# Streaming Videos in Peer Assessment to Support Training Pre-service Teachers

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**ABSTRACT**

A web-based peer assessment system using video streaming technology was implemented to support the training of pre-service teachers. The peer assessment process was synchronized with viewing of peer teaching videos so that comments could be linked to the relevant position on the video. When one viewed a comment, the associated video segment could then be played, which allowed pre-service teachers to understand more precisely the nature of a reviewer's comment. Thirty-six pre-service computer teachers, who were enrolled in a teaching practicum course, participated in the study. Five rounds of peer assessment were conducted during pre-service teachers' micro- and field-teaching sessions. The findings showed that pre-service teachers were satisfied with the peer assessment activities and perceived the streaming video as a useful feature. The video streaming feature also played an important role during pre-service teachers' web-based dialogues, but was not as significant in terms of how they commented on or replied to peers. We provide some suggestions for improved use of this technique in the conclusion of our paper.

**Keywords**

Video streaming, Peer assessment, Pre-service teachers, Reflection

## Introduction

Peer assessment is a collaborative technique in which groups of students provide comments or feedback to one another. Studies have shown that the best outcomes occur as students build their own assessment skills while working with their peers (Bransford, Brown, & Cocking, 2000). The reciprocal similar-ability peer assessment seems to fit into Piaget's model of cognitive conflicts (Topping, 1998). It enables students to assess their understanding through explaining, simplifying, clarifying, summarizing, reorganizing, and cognitive restructuring. Cognitive and meta-cognitive benefits may then accrue. Furthermore, it affords students much more immediate and frequent feedback than one instructor can possibly provide. In his review of 109 peer assessment articles in higher education, Topping (1998) concluded that peer assessment is adequately reliable and valid — its effects were as good as or better than assessments done by teachers. Peer assessment has shown positive formative effects on student achievement and attitudes when peers give marks or grades to their fellow students. Topping concluded that the benefits of peer assessment in pre-service education included creative brainstorming and fine-tuning of lessons, which resulted in improved organization, preparation, and delivery of lessons. Additionally, other studies have shown that peer assessment improves pre-service teachers' assessment, reflection, and interpersonal skills (Sluijsmans, Brand-Gruwel, & van Merriënboer, 2002; Sluijsmans, Brand-Gruwel, van Merriënboer, & Bastiaens, 2003).

The use of computers and network technology to facilitate the peer assessment process is straightforward and can be used for a variety of tasks. Computers can serve organizational and record-keeping functions, such as randomly assigning peer assessors, allowing input of marks and feedback by peers, and integrating/calculating peer-assessed marks/feedback. Computer use reduces the time and effort needed by instructors to collect, tabulate, and disseminate information. The network capability adds even more flexibility: students can participate in the peer assessment process, submit and access materials, and interact with others anytime and anywhere. The use of networks in peer assessment has been used in teacher education programs to facilitate training of student teachers, and the results shown have been promising (Tsai, Lin, & Yuan, 2002; Morris & Waggett, 2004).

Video-based pedagogy has been widely adopted in teacher training. Videos facilitate observation of teaching practices for a variety of purposes, such as viewing good teaching exemplars and reflecting on one's self and peer-teaching instances. Video-case methodology portrays realistic classroom situations that give teachers opportunities to share experiences and to reflect on models or dilemmas of classroom practices (Friel & Carboni, 2000). Through video-recorded teaching instances, one can analyze, evaluate, and improve one's own teaching performance through self-reflection or from peer feedback. Wright (1998) reported that video-based self-evaluation provided impetus for teacher change. Kpanja (2001) also discovered that video-using groups showed significant progress in microteaching skills training when compared to groups that did not use video analysis. Video-based pedagogy has been shown to be enhanced through the use of web-based environments. Pre-service teachers can access various hyperlinked video cases associated with textual description, teacher reflections, and expert analysis (Williams, Lyman, Ford, & Dobyns, 2001) and they can also participate in web-based dialogues with peers to improve reflective practices (Steve & Weisner, 2004; Wu & Lee, 2004).

The use of video-based pedagogy and computerized peer-assessment in teacher training are fairly well documented; however, the integration of both approaches has received limited attention in the field. In this study, we implemented a peer assessment system that used streaming video to enhance pre-service teachers' reflection on their teaching skills. By using the system, pre-service teachers could not only view their peer teaching videos via the Internet but could also comment on teaching incidents by marking the relevant video segment. This paper reports our implementation of the system and how pre-service teachers perceived the usefulness of the system, along with an analysis of pre-service teachers' dialogues in the peer assessment process with the support of streaming videos. Finally, we discuss the agreement between peer assessment and teacher assessment.

## The peer assessment system

We implemented the peer assessment system to support a teaching practicum course, which is required for pre-service teachers in teacher education programs in Taiwan. The course usually consists of two components: micro-teaching in the university, followed by field-teaching in local schools. It is organized accordingly to provide students with opportunities to apply pedagogical theories in a realistic teaching situation. Traditionally, pre-service teachers enrolled in the course receive feedback from peers and instructors immediately after their micro-teaching sessions or from their supervising teachers during field-teaching. Often, due to limited class periods (2–4 hours per week) and a large student-instructor ratio (30–40 students with two instructors), pre-service teachers had few opportunities to interact with and receive feedback from peers and course instructors. The system was developed to enhance the interaction among pre-service teachers and instructors, to reduce instructors' loads for administering peer assessment, and to allow pre-service teachers to watch everyone's taped teaching sessions online. Taken together, this made the process of self reflection and peer assessment more convenient. Figure 1 is a snapshot seen by a pre-service teacher (Rick) who logged on to the system to assess a teaching session of a peer (Mary). The main functionalities of the system were shown on the top screen menu bar: *News* is for course announcements, *Micro-Teaching* and *Field-Teaching* are for uploading/viewing one's own teaching materials and taped teaching videos, *Visiting Peers* is for viewing others' teaching sessions, *Peer-Assessment* is for assessing the assigned peers, and *Charts* shows the top performers of each peer-assessment round. To summarize, the system was designed with three major features: personal portfolios, peer assessment, and reflective opportunities. A brief description of each feature follows.

## Personal portfolios

The system provided features to allow pre-service teachers store/access their teaching related materials via the Internet. These included lesson plans, handouts, reflective journals, and video clips (recorded during micro- and field-teaching) of teaching sessions. The left half of the system screen is dedicated to storing and/or viewing a pre-service teacher's teaching-related materials. In Figure 1, Mary's reflective journals were hidden from viewing by Rick (and other peers) for privacy consideration. Mary and the course instructors, however, were able to view the journals when viewing the teaching session.

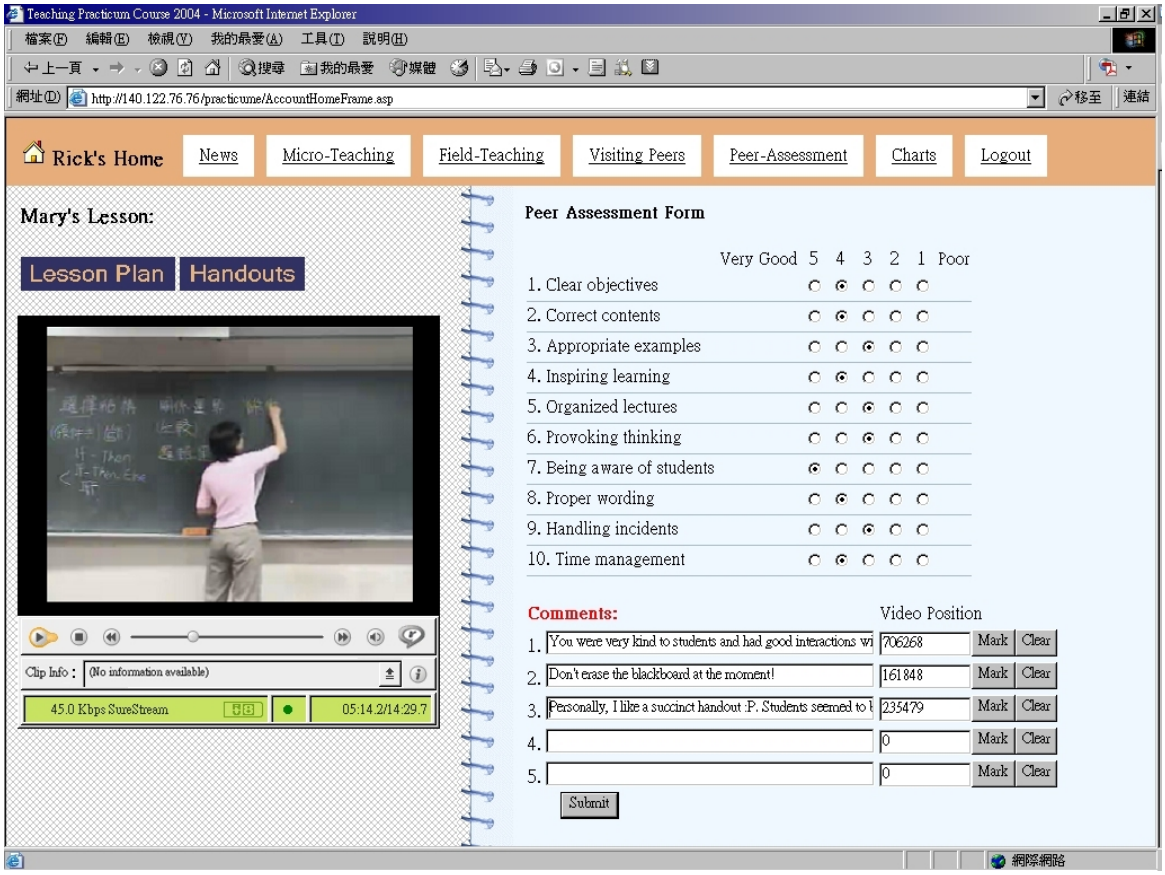


*Figure 1.* A snapshot of the peer assessment system

**Peer Assessment Summary Score** (assessed by 12 peers)

| | Very Good 5 4 3 2 1 Poor |
|---|---|
| 1. Clear objectives | 4 |
| 2. Correct contents | 4.25 |
| 3. Appropriate examples | 3.67 |
| 4. Inspiring learning | 3.33 |
| 5. Organized lectures | 4.17 |
| 6. Provoking thinking | 3.67 |
| 7. Being aware of students | 4 |
| 8. Proper wording | 4.17 |
| 9. Handling incidents | 3.58 |
| 10. Time management | 4 |
| Average Score | 3.88 |

*Figure 2.* The peer-assessed summary scores

## Peer assessment

After being randomly assigned peers for assessment, the pre-service teachers used an assessment form, found on the right half of the screen (see Figure 1), to assess a peer. The assessment form contains criteria related to teaching a

lesson unit (e.g., clear objectives, correct contents, organized presentation, motivating students, good management of time, etc.). The assessment process was synchronized with viewing of teaching videos so that a comment could be linked to the relevant position on the video. When a pre-service teacher wanted to comment on a particular screen image, he/she could "mark" the video position and provide comments. For example, in Figure 1, Rick was viewing the teaching video of Mary and ranking her performance by giving a score ranging from 1 to 5 on each item. When Mary was shown in a screenshot erasing a programming language syntax (which would be used in her following talk), Rick commented, "Don't erase the blackboard at the moment!" by marking that video position (Figure 1, Comment 2). When Mary viewed the comment later, the associated video segment could then be played, which made the comment more relevant and to the point. At the conclusion of peer assessment, the pre-service teachers were able to see their averaged peer-assessed score for each assessment item (Figure 2), summarized peer-assessed comments, the instructors' assessed scores and comments, and the best performance charts on the system.

## Reflective opportunities

In order to stimulate reflections on teaching, pre-service teachers were required to reply to peers' comments about their teaching and to submit a reflective journal at the conclusion of peer assessment. Figure 3 is a screenshot in which Mary was replying to Rick's comments. To keep assessors' identities anonymous, the system assigned a code number to the assessor, Rick (Peer #5). When replying to a comment, Mary could play the associated marked video position to see exactly what Rick had commented upon. All pre-service teachers' teaching sessions and peer-assessed comments/replies (but not assessed scores) were open to everyone, which facilitated the sharing of experiences. The intent of the reflective journal was to allow students to think about their performance and where they could improve in the future. In the reflective journal, pre-service teachers were asked to write down their thoughts about their own teaching instances, summarize peers' comments, and make notes on how they could improve in the future. A discussion forum was also linked with each teaching session so that pre-service teachers had opportunities to interact with others—not just the individuals they had been assigned to assess.

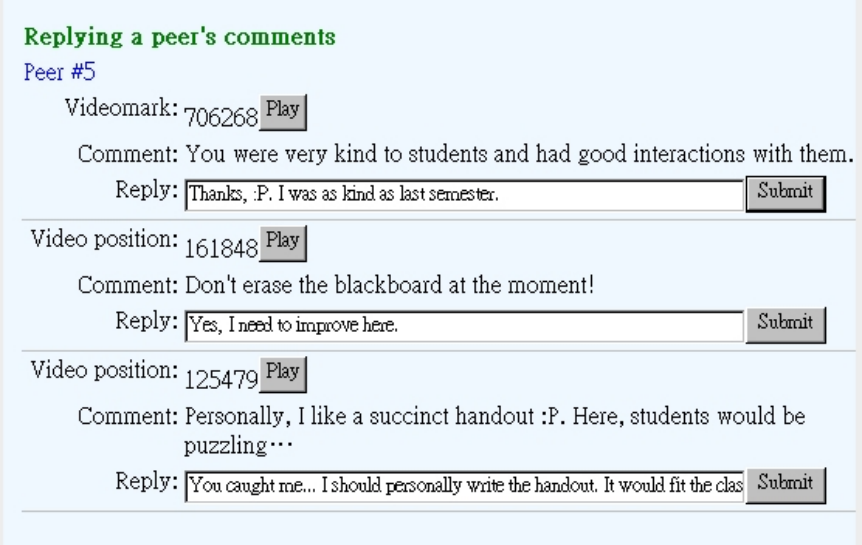


*Figure 3*. Comments/replies associated with one's teaching video clips

Two computer servers were used to implement the system. One server ran Microsoft Windows 2000 equipped with IIS 5.0 and kept all pre-service teachers' data in a Microsoft Access database. The other server was equipped with Real Networks system and was used for streaming video applications. Streaming video was used to allow quick viewing of teaching videos online and for quick playback of a specific segment of a teaching video. Figure 4 illustrates the architecture of the system.

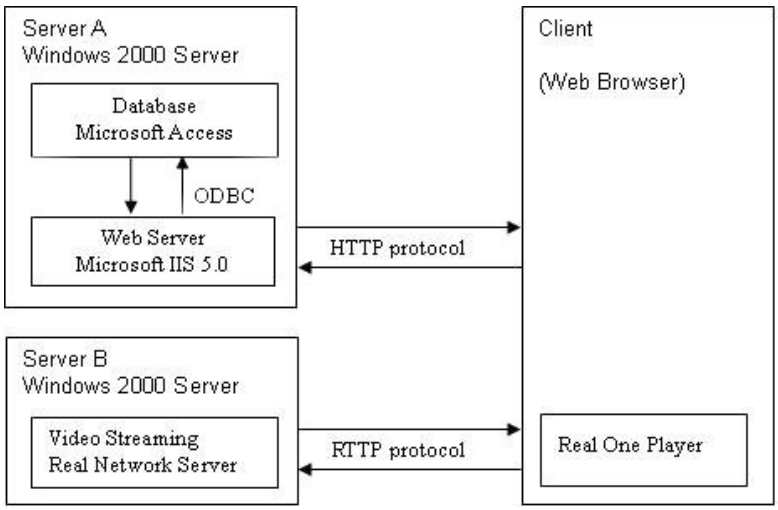


*Figure 4*. The system architecture

## Methodology

Thirty-six pre-service computer teachers enrolled in a teaching practicum course participated in the study. Five rounds of peer assessment (four in micro-teaching and one in field teaching) were conducted in the second semester of the course and lasted approximately three months (about two weeks for each micro-teaching round and one month for the field-teaching round). The pre-service teachers were required to assess two to five peers' teaching sessions each round, which depended upon the number of peers who conducted teaching during that round. All teaching sessions were video-taped for 10 to 15 minutes, transferred to a digital format (RM, Real Media format), and then uploaded to the system. A training session was conducted prior to the implementation, which demonstrated how to use the system, how to videotape a teaching session, and the process of peer assessment. To avoid possible bias and unfairness, pre-service teachers were informed that peer-assessed scores would not be counted toward their final course grades. The procedures for a peer-assessment round are summarized below:

1. Pre-service teachers upload teaching materials to the system prior to teaching sessions.
2. Pre-service teachers conduct teaching sessions, which are videotaped by peers.
3. The course teaching assistant transfers and uploads videotaped teaching sessions to the system.
4. Pre-service teachers are randomly assigned to assess peers.
5. Pre-service teachers and instructors complete the peer-assessment form online.
6. Assessment results (the assessed scores, comments, and charts) are announced online.
7. Pre-service teachers review and reply to comments given by peers, and engage in the web discussion forum.
8. Pre-service teachers submit reflective journals.
9. Instructors conclude the peer-assessment round.

The data collected and analyzed in this study included the following: questionnaires answered by the pre-service teachers after the final peer assessment round, comments and replies on the peer assessment forms, and peers' and instructors' assessed scores. We developed the questionnaire to contain three categories of questions. The first category asked pre-service teachers questions about their attitudes toward peer-assessment activities (nine items, see Table 1). The second category asked their perceptions about using streaming video (eight items, see Table 2). The last category solicited their feedback on the learning activities and the peer-assessment system (eight items). The first two categories were Likert-type questions. The pre-service teachers were asked to respond to specific questions by selecting responses on a four-point scale, which included "strongly agree," "agree," "disagree," and "strongly disagree." However, they were also opted to check the "other" response to provide written feedback. Peers' comments and replies were coded by two computer teachers (both with a master's degree in computer science education); the coding scheme was decided upon in a coding meeting and revised after a preliminary data coding session. All the comments were coded independently by the two coders and then discussed to resolve any potential discrepancies. Pre-service teachers' use of the Mark Video Position feature was also analyzed to investigate if the nature of comments was associated with using this feature.

## Results and discussions

We discussed the evaluation results from the following perspectives: students' attitudes toward the peer-assessment activities; perceptions about using the streaming video, comments, and replies associated with the "marking" aspect of the video feature; and the agreement between peer and instructor assessment.

### Attitudes toward peer-assessment activities

Table 1 summarizes pre-service teachers' attitudes toward the peer-assessment activities. Pre-service teachers' ratings on each of the Likert-type questions were converted to scores ranging from 4 to 1 as follows: 4 for strongly agree, 3 for agree, 2 for disagree, and 1 for strongly disagree. The ratings on the "other" option were excluded from computing the mean (*M*) and standard deviation (*SD*) of each question. Overall, the mean scores of the questions are greater than 3 (agree), which means the pre-service teachers were satisfied with the peer-assessment learning activities. Approximately 90 percent of the pre-service teachers were keen on knowing how others responded to their teaching (question 1), cared about the scores given by peers (question 2), and considered it an honor to be named on the best-performer charts (question 3). The pre-service teachers also agreed that peers' feedback was fair (question 4) and was useful for improving their teaching (questions 5 and 6). The process of replying to peers' comments increased their opportunities to reflect on the teaching (question 7). Finally, the pre-service teachers admitted they had spent more time preparing for teaching due to the implementation of peer assessment (question 8) and they liked the peer-assessment approach (question 9).

In their written comments, some pre-service teachers suggested that the assessment criteria might need to be modified when assessing brief video teaching sessions (10–15 minutes). Some who had received low scores in various assessment criteria requested additional explanation. The reason for assessing brief video teaching sessions in our study was to allow pre-service teachers to assess additional peers' sessions. Longer video teaching sessions might be tedious and not allow enough time for pre-service teachers to complete the viewing and provide appropriate feedback. The assessment form was originally designed for assessing a whole lesson unit in our course. A redesign of the form might be necessary when using it to evaluate shorter video teaching sessions. As to giving an explanation on assessed scores, a possible approach might be to provide links between assessment items (scores) and comments.

*Table 1*. Pre-service teachers' attitudes about peer assessment activities (*N* = 36)

| Questions | SA/A | D/SD | Other | *M* | *SD* |
|---|---|---|---|---|---|
| 1. I was eager to know the peer-assessment results after my teaching | 89% | 11% | 0% | 3.31 | 0.67 |
| 2. I care about the assessment scores given by peers | 89% | 11% | 0% | 3.08 | 0.55 |
| 3. I considered it an honor to be named on the charts | 89% | 8% | 3% | 3.11 | 0.53 |
| 4. The scores given by peers were fair | 94% | 3% | 3% | 3.11 | 0.40 |
| 5. Knowing my assessed scores helped me improve my teaching | 83% | 11% | 6% | 3.03 | 0.52 |
| 6. The comments from peers helped me improve my teaching | 89% | 8% | 3% | 3.17 | 0.57 |
| 7. Replying to peer's comments increased my reflection on teaching | 92% | 8% | 0% | 3.33 | 0.63 |
| 8. I spent more time preparing for teaching because of the peer assessment (as opposed to the last semester) | 89% | 11% | 0% | 3.00 | 0.48 |
| 9. I like learning by peer assessment | 86% | 11% | 3% | 3.03 | 0.51 |

*Note.* SA/A — Strongly Agree and Agree; D/SD — Disagree and Strongly Disagree

### Perceptions about using streaming video

Table 2 shows pre-service teachers' perceptions about using streaming video in the system. Overall, pre-service teachers responded positively to using this feature. They admitted that it was more convenient to watch the teaching videos when using the system, when compared to using VCRs during the previous semester (question 1). Viewing their own and others' teaching videos also resulted in improving teaching (questions 2 and 3). While viewing one's own videos was convenient and helpful, about one-third of participants may have viewed their videos only once (question 4, D/SD = 33%, *M* = 2.71). A pre-service teacher explained: "It was time-consuming to watch teaching videos when sometimes you needed to assess four peers in a round." Questions 5 and 6 reveal that the quality of the

streaming videos was acceptable, but a quarter of pre-service teachers might not be satisfied with the visual quality (question 6, D/SD = 25%, *M* = 2.66). We had used a 1:10 compression rate to transfer the videos to RM digital format. The average memory size of a teaching video was reduced from the original 170 MB to 17MB, which enhanced the Internet access speed (but at the expense of visual quality). Finally, pre-service teachers appreciated the features of marking video positions when making comments (question 7) and reading peers' comments while playing the corresponding "marked video segments" (question 8). Some complained that their assessors "only gave me comments but failed to mark the video positions." Below are several examples which students utilized the "mark-video" feature when commenting/replying (C = comment, R = reply):

C: You stayed on the left side of the blackboard the rest of the class time. You should move to the right "a quarter of the blackboard" [length].
R: Um … you are right. Also, I blocked students' views quite frequently. I didn't even notice it when I was teaching.…
C: Examples should be easily understood by students or they will be puzzled.
R: From the video segment [you marked], you are saying the "10 1s" [binary digits] example?! Well, I think it is still OK.
C: You looked at the notes very often — looks like you did not have confidence!
R: I just sneaked a look at it. I am surprised that it was so obvious on the video.…

*Table 2*. Pre-service teachers' perceptions about using streaming video (*N* = 36)

| Questions | SA/A | D/SD | Other | *M* | *SD* |
|---|---|---|---|---|---|
| 1. It was more convenient to watch teaching videos via the system (as opposed to using VCR in the last semester) | 91% | 3% | 6% | 3.47 | 0.56 |
| 2. It was helpful to watch my teaching videos | 100% | 0% | 0% | 3.28 | 0.45 |
| 3. Watching others' teaching videos improved my teaching | 92% | 8% | 0% | 3.11 | 0.52 |
| 4. I watched my teaching videos several times | 61% | 33% | 6% | 2.71 | 0.68 |
| 5. The audio quality of the videos was acceptable | 92% | 8% | 0% | 3.00 | 0.41 |
| 6. The visual quality of the videos was acceptable | 72% | 25% | 3% | 2.66 | 0.64 |
| 7. The "mark video" feature helped make my comments more concrete and to the point | 94% | 6% | 0% | 3.44 | 0.61 |
| 8. The "mark video" feature let me understand other's comments better | 100% | 0% | 0% | 3.42 | 0.50 |

*Note*. SA/A — Strongly Agree and Agree; D/SD — Disagree and Strongly Disagree

**Peers' comments and replies**

We were interested in knowing the nature of pre-service teachers' comments, how they replied to each other, and how the streaming video feature was utilized. There were a total of 1372 comments posted during the five-round peer assessment, an average of 7.6 comments per round per pre-service teacher. Of these, 66% commented with a "marked video" segment while 34% did not.

Table 3 shows the analysis of peers' comments. Since some comments appeared in more than one category, the total count (1432) is slightly more than the actual 1372 comments. Our analysis showed that "teaching method" (e.g., "please use a daily example to explain the ideas") was the category that received the most comments (category 1, 35% of the total comments), followed by "interactions with students" (e.g., "need to have eye contact with students") (category 2, 18%), "using blackboard" (e.g., "don't always turn your back to students when using the blackboard") (category 3, 14%), and "body language" (e.g., "you seemed not to know where to put your hands") (category 4, 13%). The percentage figures for each category may reflect the emphasis of the course and the concerns of the pre-service teachers at this stage of the training. The pre-service teachers who participated in the study had a strong content background (i.e., computer science) and interest in how to best present the content. This could explain why the category of the "teaching method" was of the most interest.

Table 3 also shows that pre-service teachers tended to use the "mark video" feature frequently. This feature was used fairly consistently across most categories: approximately two-thirds of comments were video-marked while one-third were not. The noticeable differences were on the categories "using blackboard" (category 3, 80% vs. 20%) and "wording" (category 6, 48% vs. 52%). It was believed that the blackboard was the most easily seen and static (non-moving) part of all the video-taped teaching sessions, which made it more convenient to be marked and commented upon. The audio nature of wording, conversely, was not easily viewed and might have resulted in being less frequently marked when individuals provided comments.

*Table 3*. Use of marked video feature in peer comments

| Category | Video-marked | Not video-marked | Total | % |
|---|---|---|---|---|
| 1. Teaching method | 329 (66%) | 172 (34%) | 501 | 35% |
| 2. Interactions with students | 171 (66%) | 89 (34%) | 260 | 18% |
| 3. Using blackboard | 160 (80%) | 40 (20%) | 200 | 14% |
| 4. Body language | 119 (64%) | 66 (36%) | 185 | 13% |
| 5. Using teaching tools | 75 (66%) | 38 (34%) | 113 | 8% |
| 6. Wording | 31 (48%) | 34 (52%) | 65 | 5% |
| 7. Content | 37 (61%) | 24 (39%) | 61 | 4% |
| 8. Other | 17 (36%) | 30 (64%) | 47 | 3% |
| Total | 939 (66%) | 493 (34%) | 1432 | 100% |

Peer replies were coded into five categories: "no reply," "agree," "elaborately agree" (agree with explanation), "disagree," and "irrelevant." Table 4 is a summary of the results. In 86 percent of the cases, a reply was provided. Only 14 percent of the peer replies fell in the category of "no reply" (category 1). About half of the replies fell into the category of "agree" (category 2, 47%). Of these replies, most pre-service teachers simply agreed with the peer's comment with a simple statement such as "yes" or "thank you." A significant percentage of replies provided more elaborate explanations (category 3, 35%) such as "Thank you. Because I was only paying attention on the content I am presenting.…" Very few pre-service teachers disagreed with their peers' comments (category 4, 2%). One such student, when confronted with "using an inappropriate example" in teaching the recursion concept, commented: "Well, I still consider it a good example because it was simple." In this instance, the student was made more aware of his teaching and provided reflective feedback. It is hypothesized that student reflection tended to occur more frequently when one was "elaborately agreeing" or "disagreeing" with others' comments. The comment/reply mechanism in our implementation did provide the pre-service teachers with more opportunities for reflection. Below are a few examples:

C: You did not present it clearly when mentioning the distinction between "tree" and "array" in the end. I guess it might have been because of the time limit.
R: I felt very ambivalent too. I would have liked to have finished the lecture even if the class had ran over a bit, but it turned out I left students with more puzzles to solve…
C: It was inappropriate to use English term (e.g., virtual circuit) [instead of its Chinese translation] when you first introduced the concept.
R: But I thought the English term was more popular.
C: It would be better to explain all the key ideas of the "case … switch" construct (such as "break" and "default") at the beginning, and then give examples. …
R: Um … I did think about how to present it so that students would comprehend it easily. I was afraid that students would be confused if I brought in "break" and "default" before they fully understood the mechanism of "case … switch."

We observed that the percentages of replies on video-marked and non video-marked comments in the "no reply" category (62% vs. 38%) were similar to the "total" (66% vs. 34%), which implies that the pre-service teachers' choice of replying to a comment or not might not relate to whether a comment was video-marked or not. In fact, a similar frequency pattern seemed to exist across all categories. A chi-square test (of homogeneity of proportions) was performed to determine whether the five replying categories exhibited the same frequency pattern. The statistical result showed that the frequencies among the categories were not significantly different, $\chi^2(4, 1372) = 2.18$, $p = .714$, which means the pre-teachers' replying behaviors appeared not to be affected by whether or not a comment was video-marked.

*Table 4*. Use of marked video feature in peer replies

| Category | Video-marked | Not video-marked | Total | % |
|---|---|---|---|---|
| 1. No reply | 121 (62%) | 74 (38%) | 195 | 14% |
| 2. Agree | 434 (67%) | 218 (33%) | 652 | 47% |
| 3. Elaborately agree | 323 (67%) | 157 (33%) | 480 | 35% |
| 4. Disagree | 14 (61%) | 9 (39%) | 23 | 2% |
| 5. Irrelevant | 15 (68%) | 7 (32%) | 22 | 2% |
| Total | 907 (66%) | 465 (34%) | 1372 | 100% |

**Peer assessment and instructor assessment**

The role and function of peer assessment might differ from that of instructor assessment; however, it would be favorable if the two corresponded in certain areas, such as in giving marks. Table 5 presents the Pearson correlation coefficients between peer and instructor assessment scores. The assessment scores given by both peers and instructors significantly match with respect to the following four assessment items: "correct contents" (item 2, $r(34) = .65$, $p < .01$), "appropriate examples" (item 3, $r(34) = .35$, $p < .05$), "organized lectures" (item 5, $r(34) = .42$, $p < .05$), and "being aware of students" (item 7, $r(34) = .55$, $p < .01$). The correlation coefficients of the remaining assessment items ranged from .25 to .32, indicating fair agreement between peers and instructors. As to the overall assessment scores, the agreement between peer and instructor assessment was significant, $r(34) = .89$, $p < .01$. Our results of the agreement between peers' and instructor' marks differ from those of Tsai, Lin, and Yuan (2002), in which pre-service teachers' and experts' marks disagreed when assessing peer-developed science activities. Their study did show, however, that pre-service teachers improved their work when using a networked peer assessment system (which is consistent with our findings). Topping's (1998) review also indicated that peer assessment of professional skills demonstrated adequate reliability, and the outcome was at least equivalent to that of teacher assessment.

*Table 5*. Correlation of peer and instructor assessment scores ($N = 36$)

| Assessment items | Measure | *M* | *SD* | *r* | *p* |
|---|---|---|---|---|---|
| 1. Clear objectives | Peers | 4.28 | .20 | .32 | .055 |
| | Instructors | 4.28 | .51 | | |
| 2. Correct contents | Peers | 4.19 | .29 | .65** | .001 |
| | Instructors | 3.97 | .65 | | |
| 3. Appropriate examples | Peers | 3.93 | .25 | .35* | .035 |
| | Instructors | 3.42 | .77 | | |
| 4. Inspiring learning | Peers | 3.60 | .29 | .28 | .095 |
| | Instructors | 2.56 | .85 | | |
| 5. Organized lectures | Peers | 4.12 | .27 | .42* | .012 |
| | Instructors | 3.72 | .85 | | |
| 6. Provoking thinking | Peers | 3.72 | .27 | .29 | .085 |
| | Instructors | 2.53 | .94 | | |
| 7. Being aware of students | Peers | 3.80 | .30 | .55** | .001 |
| | Instructors | 2.78 | .96 | | |
| 8. Proper wording | Peers | 4.07 | .18 | .30 | .081 |
| | Instructors | 3.75 | .44 | | |
| 9. Handling incidents | Peers | 3.72 | .22 | .27 | .111 |
| | Instructors | 3.83 | .61 | | |
| 10. Time management | Peers | 3.90 | .30 | .25 | .149 |
| | Instructors | 3.94 | .72 | | |
| Overall | Peers | 3.93 | .26 | .89** | .001 |
| | Instructors | 3.48 | .73 | | |

*$p < .05$, **$p < .01$.

Table 5 shows that pre-service teachers tended to give slightly higher scores than did instructors: the average scores given by peers were 3.93 when compared to the instructors' score of 3.48. Although our peer assessment process was anonymous, some pre-service teachers still said, "I did not feel comfortable giving my friends too low scores" (most of them have been in the same mentor class for years). Lin, Liu, and Yuan (2001) also found pre-service teachers hesitated to criticize their peers even in anonymous situations. Additionally, it was found that pre-service teachers considered instructors' comments to be "more objective" and "concrete and to the point" than their peers, and stated that "it would be better if the instructor could give me more feedback."

## Conclusions

When training pre-service teachers in traditional settings, owing to time and place constraints, taped videos of teaching sessions could be viewed only on a VCR by pre-service teachers (either alone or with the course instructor) at an arranged time. Due to these limitations, pre-service teachers had few opportunities to learn and to emulate from each other. With the Internet and video streaming technology, pre-service teachers in our study can now interact more frequently using a peer-interactive system, which allows for more accurate and more probing reviews of teaching instances. In addition, reflective dialogues can be tailored to a specific type or scenario of teaching.

Our evaluation results showed that pre-service teachers were satisfied with the peer assessment activities supported by the system and perceived the streaming video as a very useful feature. The results also showed that peer assessment was adequately reliable as teacher assessment. With the association of comments/replies with teaching videos in our system, pre-service teachers' assessment on peers' teaching tended to focus more on pedagogical aspects (such as teaching methods, interacting with students, and using the blackboard) and reflective opportunities were greatly promoted. The mark video feature was useful in providing more specific comments about peers' teaching, which allowed pre-service teachers to understand more precisely the nature of an assessor's comment. We believe that the linking of reviewer comments to actual teaching incidents is an important feature that helps motivate students. This allows them to reflect upon ways they can improve their teaching. We consider our implementation to be an effective approach in teacher education.

The use of streaming videos in peer assessment can be readily tailored to more specific needs of a variety of learning/training environments. Assessment criteria can be easily modified for lengthy or abbreviated teaching and learning modalities. Technical problems such as the low quality of video streaming can readily be enhanced. In our case, most of the pre-service teachers accessed the system via the campus network, which has a bandwidth ranging from 100 MB to 1 GB. Therefore, the visual quality can be improved by using a lower video compression rate without sacrificing Internet access speed. One final comment is that our teaching instances were video-taped by peers of pre-service teachers, who sometimes failed to record some critical teaching moments. As our class is usually large, it just isn't feasible to have a media professional support all the video taping. A practicable implementation of our approach will be to give pre-service teachers more training on taping a teaching session. In fact, the videos mainly serve as a means to stimulate reflective dialogue in peer assessment: the less-than-perfect quality may still be considered acceptable.

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