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ABSTRACT

As Web-based courses using videos have become popular in recent years, the issue of managing audiovisual aids has become noteworthy. The contents of audiovisual aids may include a lecture, an interview, a featurette, an experiment, etc. The audiovisual aids of Web-based courses are transformed into the streaming format that can make the quality of Internet-based videos acceptable to learners using a limited bandwidth. Although streaming technique enables learners' accessibility of audiovisual aids over Internet, the usage of audiovisual aids still totally adheres to instructors' perspectives. In fact, distance learners can contribute ideas not only in text format, but also in audiovisual format. However, previous research has not considered the feasibility of audiovisual aids contributed from distance learners. This paper argues that the usage of audiovisual aids from distance learners' perspectives should be considered in designing Web-based courses. To demonstrate this concept, this paper first introduces a screen camcorder tool that enables learners to record screen activity as videos in standard format or streaming format. Then, a collaborative learning strategy called Jigsaw II is applied to encourage expertise group streaming videos for training other learners. Finally, a preliminary survey of technology acceptance is implemented on 37 learners. Results confirm the feasibility of audiovisual aids contributed from distance learners. (Contains 13 references, 2 figures, and 2 tables.) (Author)

Record desktop activity as streaming videos for asynchronous, video-based collaborative learning

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Abstract: As Web-based courses using videos become popular in recent years, the issue of managing audio-visual aids becomes noteworthy. In general, the contents of audio-visual aids may include a lecture, an interview, a featurette, or an experiment etc. Then, the audio-visual aids of Web-based courses are transformed into the streaming format that can make the quality of Internet-based videos acceptable to learners using a limited bandwidth. Although streaming technique enables the learners' accessibility of audio-visual aids over Internet, the usage of audio-visual aids is still totally adhere to instructors' perspectives. In fact, distance learners can contribute ideas not only in text format, but also in audio-visual format. However, previous researches did not consider the feasibility of audio-visual aids contributed from distance learners. The objective of this paper is to argue that the usage of audio-visual aids from distance learners' perspectives should be considered in designing Web-based course. To demonstrate this concept, this paper first introduces a screen camcorder tool, which enables learners to record screen activity as videos in standard format or streaming format. Then, a collaborative learning strategy, called Jigsaw II, is applied to encourage expertise group contribute streaming videos for training other learners. Finally, a preliminary survey of technology acceptance is implemented on 37 learners. Results confirm the feasibility of audio-visual aids contributed from distance learners.

Introduction

As Web-based courses using videos become popular in recent years, the issue of managing audio-visual aids becomes noteworthy. It is not a new idea of using videos for distance learning (Kozma, 1986; Zigerell, 1991; Levne, 1992). For instance, a distance learning course may conventionally transmit videos by videotapes, cable TV, broadcast TV, or VCD. Although researches indicate that the face-to-face (synchronous or asynchronous) situation is not an essential factor of learning performance, some reports show that distance learners prefer video to other media. Hence, a distance learning instructor may often provide teaching video to distance learners by Internet in recent years.

The contents of audio-visual aids may include a lecture, an interview, a featurette, the operation of a machine, or an experiment etc. In fact, the contents of audio-visual aids are discipline-dependent. For instance, the major portion of the video contents for a Physics course may be used to demonstrate an experiment. Anyway, the instructor is the only provider of audio-visual aids in most Web-based courses. Furthermore, very few instructors were involved in planning or designing the teaching videos. Instead, audio-visual aids are considered as replacements of learning activities that can not be implemented in a classroom situation. As Benney said "Most certainly video is a successful medium for taking students into the field to observe facts, processes and emotional events which would otherwise be impossible to see and experience" (Benney, 2001).

To provide teaching video over Internet, the video signals should be transformed into the streaming format that can make the quality of Internet-based videos acceptable to learners in a limited bandwidth. The streaming format means that the requested video signals are stepwise transmitted from server to clients. The most famous commercial products for providing streaming-video functionalities are the windows media server of Microsoft™ and the realmedia server of RealNetworks™. Consequently, a Web-based course should prepare contents of videos, transform videos into streaming format, and setup a media server to provide teaching videos through Internet.

Existing learning strategies of video-based instruction can be categorized by three types: (1) passive watching, (2) learn/practice while watching, and (3) learn/practice after watching (DeMartino, 2001). The

passive watching strategy means that students do not be engaged in a discussion activity or a learn-by-doing activity. The passive watching strategy generally results in poor long-term outcomes. The learn/practice while watching strategy means that a student or a learning group can pauses, stops, forwards, or rewinds a video clip to self-pace learning by joining a discussion or learn-by-doing activity with learning partners. The learn/practice after watching strategy means that the discussion activity or learn-by-doing activity following a teaching video provides a reflective opportunity to deepen long-term outcomes.

No matter which type of learning strategies for video-based instruction is used, the usage of audio-visual aids is totally adhere to instructors' perspectives. Distance learners are not expected to be able to provide videos to depict an idea or communicate with others. Hence, a distance learning instructor tends to provide BBS, email list, or WBB (Web Bulletin Board) to support asynchronous, collaborative learning after watching an instruction-video (Repenning, Ioannidou, & Phillips, 1999). In fact, distance learners can contribute ideas not only in text format, but also in audio-visual format. However, previous researches did not consider the feasibility of audio-visual aids contributed from distance learners.

The required computer hardwares for videoconferencing, such as video camera, video capture card, and netowrk bandwidth etc., will be a considerable expense for a distance learner. Consequently, most Web-based courses do not implement completely video-based communication environment because of considering distance learners' financial burden. Moreover, video-based instruction is generally regarded as a synchronous communication tool or a passive medium such as recorded lectures. However, a noteworthy idea is that distance learners can contribute audio-visual aids in their own way instead of an instructor's way. In other words, distance learners can record computer screen activity as video and oral explanation as audio in a video-based communication environment without additional computer hardware. Consequently, distance learners can join the process of asynchronous, video-based instruction to ease the general problem, that is instructors tend to spend too much time lecturing, of video-based instruction.

To demonstrate this idea, the followng section first introduces a screen camcorder tool, which enables learners to record screen activity as videos in standard format or streaming format. Then, a collaborative learning strategy (Jigsaw II), which was proposed by Elliot Aronson(Slavin, 1995; Aronson & Patnoe, 1997), is applied to encourage expertise group contribute streaming videos for training other learners. Finally, a preliminary survey of technology acceptance was investigated and results are shown and discussed.

Computer Desktop Camcorder

Many commercial products can record computer desktop activity and voice from a microphone as videos in standard AVI formats, for instance Lotus™ ScreemCam[1], TechSmith™ Camtasia[2], and Hyperionics™ HyperCam[3] so on. Computer "desktop activity" means that learners' every action, such as open a file, execute a program, show slides for a lecture, use browser, and even all mouse-pointer movements so on, wil be recorded as a video. Furthermore, learners' explanations during the aforementioned interval of actions can be recorded as the audio track of a teaching video through the microphone of a computer. Because computer desktop or screen is like the viewfinder of a video recorder, aforementioned softwares are called *desktop camcorder* or *screen camera*.

Originally, desktop camcorder tools are used to train users for new software by an kind of active style. Hence, most desktop camcorder tools includes the following features:

(1) Users (here it means learners) can determine the video capture area.
(2) Users can use zoom effects to zoom in or zoom out during capture.
(3) Users can annotate a caption on the captured video.
(4) Users can use a microphone to input audio during capture.

To get an overview of computer desktop camcorder, TechSmith™ Camtasia is used for demonstration. Figure 1 illustrates use TechSmith™ Camtasia to capture slides, mouse movement, audio from microphone input as teaching videos. Instructors can press the capture hotkey or click on the record button (the red one) on the toolbar to start recording. During recording, Camtasia recorder can be minimized to aviod obstructing learners' lines of sight. Instructors can stop the capture by a hotkey and save the captured video to a file.

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[1] Lotus ScreenCam. URL: http://www.lotus.com/home.nsf/rightframe/1screencam
[2] TechSmith Camtasia. URL: http://www.techsmith.com
[3] Hyperionics HyperCam. URL: http://www.hyperionics.com/hc/index.html

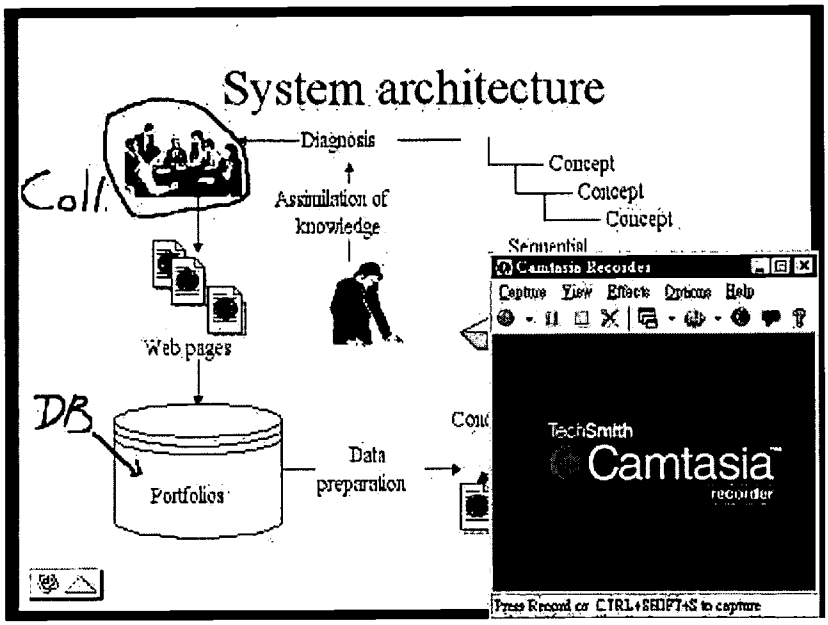

Figure 1. Use computer desktop camcorder to produce lecture videos.

In general, the captured videos are produced in standard AVI formats. However, the captured videos can be easily transformed into proper streaming formats that depends on the technology for streaming media services, i.e. the windows media server of Microsoft™ or the realmedia server of RealNetworks™. Both companies provide freeware to transform videos of standard AVI formats into proper formats. Fortunately, TechSmith™ Camtasia tools can support both transformations. Consequently, users can easily produce streaming videos no matter which technology for streaming media services is used.

Collaborative learning strategy

The elements for a collaborative learning strategy include heterogeneous grouping, interdependence, individual accountability, and group processing (Warschauer, 1997). Those elements are used to make sure learners will try to help each other. Some researches developed learning environment for implementing collaborative learning strategy (Brandon & Hollingsheda, 1999; Persico & Manca, 2000). However, there is not any collaborative learning environment based on streaming, asynchronous, and video-based technique instead of Web-based or videoconferencing techniques. Furthermore, collaborative learning strategies are also required to promote learning motivation and learning performance when we apply the novel technique to distance learners.

Before developing prototype system, another question arises from 'which one of collaborative learning strategies in literature is more suitable for computer desktop camcorder technique than others'. It is difficult to prove that a collaborative learning strategy is more suitable than others are because no literature reports using computer desktop camcorder technique in collaborative learning activities. Furthermore, the selected collaborative learning strategy should be able to encourage distance learners contributing instructional videos to training learning partners from distance learners' perspectives. In consideration of those issues, the Jigsaw II collaborative learning strategy is choosed because the expertise groups mechanism of Jigsaw II can support distance learners to master a learning topic. Then, we can encourage members of an expertise group to sharing their knowledge in streaming video style.

It is assumed that an instructor would like to construct a collaborative learning strategy, for this example Jigsaw II, on Web. In general, there are three steps in the Jigsaw II collaborative learning strategy. First, distance learners are heterogeneously assigned to groups according their cultures, mother tongues, and grade point averages so on. Hence, the groups of first step are called *heterogeneous groups or jigsaw groups*. Then, every distance learner of a heterogeneous group is respectively assigned to a study group for mastering a specific learning topic. Distance learners collaboratively study an expertise or learning topic to support each other

becoming an "expert" of a topic in a study group. Consequently, the study groups of step two are called *expertise groups*. Finally, every member of an expertise group will return to his/her own heterogeneous group. After distance learners return to geterogeneous groups, every member of a heterogeneous group is acountable for teaching a learning topic, which he/she learned in an expertise group, to the other members. In other words, each student should present a well-organized report to teaching a learning topic when he/she comes back to his/her heterogeneous group.

The required processes, heterogeneous groups, and expertise group for Jigsaw II collaborative learning are illustrated in Figure 2. From the perspective of a distance learner, computer desktop camcorder can support him/her to tutor learning partners in a heterogeneous group by video-based instruction. To apply video-based instruction, a distance learning instructor should setup a media server as a streaming video provider. Then, distance learners of an expertise group should not only study a learning topic, but also plan a teaching video. Finally, distance learners of an expertise group can produce a teahing video by computer desktop camcorder and upload the teaching video to a media server. Consequently, video-based instruciton in a heterogeneous group becomes feasible. The refining part of Jigsaw II collaborative learning is depicted in the right part of Figure 2.

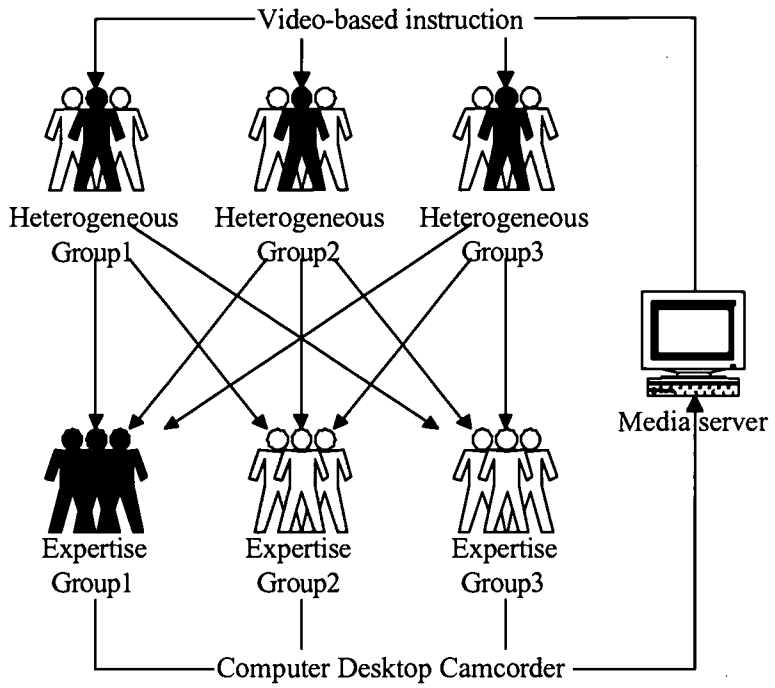

Figure 2. Integrating video-based instruction by a desktop camcoder supports Jigsaw II collaborative learning

Analysis of Preliminary Evaluation

The evaluation presented in this section attempts to analyze distance learners' technology acceptances of using desktop camcorder for collaborative learning. This experiment was carried out in Da Yeh University and a sample of 37 students (18 females and 19 males) was chosen from a class of information management department. The objective was to figure out how useful and ease of use the distance learners think desktop camcorder is.

A questionnaire, used in Davis 's technology acceptance model (TAM), was chosen as an evaluation tool (Davis, 1989). Davis 's TAM can support managers to understand the process of adopting new technology. One can realize the importance of TAM from this description: "(TAM)...are widely accepted among the MIS research community as tools for evaluating information system applications and predicting usage" (Doll, Hendrickson, &

Deng, 1998). In other words, the results of TAM can provide evidence to be weigh for or against the application of adopting desktop camcorder in collaborative learning. Originally, there are twleve questions classified as two categories (perceived usefulness and perceived ease of use) in Davis's questionnaire for TAM. In this evaluation, one overall ranking question was added to the original questionnaire. The contents of the questionnaire used in this evaluation are listed as following:

USEFULNESS	Q1.	Using <computer desktop camcorder> in my job would enable me to accomplish tasks more quickly.
	Q2.	Using <computer desktop camcorder> would improve my job performance.
	Q3.	Using <computer desktop camcorder> in my job would increase my productivity.
	Q4.	Using <computer desktop camcorder> would enhance my effectiveness on my job.
	Q5.	Using <computer desktop camcorder> would make it easier to do my job.
	Q6.	I would find <computer desktop camcorder> usefule in my job.
EASE OF USE	Q7.	Learning to operate <computer desktop camcorder> would be easy for me.
	Q8.	I would find it easy to get <computer desktop camcorder> to do what I want it to do.
	Q9.	My interaction with <computer desktop camcorder> would be clear and understandable.
	Q10.	I would find <computer desktop camcorder> to be flexible to interact with.
	Q11.	It would be easy for me to become skillful at using <computer desktop camcorder>.
	Q12.	I would find <computer desktop camcorder> easy to use.
	Q13.	Overall, I find using <computer desktop camcorder> useful in my job and believe that <computer desktop camcorder> is easy to use.

Table 1: Contents of the questionnaire for evaluation.

Every question in Table 1 was scored on a 7-point scales, with strongly disagree (1) and strongly agree (7) as the two endpoints. Table 2 depicts descriptive statistics to analyze results of this preliminary evaluation. From the mean of the 13-th question (Q13), most learners *agree* that computer desktop camcorder is useful and easy to use. Noteworthily, the data show that, on the average, learners' *perceived usefulness* respondents (Q1~Q6) had relatively lower than learners' *perceived ease of use* respondents (Q7~Q12). Through an informal interview, students indicate that video-based instruction is not very critical because they are not in a distance learning situation. One student said "it (teaching video) will be very useful in heterogeneous group status if we (learning partners of a heterogeneous group) can not meet one or two times per week".

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Mean	5.27	5.19	5.03	5.22	5.08	5.65	5.86	5.43	5.49	5.11	5.62	5.73	5.68
SD	1.52	1.21	1.38	1.46	1.62	1.36	0.98	1.26	1.10	1.43	1.16	1.12	1.42

Table 2: Descriptive statistics of preliminary evaluation results.

Conclusion

Although streaming technique enables the learners' accessibility of educational multimedia over Internet in recent years, the usage of educational multimedia is still totally adhere to instructors' perspectives. In other words, all teaching videos and audio-visual aids of most instructional website are contributed by instructors or instructional teams. This paper introduces a tool, computer desktop camcorder, to support distance learners contributing teaching videos for collaborative learning. We integrated computer desktop camcorder into a famous collaborative learning strategy, Jigsaw II, as additional supports for heterogeneous group learning. After training distance learners for using desktop camcorder, a preliminary evaluation of technology acceptance is implemented on 37 learners. Results show that most learners agree that computer desktop camcorder is useful for

collaborative learning and easy to use. Most important of all, this paper indicates the feasibility of audio-visual aids contributed from distance learners.

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