

## Development of e-Teaching Portfolio for Ubiquitous Peer Reviewing Process

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**Abstract:** This system development realizes ubiquitous peer reviewing and reuse of comments of reviewers for assessment of teaching/learning in higher education. The purpose of this project is two fold: (1) to develop application for recording and storing reviewers annotations to streaming class lecture as time sequence data of pen-tip coordinates, and (2) to identify key principles and criteria from annotated video data to assess and evaluate the quality of teaching and learning (e-Portfolio). Moreover, by developing handwriting interface with easy operability, it aims to provide teachers outside class with on-line peer reviewing opportunity that is necessary to and relevant to their teaching/learning improvement. The collection of reviewers' annotations also has capability of reusing collected comments in order to suggest weak and strong points of class lectures and to design the rubric to assess lectures as e-teaching portfolio.

### Problems with traditional faculty Development

Higher educational institutions provide various institutional programs for educating and developing academic staff: from the development of teaching philosophies, through campaigns to raise awareness of certain key components, the strategic use of experts such as educational developers and teaching fellows, to funding projects aimed at particular issues. Such traditional faculty development approach, however, is sometimes problematic. One reason is because faculty members have few incentives and little time to investigate in professional efforts. In other words, even when faculty members recognize the scholarship of teaching and its difficulties, they often are pulled in other directions because scholarly activities involving research and publishing are valued more highly at many academic institutions (Boyer, 1990). Another reason is because 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 teaching skills.

Because of problems of 'top-down' models of faculty development, more effective strategy should be proposed, based upon individual contacts between staff at all levels, a mentor/developer, and students in their institution. In other words, more bottom-up approach is needed in order to cause real change to teaching activity in more academic staff by organizing a faculty learning community.

### Lesson Study: Assessment for Teaching and Learning

In order to collect useful information concerning teaching and learning improvement, student evaluation and self- and peer-assessment are conducted. These assessments 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, however, "*lesson study (Jyugyo kenkyu)*" is popular professional development approach whereby lecturers collaborate to study content, instruction, and how students solve problems and reach for understanding in order to improve instruction and learning at elementary and secondary schools. From engaging in "*lesson study*", teachers feel connected to each other and to a body of knowledge that they generate, share, and continuously refine. In other words, it is a highly justified activity, which allows teachers to come together to develop their pedagogical knowledge and skills.

Unfortunately, in the context of university education, it is difficult to learn from each other and break the pervasive isolation of professionals. Recently, some leaders at higher education provide Open Course Ware (OCW), which share free lecture notes, exams and other resources. But from the viewpoint of teacher training, its 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 is organized to conduct "lesson study" and to share teaching/learning knowledge for improvements by use of Information Communication Technology. 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 of collecting data of reviewers' comments, labeling them, and suggesting weak and strong points based on instructional design database. Strategies to improve instruction and criteria to assess the evaluation of teaching/learning are suggested by retrieving from database of reviewers' comments specific to a 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 learning 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 developed curriculum materials, technologies, instructional designs, they often concurrently conduct professional development for participating teachers.

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

The most effective way to improve their teaching/learning activities is rooted in real-world context of practice (Fishman & Davis, 2006). In other words, engagement in professional development requires teachers to examine their own practice, promotes reflection, provides opportunities for social supports and is closely related to what is expected to be taught in the classroom.

Learning sciences research on teacher learning and professional development has emphasized that "community" is essential to effective teacher learning (Bruckman, 2006). Huge amount of system development have tried 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 leaning-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).

In this paper, we report the result of our on-going development regarding the use of tablet PCs for peer reviewing. By developing handwriting interface with easy operability, it aims to provide teachers outside class with on-line peer reviewing opportunity that is necessary to and relevant to their teaching/learning improvement. Moreover, the database of reviewer annotation has capability of reusing collected comments in order to suggest weak and strong points of class lectures and to design the rubric to evaluate lectures as e-teaching portfolio. This system development realizes ubiquitous peer reviewing and reuse of comments of reviewers for assessment of teaching/learning in higher education.

We presents the the overview of our Online Peer Reviewing Process Project and five pilot studies conducted in 2008. By presetting result of our trials, we hope to gain new insights regarding what is good practice for learning and teaching in higher education. We also investigate the positive and negative effects of mobile computing for peer reviewing process.

## **Building Teaching Commons in Ubiquitous Environment**

The emergence of ubiquitous and wireless networks has lead to the wide deployment of mobile devices that

allow us to access and to handle information almost anytime, anywhere. Diverse multimedia application and Learning Management System (LMS) have also flourished with recent advances in hardware such as intensive video-capture devices and handwriting interface with easy operability. All these forms of interactive multimedia and communication tools offer new possibilities for supporting innovative ways of learning, collaborating, and communicating (Thornton & Houser, 2004).

Such rich representations by new media and network will support to build “Teaching Commons”, which are communities of educators committed to pedagogical inquiry and innovation come together to exchange ideas about teaching and learning, and use them to meet the challenges of educating students for personal, professional, and civic life in the twenty-first century (Huber & Hutchings, 2005). All who are committed to this teaching mission need ways to make new pedagogical practices, tools, and understandings broadly available, not only by building the teaching but also by ensuring access through new media and network.

Another trend is called “electronic teaching portfolios”, which can enhance the ability of teaching portfolios to provide rich presentations of college teaching and learning. Originally, teaching portfolio is a collection of materials that document teaching performance (Seldin, 2004). It brings together in one place information about a professor's most significant teaching accomplishments. If any teaching portfolio is stored on and accessed through electronic media, qualifies as an electronic teaching portfolio. Most important, by placing a teaching portfolio on the web, a faculty member takes a crucial step toward making his or her teaching public and available for others to comment on and learn from (Kahn, 2004).

### **Educational Resource for Improvement: MIT OpenCourseWare**

The Massachusetts Institute of Technology's OpenCourseWare (OCW) project is an important case. A large-scale Web-Based electronic publishing initiative, the OCW “makes MIT's core teaching materials—lecture notes, problem sets, syllabi, reading lists, simulations, etc.—freely and openly available for non-commercial educational purposes”(MIT OpenCourseWare, 2004, p2). The project plans to publish all MIT courses and then to begin a cycle of updating. This project has not only aimed to provide excellent educational resources all over the world, but has also helped MIT faculty themselves become more about their teaching and more aware of what their colleagues are doing in the classroom (Huber & Hutchings, 2005).

### **Making Good Work Public for Electronic Teaching Portfolio**

Hatch (2000) notes that as more faculty make presentations of their teaching publicly available via the web and have increased opportunities to look across the experiences of many different teachers working in many different disciplines and contexts. Through such process, they will provide chances to generalize from those experiences, and to develop, explore, and challenge new ideas and theories about teaching and learning.

Hatch et al. (2004) also emphasized that many scholars are excited about the promise of electronic media for “publishing” rich representations of teaching and learning, including solutions to course design and classroom problems, and examples of student work. This indicated the importance of teaching portfolios, which are developing new modes of collaboration and sharing, like teaching circles and project groups and new forms of presentation, like the course portfolio or the pedagogical colloquium (Huber & Hutchings, 2005).

### **Examples of Peer Reviewing Projects**

The Peer Reviewing of Teaching Projects headquartered at the University of Nebraska, the Visible Knowledge Project 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 snapshots for ideas to improve 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).

## Brief Overview of Online Peer Reviewing Process

The main objectives of this project are to support peer-reviewing process and to restore and retrieve key concepts with multimedia information for construction of e-teaching portfolio. We will develop content tools for the reviewers allowing them to multicast video, images, and text from tablet PCs and PDAs, which are distributed over networks.

By developing handwriting interface with easy operability, it aims to provide teachers outside class with on-line peer reviewing opportunity that is necessary to and relevant to their teaching/learning improvement. Moreover, the database of reviewer annotation has capability of reusing collected comments in order to suggest weak and strong points of class lectures and to design the rubric to evaluate lectures as e-teaching portfolio. This system development realizes ubiquitous peer reviewing and reuse of comments of reviewers for assessment of teaching/learning in higher education.

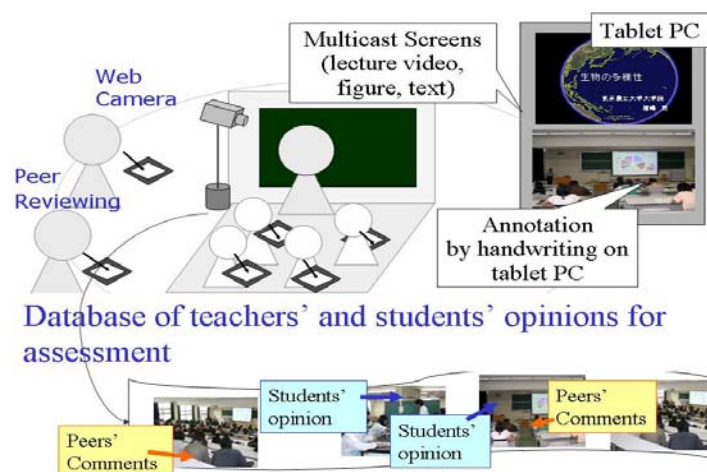


Fig.1 Overview of the Project

The project will develop the system can assist the peer-reviewers and students monitors to review the class rlectures and to record and retrieve the reviews comments on video lactures. The following fuctions are realised by use of InkML technology and multimedia networking technology (DirectShow).

- 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.

The collected annotations are used to suggest weak and strong points of class lectures for teaching/learning evaluation. Moreover, they are used to make the rubric to evaluate the quality of teaching/learning.

## System Design for Peer Reviewing Process

We have designed and developed an online peer reviewing system "FD\_Commons" for lesson study. This system developed using (DirecstShow) and Ink Markup Language (InkML), which realized integrated video streaming and annotation including lines, colors, erases, and extended tools (Houriet al.2008a,b).

DirectShow is a multimedia framework and API produced by Microsoft for software developers to perform various operations with media files or streams. It is the replacement for Microsoft's earlier Video for Windows technology. Based on the Microsoft Windows Component Object Model (COM) framework, DirectShow provides

a common interface for media across many programming languages, and is an extensible, filter-based framework that can render or record media files on demand at the behest of the user or developer. The DirectShow development tools and documentation were originally distributed as part of the DirectX SDK, however, they are currently distributed as part of the Windows SDK (formerly known as the Platform SDK).

On the other side, the Ink Markup Language is the data format used to represent ink entered with an electronic pen or stylus in a multimodal system. Hardware and software vendors have typically stored and represented digital ink using proprietary or restrictive formats. The lack of a public and comprehensive digital ink format has severely limited the capture, transmission, processing, and presentation of digital ink across heterogeneous devices developed by multiple vendors. In response to this need, the Ink Markup Language provides a simple and platform-neutral data format to promote the interchange of digital ink between software applications.

As detailed in the multimodal Interaction Requirements document, the W3C multimodal Interaction Activity is extending the Web user interface to allow multiple modes of interaction, offering users the choice of using their voice, or an input device such as a key pad, keyboard, mouse, stylus or other input device. For output, users will be able to listen to spoken prompts and audio, and to view information on graphical displays. The Working Group is developing markup specifications for synchronization across multiple modalities and devices with a wide range of capabilities. The specifications should be implementable on a royalty-free basis.

We designed and developed an Online Peer Reviewing Process (FD Commons) and conducted one pilot study in 2008. By presetting result of our trials, we hope to gain new insights regarding what is good practice for learning and teaching in higher education. In order to improve the present situation in higher education, a faculty learning community is organized to conduct “*lesson study*” and to share teaching/learning knowledge for improvements. This prototype system was developed by use of DirectShow and InkML technology.

### Prototype System for Online Peer Reviewing Process

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. We also investigate the positive and negative effects of mobile computing for peer reviewing process in pilot study of our prototype system. It also has the function to realize and build teaching commons to conduct “*lesson study*” and to share teaching/learning knowledge for improvements.



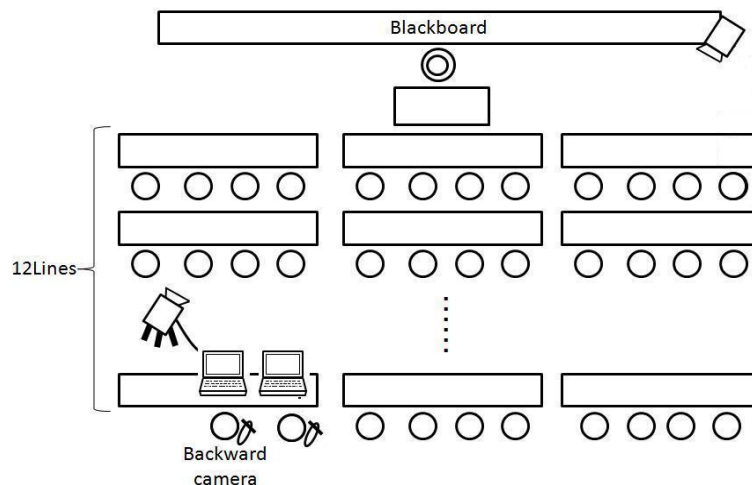
Fig.2 Screenshot of FD Commons (Ver. 2)

### Pilot Studies

In the pilot studies, we investigated the effects and operability of online peer reviewing system on five reviewers. The reviewers were all teachers who are faculty member at Tokyo University of Agriculture and Technology. One was instructional designers who belong to center of educational development (faculty developer). The others were academic staffs majoring computer science and mechanical engineering. Totally, five trials were conducted from July to October, 2008, as shown in Table 1. All reviewers who used "FD Commons" had no problem with system operability and their views of accessibility. In the set of each trial, two reviewers checked the media usability, interface design, and effectiveness of "FD Commons" in the situation (Fig.2).

**Table 1 Pilot Study of FD Commons**

	Date	Version	Class	Class Size (level)	Reviewer A	Reviewer B
1	2008.Jul.30	Ver. 1	Cognitive Interface Design	15 students (graduate)	Faculty Developer	Computer Science
2	2008.Oct.3	Ver. 2	Electronics	70 students (undergraduate)	Faculty Developer	Mechanical Engineering
3	2008.Oct.7	Ver. 2	Cross Cultural Communication	35 students (undergraduate)	Computer Science	Mechanical Engineering
4	2008.Oct.10	Ver. 3	Electronics	70 students (undergraduate)	Faculty Developer	Computer Science
5	2008.Oct.24	Ver. 3	Material Mechanics	70 students (undergraduate)	Faculty Developer	Mechanical Engineering



**Fig.3 Evaluation Study of the System**

**First Trial**

In the first set of trials on July, 30, two reviewers (faculty developer and computer science) were more likely to refine the multicasting functions including streaming video, voice sound, and annotation. Both reviewers used movies taken from a camera located backward to view both teacher and students (Fig.3). They started to add annotation from the beginning of the class. Reflection session was held immediately after the class.

In this evaluation study, we found the following three points concerning functions of FD commons (Ver.1):

- 1) Variation of color and size for pen device was not used in pilot study.
- 2) Time records of snapshots were useful for reviewers to identify the class events and teaching activities during

refection.

- 3) The functions of "New page" were confused with "Snap shot". Some records on summary kept the annotation in the brink of an eye because reviewers push the button of "New page" immediately after "Snap shot".

Additionally we found the following two points concerning effectiveness for educational improvement:

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

Base on the comments form two reviewers, we reconsidered the interface to integrate multicast information source for improving usability and developed version2 (Fig. 2).

## Conclusion and Future Works

Recent development in mobile technologies have contributed to the potential support learning and teaching for higher education. The emergence of ubiquitous and wireless networks has lead to the wide deployment of mobile devices that allow us to access and to handle information almost anytime, anywhere. Rich representations by new media and network will support to build "Teaching Commons", through thorough new media and network.

In this study, we proposed the prototype system which can realizes ubiquitous peer reviewing and reuse of comments of reviewers for assessment of teaching/learning in higher education. In future study, we will develop the database of reviewer annotation as teaching portfolios which has capability of reusing collected comments in order to suggest weak and strong points of class lectures, and to design the rubric to evaluate lectures as e-teaching portfolio.

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This project at TUAT : [http://www.tuat.ac.jp/~fd\\_tools](http://www.tuat.ac.jp/~fd_tools)