Sungbuk-Gu, Seoul, South Korea jkim@hansung.ac.kr

Abstract

The popularity of online education technology has resulted in increase of interests on social learning network and online training aids for traditional class educations. In this paper, we designed and implemented a peer report grading system and studied the educational effect of the grading system. Instead of traditional one-sided evaluation done by professors, the system reduced the burden of grading and evaluating assignments and facilitated idea-sharing among students. We took advantage of web technology to maximize the effectiveness of peer feedback. In this paper, we concluded that the web based grading system showed better educational effect than traditional grading systems.

Keywords: Web grading system, Peer feedback system, JSP web system

1. Introduction

With the advent of high-speed internet, computer network and social media provide us new ways to communicate and learn. The size of information has become much bigger and more information is being exchanged at a faster rate than before. Existing and emerging computer technologies are having intense and disruptive transformation on education. As e-learning has become more pervasive, however, some students keep passive learning attitudes in front of computers.

Information technology has spawned many innovations and services. Information technology has been widely applied for effective education. These days, students can take on-line lectures, post questions to bulletin boards, and submit assignments using on-line file transmit services. Early smart phones were not widely used for educations because the functions were very limited. Since Apple Inc. released iPhone in 2007, smart phones have gained surprising popularity and became one of daily necessities. The emergence of smart phones and wireless networks allowed us to access and to handle data almost anytime and anywhere.

With smart phones' gaining popularities, more Universities started to provide education services using smart phones. Existing PC-based on-line education services have changed to provide smart phone services. For examples, many universities provide class registration, book searching in a library, and various multimedia contents with smart phones. MUSIS [1] (Multicasting Services and Information in Sweden) was developed for ubiquitous learning using Smart phones.
in Sweden. The MUSIS system reported the results of educational activities regarding the use of smart phones and mobile services in the classrooms. Liu [2] provided hearing-impaired students with learning care after classes through smart phones and the GPRS (General Packet Radio Service) network. Figure 2 show that Lawrence tech's library provides various services with QR codes.

Web 2.0 technology, which emphasizes user-generated content and interoperability, has the potential which can innovate current on-line learning [3]. Many researchers claimed that these social networking tools could result in a big shift in the way students learn, consume, and produce new knowledge [4]. Since many people acquire various knowledge through the internet, social learning became one of the major trends for learning in the twenty-first century. The basic principle of social learning is chaining the cognition and behavior by sharing knowledge and information [5].

Originally social learning took place at a wider scale than individual or group learning through social interaction among various individuals. It may change in attitudes and behavior. With the advent of the network and mobile technology, various and faster communication channels have been provided between peers. Social learning through open platforms like Facebook or Wikipedia is growing rapidly. Closed platforms like Corporate Social Learning Network is also growing up rapidly [6]. There are many media examples which can be used for social learnings. User generated contents like YouTube or Podcast could be used for learning on demand. The set of learners and the set of teachers in social learning cannot be disjointed. It is an evolving peer learning process in which learners acquires, master, and then distributes their knowledge to others over time. This type of social network for learning is called social learning network (SLN).

In our research, we designed and implemented a social learning tool which was a peer homework review system. The system was used for uploading and grading operating system assignments. The purposes of this paper are to implement a web-based peer review system and to heighten the educational effect. The peer review system also provides idea sharing among learners. A learner can view other’s homework and evaluate the grades. This system is different from existing systems. We show the feedback between learners bring positive learning effect.

2. Background Knowledge

Social learning started even before personal computers were introduced. In 1960’s, Bandura insisted that learning is a cognitive process that takes place in a social context and can occur purely through observation or direct instruction, even in the absence of motor reproduction or direct reinforcement [7]. Bandura insisted that individuals can learn through the observation of rewards and penalties which is widely known as vicarious reinforcement. The theory expands on traditional behavioral theories, in which behavior is affected solely by reinforcements, by emphasis on the roles of various internal processes in the learning individual [8].

Peer review is the evaluation of report by one or more students of similar competence to the writers of the reports. Peer review consists of a form of self-regulation by qualified teachers within the related area. Peer review is applied to enhance performance, maintain standards of quality, and provide the credibility of the report grades. In many research journals, peer review is commonly used to determine an academic paper’s suitability for publication.

The first recorded editorial pre-publication peer-review process was at the Royal Society of London in 1665 by the founding editor of Philosophical Transactions of the Royal Society. Peer review became common for the publication of academic papers and the funding allocations of science researches. The present-day peer
review system have evolved from 18th century processes and become commonplace since the mid-20th century.

The objective of peer review is that of “responding to one another’s writing for the purpose of improving writing” [9]. Fitzpatrick researched on peer review in an online technical writing course. She analyzed peer review activities and their outcomes with multiple sections of a course and their outcomes within multiple sections of a course taught online using the same template and course management system [10]. Some works researched the effectiveness of online discussion for collaborative learning and pervasive computing in education [11, 12].

Since most Korean students are used to learning passively in middle school and high school and try to take higher Korean SAT scores for applying better universities, they are not used to interact with professors or instructors. They are accustomed to absorb what they are taught and have few opportunities to express their own ideas. Most Korean students keep passive learning habits even in Universities. The goal of this research is to enhance the learning effect exploiting interactions between peers, which are totally different from the existing one-way learning.

In order to increase the effect of peer review, you need to consider the characteristics of curriculum. If a class requires expert knowledge or experience, applying peer review to the class may not be appropriate. The assignments of such classes are appropriate to be graded by traditional ways. On the other hands, for examples, in humanities classes, a large number of people can share a variety of perspectives through the long process of discussion. Therefore, humanities classes are better to apply the peer review.

3. Platform and Tools for Implementation

In this research, we designed and implemented a peer review system with Java Server Page and Tomcat Webserver. A computer system with Microsoft window was used. JSP (Java Server Page) and Tomcat 6 were used for server-side computing. HTML5 [13] and JavaScript were used for client-side computing. For user convenience, an android smartphone app was also implemented. We also used MySQL [14] database for storing students’ reports. Students can upload their homework and review others’ homework through the system. Though students could not upload file to the system with their smartphones, they could check the public notice with smartphones. Platform and Programming languages used for this research are shown in Table 1. The System structure we have implemented is depicted in Figure 1.

<table>
<thead>
<tr>
<th>Tool Type</th>
<th>Tool Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System</td>
<td>Window 7</td>
</tr>
<tr>
<td></td>
<td>Android 4.0</td>
</tr>
<tr>
<td>Client</td>
<td>HTML5, JavaScript</td>
</tr>
<tr>
<td>Sever</td>
<td>Java Server Page, Tomcat 6</td>
</tr>
<tr>
<td>Data Base</td>
<td>MySQL 5.0</td>
</tr>
</tbody>
</table>

We chose WEB environment for implementing the peer review system because we thought the system could take advantage of the Internet and students could share...
the knowledge easily. We also tried to implement the system with open-source software. In production and development, open source as a development model promotes a universal access via a free license to a product’s design or blueprint, including subsequent improvements to it by anyone. For this purpose, we chose Java Server Page, MySQL database and Tomcat web server [15]. Since iOS and Android were released by Apple Inc. and Google, smartphone became an important tool in campus life. As of 2014, most students of the computer science department in Hansung University are using smartphones instead of traditional feature phones. We allowed smartphone access to the system for the students’ convenience. Though iOS and Android [16] are both commonly used operating systems for smartphones, we chose Android because it is open software and gives more freedom to developers.

Figure 1. Peer Review System Overview

4. System Structure and its Functions

The system has three user types: system manager, lecturer, and student. The system administrator should be able to register classes, instructors, and students to the system. The system administrator is responsible for the overall system operation. The basic system structure can be simplified as in Figure 2.
Each class would be assigned to an instructor and students. The instructor registers assignments and sets deadlines. When an assignment is registered, the students will receive an e-mail and text messages. The instructor would post the solutions for problem solving assignments and the solutions would be visible to students after the deadlines passed. The system that we implemented in this research was comprised of the following modules.

1) Login module – The system administrator manages this login module. Each instructor and student information should be registered by the system administrator. All instructors and students are required to login. Instructors have the authority to register the study materials, public notices, assignments and solutions.

2) Assignment Management module – Students need to finish their assignments and upload them before the deadlines. This module should forbid upload assignments after the deadlines. Students could see the assignment solutions and grade their peers’ assignments.

3) Peer review Evaluation module – Each student would get 10 reviews for his assignment. Some of the reviews would be considered valuable, while others would not. Each student can grade the each peer review anonymously. The grades are feedback to the reviewers. This feedback is important to lead to the integrity of the peer review.

4) Survey & Public notice module – The instructor could ask for suggestions to the students or survey on his lectures. The instructor can post important notices to students and send text messages to students for urgent notices.

5) Similarity check module – Some students might try to copy other students’ work. With this module, we can prevent unrighteous report sharing and encourage finishing assignments by themselves. Since the similarity check processing is a time consuming task, the last minute uploaded reports are main targets for this processing.

6) Statistic modules – This module shows the statics on the ratio of the assignment submission, the grade distribution and etc. This module can be used as important data for teaching aids.

The relationship between users and the functions of the system was drawn in Figure 3. We drew Usecase diagram for depicting the relationship.

Figure 3. Usecase Diagram for the Peer Review System

5. Peer Review

Computer science major students in Hansung University were chosen for this experiment in 2014. We tested three different types of assignment: programming assignment, essay, and problem solving. Students have the responsibility to upload
their homework to the system before the homework deadlines. Every student could view others’ homework through the system. Author’s name and other identifications of the homework were hidden to others. Each student was required to review and to grade ten assignments, which are randomly selected. The minimum grade was 1 and the maximum grade was 5 and the interval was 1. The average of each student grade was normalized to 3. After grading homework, each student has to leave comments. The grader identification was also hidden.

6. Experiment Procedure

The experiment procedure of this paper was conducted as follows:
- Every student needs to finish homework on time and upload to the system.
- After the deadline passed, each student has to review and grade 10 assignments.
- Peer review grades are reported to each student.
- The homework with the highest score would be open to public.
- There are two student groups: one for peer review, the other for traditional grading.
- The professor gives a similar assignment and compares the previous work.
- Compare the experiment results of the three types of assignments.

Another experiment we conducted was to show the effects of peer review. There were two student groups. The first group’s assignments were graded as the traditional way. The second group was told that their assignment would be reviewed by peers. The assignment qualities of two groups were compared.

7. The Experiment and Results

In the beginning, each student finished homework with his own ability and style. From the second assignment, more and more students tried to improve the assignment quality. Many students learned from imitating the other assignments. For programming assignments, the interface and the function were improved comparing with the previous assignments. For essay, many students improved their expression skill. They had begun to use clearer and more definite expressions. For problem solving assignments, some students seemed to understand the problem solutions more easily and clearly. These positive educational effects could not be fulfilled in traditional assignment grading systems.

8. Participants’ Opinions

We surveyed participants’ opinions after the experiment. Some participants had very positive opinions while some of them complained extra works. The opinions were summarized as follows:

1) Participant 1 – Peer review was new to me but it was very interesting. By grading colleagues’ homework I could clear understand what was ambiguous at first. I think the grading system needed some improvement. Some interface was not intuitive and inconvenient.

2) Participant 2 – I thought that we could not conduct the peer review properly because we lack expertise and experience of grading other’s reports. However, the comments from peers were accurate and helpful. When the highest scored homework was open to public, I could not complain my grade any more.

3) Participant 3 – Peer review seemed extra work for students to me. I could not find any good point from the student perspective. My feeling was not comfortable because my friends were supposed to review my work. However, seeing and grading
the work of my friends stimulated my competitive sentiment. I began to work harder and concerned about my homework. I eventually like the peer grading system.

4) Participant 4 – Peer review system was very beneficial to me. I got the objective comments from my friends, which was helpful to correct mistakes in my work. I was happy whenever I saw complimentary comments on my works from peers.

5) Participant 5 – I got the opportunity to look at other’s homework, which was not possible before. I thought I learn a lot from seeing others’ assignments as much as the lectures in the class.

9. Experiment Results

The experiment was conducted by dining into two groups: one was traditional grading group and the other was peer grading group. The experiment results are shown in Table 2 and 3. The group of students who participated in the peer review took more time to finish their homework and got better grades as shown in table 2. Students who participated in the peer review were getting better grades than previous grades as shown in table 3. Table 3 showed that the educational effect of peer review. As we stated in experiment procedure, we tested three different type of homework in this research. However, we did not find any meaningful difference of the educational effect of each type.

Table 2. Average Score & Working Hours

<table>
<thead>
<tr>
<th>Grading Type</th>
<th>Avg. score</th>
<th>Avg. hours for a HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional grading</td>
<td>3.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Peer review grading</td>
<td>3.8</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Table 3. Average Scores for Each Homework

<table>
<thead>
<tr>
<th>Avg. score</th>
<th>HW#1</th>
<th>HW#2</th>
<th>HW#3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional grading</td>
<td>3.4</td>
<td>3.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Peer review grading</td>
<td>3.5</td>
<td>4.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>

10. Conclusion and Further Works

Peer review is the evaluation of work by one or more people of similar competence to the producers of the work. It constitutes a form of self-regulation by qualified members of a profession within the relevant field. If peer reviews are conducted properly with computer technology, the educational effect could be enhanced greatly. We experimented blind review and grading assignments. In this research, we found that interaction and feedbacks among students are helpful in understanding lectures and enhancing teaching effectiveness.
Grading assignments is a big burden for instructors because students may complain about the scores of their assignment and grading homework may take a long time. We found that instructors were more pleased than students with the system because the burden was moved to students’ shoulders. Professors/instructors could concentrate more on the teaching contents rather than grading assignments. In addition, students were also satisfied with the system and would agree with their scores. The peer review system improved the credibility of report grading.

The sample of students comprising this research was not big enough and therefore finding might not be generalized beyond this research. The computer hardware which we used for the implementation was not stable enough to support as many students as we expected in the beginning. In the future work, we need to use more powerful and stable computer hardware and collect more participants for the peer review. Since many participants complained about the interfaces of the peer review system, we also need to redesign the interface in the further work.

Acknowledgements

This research was financially supported by Hansung University in S. Korea.

References


Authors

Il-Min Kim, Professor, Hansung University, Dept. of Computer Engineering. Interest Area: Digital Content, Distributed processing.

Sae-Hong Cho, Professor, Hansung University, Dept. of Multimedia Engineering. Interest Area: Multimedia, Virtual Reality, Big Data, Digital Contents
E-mail: chosh@hansung.ac.kr

Jong Wook Kim, Assistant Professor, Sangmyung University
Dept. of Media Software. Interest Area: Web Data Mining, Information Retrieval, DB Systems.
E-mail: jkim@smu.ac.kr