International Journal for Educational Media and Technology
2009, Vol.3, Num. 1, pp. 81-91

E-Teaching Portfolio to Realize Ubiquitous Peer Reviewing Process in Higher Education

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This system development enabled an ubiquitous peer review and reuse of reviewer comments to assess teaching/learning in higher education. The purpose of this project was two-fold: (1) to record and store reviewer annotations on streaming class lecture as time sequence data, and (2) to identify key principles and criteria from annotated video data to assess and evaluate the quality of teaching and learning (e-teaching portfolio). The evaluation studies were conducted to gain a broad understanding of how reviewers identify and recorded the educational events effectively and appropriately during "lesson study (Jyugyo kenkyu)" when using this system. The collection and analysis of reviewers' annotations indicated that this system is capable of reusing collected comments in order to suggest weak and strong points in class lectures from different reviewers' perspectives.

Keywords: e-Teaching portfolio, peer review, lesson study, faculty development

Problems with Traditional Faculty Development

Higher education institutions provide various institutional programs for educating and developing academic members: from the development of teaching philosophies, campaigns to raise awareness of certain key components, the strategic use of experts such as educational developers and teaching fellows, and funding projects aimed at specific issues. This traditional faculty development approach, however, is sometimes problematic. One reason is that faculty members have few incentives and little time to pursue professional effort: even when faculty members recognize the scholarship of teaching and its difficulties, they often are pulled in other

directions because, at many academic institutions, scholarly activities involving research and publishing are valued more highly than teaching (Boyer, 1990). Another reason is that workshops and seminars tend to be isolated, generic, and decontextualized. Therefore, the models of instruction used for many faculty development efforts are not conducive to helping faculty members change their approach to brushing up on teaching skills.

Because of inherent problems with 'top-down' models of faculty development, more effective strategies should be utilized, based upon individual contacts between staff at all levels, a mentor/developer, and students at the faculty's institution. In other words, a more bottom-up approach is needed in order to organize a faculty learning community and to cause real change in teaching strategies in more academic staff members.

Lesson Study: Assessment for Teaching and Learning

In order to collect useful information on improving teaching and learning, student evaluation and self- and peer-assessment are often conducted. These assessments, however, fail to provide information about factors specific to individual departments, courses, and teaching styles because standard assessments provide only general information at the end of a term. In Japan, "lesson study (Jyugyo kenkyu)" is a popular professional development approach in elementary and secondary schools, whereby teachers collaborate to improve instruction and learning by studying content, methodology, and how students solve problems and reach for understanding. By engaging in "lesson study", teachers feel connected to each other and to a body of knowledge that they generate, share, and continuously refine. It is a highly worthwhile activity, which allows teachers to come together to develop their pedagogical knowledge and skills.

Unfortunately, in the context of university education, it is difficult for lectures to learn form each other and break the pervasive isolation of professionals. Recently, some leaders at higher education institutions have begun to provide Open Course Ware (OCW), which enable free sharing of lecture notes, exams and other resources. From the viewpoint of teacher training, however, OCW's functions are limited. Therefore, most university teachers learn to teach in a sink-or-swim approach and ignore the fact that teaching is a highly complex enterprise influenced by multiple variables.

To improve the present situation in higher education, a faculty learning community should be organized using Information Communication Technology to conduct "lesson study" with the aim of sharing and improving teaching/learning knowledge. The use of mobile technology such as tablet PCs and pen-based devices provide busy teachers with an opportunity to work on "lesson study" with wireless network. On-line handwriting recognition has capabilities to collect data of reviewers' comments, label them, and suggest weak and strong points based on an instructional design database. Strategies to improve instruction and criteria to assess teaching/learning are obtained by retrieving from database reviewers' comments specific to given instructional settings (subject, teaching mode, target audience, learning objects, etc.).

Teacher Learning Research for Professional Development

The term "teacher education" usually refers to teachers' formal training in schools of education or in alternative certification programs. In contrast, "teacher learning" refers to teacher education after teachers are working full-time. As learning sciences researchers develop curriculum materials, technologies, and instructional designs, they often concurrently conduct professional development for participating teachers.

How do "teacher learning" and "professional development" improve the quality of teaching? Learning sciences researchers assume that engagement in teacher learning or professional development leads to changes in both teachers' beliefs and knowledge and in students' learning activities (Fishman& Davis, 2006). The learning sciences have only recently developed a focus on teacher learning and professional development, but teacher learning is now an active area for educational research because the learning sciences perspective offers great promise. Learning sciences researchers have more contributions to, and extended research on, new directions.

The most effective way to improve teaching/learning activities is rooted in real-world context of practice (Fishman & Davis, 2006). Engagement in professional development requires teachers to examine their own practice, promotes reflection, and provides opportunities for socializing.

Learning sciences research on teacher learning and professional development has emphasized that "community" is essential to effective teacher learning (Bruckman, 2006). Huge amounts of system development have attempted to create communities by providing online communication tools which promote open exchange of ideas and communication among teachers. These online environments support a kind of learning-on-demand, where learning goals and objectives emerge from the situation at a hand, rather than being contrived by faculty developers and presented through an artificial context (Nelson, 2003).

Making Good Work Public for Electronic Teaching Portfolios

The Peer Review of Teaching project headquartered at the University of Nebraska, the Visible Knowledge Project of based at Georgetown University, and the Carnegie Foundation's Knowledge Media Laboratory (KML) have all explored alternative genres to enable scholars of teaching and learning to document their work online in ways not possible in regular print. The KML encourages viewers of their galleries of online portfolios to gather ideas for improving their teaching, and to use the portfolios as “launching points for discussions and reflections, peer review of teaching and learning, collaborative inquiries, and further investigations” (Huber & Hutchings, 2005).

In this paper, we report the result of Tokyo University of Agriculture and Technology’s Center for Higher Education’s ongoing development of the use of tablet PCs for peer review. Here we present an overview of our Online Peer Review Process Project and ten pilot studies conducted in 2008 and 2009. By presenting the results of our trials, we hope to gain new insights regarding best practices for learning and teaching in higher education.

Brief Overview of the Online Peer Review Process

The main objectives of this project are to support the peer review process and to restore and retrieve key concepts with multimedia information for the purpose of constructing e-teaching portfolios. We developed content tools for reviewers allowing them to multicast video, images, and text from tablet PCs and PDAs, which are distributed over networks as shown in Figure 1.

By developing easily operable handwriting interfaces, this project aims to provide teachers with online peer review opportunities outside of class that are necessary to and relevant to their teaching/learning improvement. Moreover, the database of reviewer comments is capable of reusing collected comments in order to suggest weak and strong points in class lectures and to design a rubric to evaluate lectures as e-teaching portfolios. This system development enables ubiquitous peer review and reuse of reviewer comments for assessment of teaching/learning in higher education.

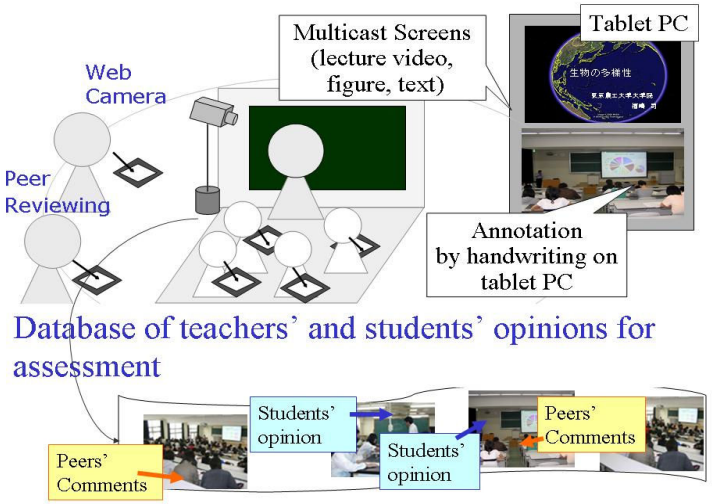

Figure 1. *Project Overview*

The project will develop the system can assist the peer-reviewers and students monitors to review the class lectures and to record and retrieve the reviews comments on video lactures. We have designed and developed "FD Commons," an online peer review system for lesson study, and conducted ten pilot studies during 2008 and 2009. This system was developed using DirectShow and SampleGraberk, which enabled integrated video streaming and annotation including lines, colors, erasers, and extended tools as shown in Figure 2 and Figure 3 (Houri et. al., 2008 a, 2008b, Kato et.al.2008a, 2008b).

1) Collecting comments effectively from peer reviewers outside and students in class by tablets PC over networks. Both peer reviewers and student monitors can check the multi screens and write comments and annotation on the video lectures and ppt slides by use of tablet PCs.

2）Develop application for viewing reviewers' annotations to streaming class lecture as time sequence data of pen-tip coordinates.

Figure 2. *Screenshot of FD Commons (Ver. 2)*

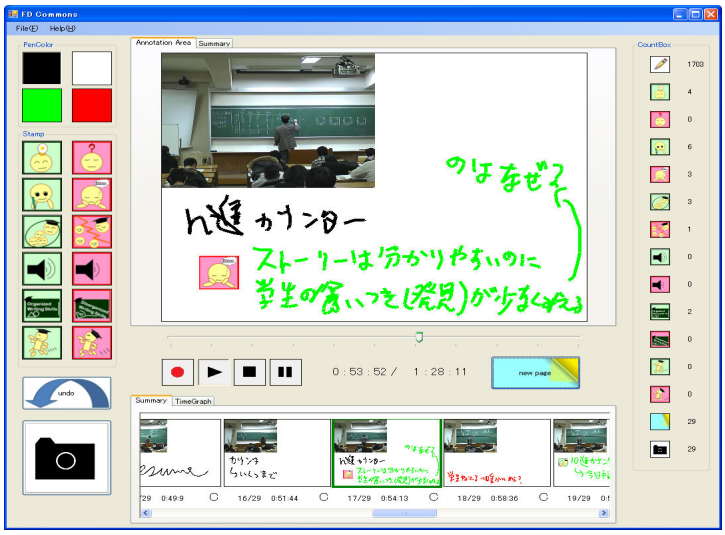

Figure 3. *Screenshot of FD Commons (Ver. 3)*

Pilot Studies

In the pilot study, we investigated the effects and operability of our online peer review system on five reviewers. The reviewers were all faculty members at Tokyo University of Agriculture and Technology. One teacher was an instructional designer from our Educational Development

Center (faculty developer). The other four teachers were academic staff specializing in computer science and mechanical engineering. In total, ten trials were conducted from July 2008 to January 2009, as shown in Table 1. All reviewers who used FD Commons had no problems with system operability and accessibility. In each trial, two reviewers checked media usability, interface design, and effectiveness of FD Commons (Figure 2 and Figure 3).

Table 1. *Pilot Study of FD Commons*

	Date	Ver.	Class	Class Size (level)	Reviewer A (Teaching experience)	Reviewer B (Teaching Experience)
1	Jul. 30, '08	Ver. 1	Cognitive Science	15 students (Graduate)	Faculty Developer (15 Yrs)	Media Informatics (1 Yr)
2	Oct. 3, '08	Ver. 2	Electronics	70 students (Undergraduate)	Faculty Developer (15 Yrs)	Mechanical Engineering (0.5 Yr)
3	Oct. 7, '08	Ver. 2	Cross Cultural Comm.	35 students (Undergraduate)	Computer Science (6 Yrs)	Mechanical Engineering (25 Yrs)
4	Oct. 10, '08	Ver. 2	Electronics	70 students (Undergraduate)	Faculty Developer (15 Yrs)	Computer Science (6 Yrs)
5	Oct. 17, '08	Ver. 2	Electronics	70 students (Undergraduate)	Faculty Developer (15 Yrs)	Media Informatics (1 Yr)
6	Oct. 24, '08	Ver. 3	Material Mechanics	75 students (Undergraduate)	Faculty Developer (15 Yrs)	Mechanical Engineering (25 Yrs)
7	Nov. 14, '08	Ver. 3	Electronics	70 students (Undergraduate)	Faculty Developer (15 Yrs)	Computer Science (6 Yrs)
8	Dec. 5, '08	Ver. 3	Electronics	70 students (Undergraduate)	Media Informatics (1 Yr)	Computer Science (0 Yr)
9	Dec. 19, '08	Ver. 3	Electronics	70 students (Undergraduate)	Computer Science (1 Yr)	Computer Science (3 Yrs)
10	Jan. 9, '09	Ver. 3	Electronics	70 students (Undergraduate)	Computer Science (6 Yrs)	Computer Science (3 Yrs)

First Trial of Version 1 (July, 30, 2008)

In the first set of trials on July 30, two reviewers (faculty developer and computer science teacher) were more likely to refine the multicasting functions including streaming video, voice sound, and annotation. Both reviewers used video taken from a camera located in the back of the classroom, in order to view both teacher and students (Figure 4). They started to add annotations from the beginning of the class. A reflection session was held immediately after the class. In this first trial, we found the following two benefits for effectiveness for educational improvement:

1) Although discussion usually tends to diverge in reflection sessions after lesson study, by using FD Commons, the focus of discussion can be selected and retained.
2) By using a pen-based device, reviewers could freely write comments and mark discussion points on the class video.

Based on the comments from the two reviewers, we reconsidered the interface to integrate multicast information sources for improving usability, resulting in development of Version 2 (Figure 2). In Version 2, we set up six different stamps, which indicated three "perspectives" (interaction, content, and methodology), that need to be drawn on to record the properties of

educational events adequately and clearly during review of class lectures. After continuing evaluation studies, we developed Version 3 (Figure 3), which added three additional "perspectives" (oral presentation, writing on the blackboard, and lecture pace), which were convenient to use in evaluating and checking basic teaching skills.

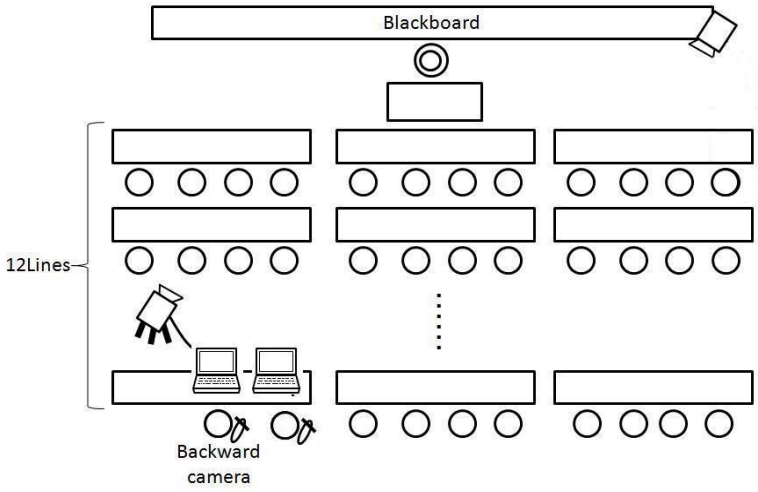

Figure 4. *Evaluation Study Layout*

Evaluation Studies of Version 2 (Oct, 3-17, 2008)

This evaluation study continued our inquiry on how best to construct FD Commons. In order to determine any differences in identification of educational events, the novice teachers and faculty developer comments are compared on the main three "perspectives" in Version 2, and one perspective including basic teaching skill factors, added in Version 3. Our research questions were:

1) By using a pen-based device, do reviewers write more comments and mark more points on class lecture videos, in comparison with the usual end-of-term questionnaire?
2) Are there any differences in comments by novice teachers and the faculty developer when using FD Commons?

Participants

Four teachers participated; all were faculty members at Tokyo University of Agriculture and Technology. Reviewer A was an instructional designer at the Center of Educational Development (faculty developer) and has experienced "lesson study" at another university. Reviewer B was an assistant professor specializing in media informatics (1 year teaching experience), Reviewer C was an associate professor specializing in computer science (6 years experience), and Reviewer D was a new comer assistant professor with the same specialty as the lecturer: mechanical engineering. But Reviewer D has not taught students because he was a Post Doctorial student at a previous university. Based on teaching experience, Reviewer B and D were assigned to novice teachers group. Regarding research the second question, in comparison faculty developer with novice teachers, Reviewer C was excluded in analysis.

Data Source and Analysis

To answer the research questions, “by using a pen-based device, do reviewers write more comments and mark more points on class lecture videos, in comparison with the usual end-of-term questionnaire?” and “are there any differences in comments by novice teachers and the faculty developer when using FD Commons?”, we used the content analysis approach .To measure the differences between evaluation instruments or reviewers’ use of FD Commons (Ver. 2), "Snap Shots" data from different sessions of the same class (Electronics) were collected on Oct. 3, 10, and 17. Based on the types of comments, each “Snap Shot” was classified into four categories: interaction, content, methodology, and basic teaching skills. The first three categories were designed as stamps of FD Commons (Ver. 2). These three "perspectives", interaction, content, and methodology, which need to be drawn on to record the properties of educational events adequately and clearly during review of class lectures. On the other hand, one more category was used to check basic teaching skills, including oral presentation, writing on the blackboard, and lecture pace added in Version 3. These perspectives on basic teaching skills were used to collect student feedback on the effectiveness of course and teachers as the usual end-of-term questionnaire.

To address the first research question, we used content analysis approach to investigate the difference between reviewers’ comments and student survey. The total number of "Snap Shots" was 258. As shown in Table 2, 31.8% of the recorded comments on "Snap Shots" were related to lecture content and 30.2% related to the interaction between teacher and students during class activities. Only 12.4% mentioned basic teaching skills, which are usually covered by end-of-term questionnaires. The results indicated that use of FD Commons promoted more variation of comments than student evaluation survey.

Regarding the second research question, the data were analyzed using Chi-square contingency table tests. There was a significant difference between the faculty developer and novice teachers in the way that they evaluated class lectures ($\chi^2 = 11.03$, d.f. =3, $p < .05$). As shown in Table 3, residual analysis showed a significant difference with respect to the categories of "Lecture content" ($p < .001$), and "Methodology" ($p < .05$). No significant difference was found for the "Interaction" and "Basic teaching skills" categories.

Table 2. *Comments on class reviewing by category*

	Interaction between teacher and students (%)	Property of lecture content (%)	Methodology (%)	Basic teaching skills (Voice, Writing, Pace) (%)	Total (%)
All reviewers	78 (30.2)	82 (31.8)	66 (25.6)	32 (12.4)	256 (100.0)

Table 3. *Faculty developer and novice teachers compared: Comments on class review by category*

	Interaction between teacher and students	Property of lecture content	Methodology	Basic skills (Voice, Writing, Pace)	Total
Faculty Developer (Reviewer A)	45 (41.19)	39** (49.55)	38* (31.53)	17 (16.73)	139
Novice Teachers (Reviewer B&D)	19 (22.81)	38** (27.45)	11* (17.47)	9 (9.27)	77

**$p<.001$, *$p<.05$, Expected value (in parenthesis) of each category

The results indicated that a faculty developer is more likely than novice teachers to report comments regarding methodology. Novice teachers are more likely to focus on lecture content.

Results and Discussion

The evaluation study continued our inquiry on how best to construct FD Commons. Compared to an ordinary student survey, FD Commons might be capable of recoding and restoring educational events timely and appropriately. Moreover, in order to determine any differences in identification of educational events, the novice teachers and faculty developer comments are compared on the main three "perspectives" in Version 2, and one perspective including basic teaching skill factors, added in Version 3.

Regarding research question 1, “when using a pen-based device, do reviewers write more comments and mark more points on class lecture videos, when compared to the usual end-of-term questionnaire?”, based on the data analysis recorded as "Snap Shots," reviewers comments on “basic teaching skills” only made up 12.4% of the total comments. Therefore, when compared to question items on end-of-term questionnaires, more variation of comments was found when FD Commons was used. Although the responses to end-of-term questionnaires can be quickly recorded and assembled as qualitative feedback, they provide only general information. On the contrary, FD Commons might provide information about factor specific to individual department, courses, and teaching style. This result suggests that FD Commons has the capability to reuse collected comments in order to suggest weak and strong points in class lectures from different reviewers' perspectives.

Regarding research question 2, “are there any differences in comments between novice teachers and the faculty developer in use of FD Commons?” there was a significant difference in the "Property of lecture content" and "Methodology" categories. The results indicated that a faculty developer is more likely than novice teachers to comment on methodology. On the other hand, novice teachers are more likely to focus on lecture content. However, in the "Interaction" and "Basic teaching skills" categories, there was no significant difference between reviewer types.

Conclusion and Future Work

Recent developments in mobile technologies have contributed to its potential to support learning and teaching in higher education. The emergence of ubiquitous and wireless networks has led to the wide deployment of mobile devices that allow us to access and handle information almost anytime, anywhere. Rich representations by new media and networks will support building a “Teaching Commons” through new media and networking.

We designed and developed an Online Peer Reviewing Process (FD Commons) to gain new insights regarding what is good practice for learning and teaching in higher education. The main objectives of this project are to support the peer review process and to restore and retrieve key concepts with multimedia information for the purpose of constructing e-teaching portfolios. FD Commons for peer reviewers and student monitors can allow them to multicast video, images,

and text from tablet PCs and PDAs, which are distributed over networks.

In this study, we reported ongoing system development and ten evaluation studies for investigating the usability and effects of FD Commons. We endeavored to determine whether FD Commons can record and restore the useful comments for educational improvement. Specially, we examined the differences in identification of educational events between student survey and FD Commons. The result indicated that more variation of comments was found when FD Commons was used. More importantly, this finding also suggested that the use of FD Commons might promote more variation of comments than student evaluation survey.

Second, we examined the differences in identification of educational events between novice teachers and faculty developer in use of FD Commons. The content analysis of “Snap Shots” suggested that there was a significant difference in the "Property of lecture content" and "Methodology" categories. The result indicated that FD Commons is capable of suggesting weak and strong points in class lectures as qualitative feedback from different reviewers' perspectives. When using FD Commons, more detail of class lecture might be analyzed and discussed by peer faculty and student monitors, which contributes to an understanding of teacher performance, good practice and student learning in higher education.

As with any other research, limitation of our work needs to be noted. The first limitation of the study was the small number of data being analyzed. This is due to the fact that we could not continue to use old version because we revised the system based on evaluation studies. Now we have developed FD Commons (Version 3), and plan to conduct new evaluation studies. Further studies with larger with lager sample sizes would be useful to verify our findings.

In future studies, we will develop a database of reviewer annotations as teaching portfolios with the capability to reuse collected comments to design a rubric to evaluate lectures as an e-teaching portfolio. The collected annotations are used to suggest weak and strong points of class lectures for teaching/learning evaluation. When using FD Commons in our institution, we would like to construct “Teaching Commons”, which are communities of educators and student mentors committed to pedagogical inquiry and innovation.

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Acknowledgment

This work has been partly supported by Microsoft Research Asia (MSRA) under Mobile Computing in Education Theme *"Innovation Based on Recognition Research Platform"* and CASIO Science Promotion Foundation.

I wish to thank MSRA project collaborative members, Prof. Norihiro Umeda, Prof. Shigeru Nagaki, and Prof. Yukiko Nakano for their cooperation. His project at TUAT : http://www.tuat.ac.jp/~fd_tools