

# **Webcast Technology in Teaching: It's Implementation from the Perspective of Instructors**

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## **Abstract**

The paper reports issues relating to the use of three modes of webcast technology in the teaching of two undergraduate courses, namely, BTK4003 (Bioinformatics) for Bachelor of Science (Biotechnology) programme at the Faculty of Food Science and Biotechnology, and DCE 3301 (Learning at Workplace) for Bachelor of Science (Human Resource Development) programme at the Faculty of Educational Studies at the Universiti Putra Malaysia. The study, aimed in determining the effectiveness of using webcast technology at the university was carried out in two phases over a period of two successive academic sessions. This report focuses on the experiences and perceptions of the observers who were instructors of the two courses. Lectures were conducted via three different modes of webcasting: i) Live streaming; ii) Pre-recorded streaming; and iii) Video-on-demand. The fourth group, which is the control group received live face-to-face normal lecture. Observations noted by instructors during the actual exercise were reported back to the research team to be compiled throughout the duration of the study. Findings show that experiences relayed by instructors who participated in the study ranged from the instructors' state of readiness to be involved in the study to the management of students' behaviour and the quality of network and connectivity. Lessons learned throughout the course of the study as well as some recommendations on best-practises are discussed.

**Keywords:** Webcasting technology, live streaming, video-on-demand, ICT in education.

## **1. Introduction**

Distance education (DE) has a long tradition and is often delivered in the form of video (Schamber, 1988; Tobagi, 1995; Moore & Kearsley, 1996; Klein, 1998; Latchman, Salzman, Gillet, & Bouzekri, 1999; Jesshope & Liu, 2001; Pullen, 2001; Simonson, Smaldino, Albright, & Zvacek, 2003). According to reports (Hart-Davidson & Grice, 2001; Simonson et al., 2003), there are three main mode of delivery of distance education using video and these are: (i) interactive two-way video and audio, the so-called traditional video conference (Hu et al., 2002; Tesone, Kelsey, Gibson, & Blackwell, 2002), (ii) one-way live video and two-way audio (Fong & Hui, 2001), and (iii) one-way delayed audio and video (Barger, Gupta, Grudin, & Sanocki, 1999; Haga, 2002). Delivering distance education through the interactive two-way video and audio mode, has the obvious advantage where it is most closely resembled the atmosphere of the traditional classroom but it requires high-speed networks (Klein, 1998) and also requires that all learners participate synchronously at the same time. The one-way video and two-way audio mode of delivering distance education has been widely employed in the US and other more developed nations as a result of bandwidth scarcity, particularly in the last mile to the learners' homes. Many universities have been offering distance education courses in this profile since the 80's including some universities in Malaysia. In these courses, the video feed (including the instructor audio) is delivered using a combination of satellite and terrestrial microwave links in the context of the Instructional Television Fixed Service (ITFS) system (Gossman, 2001), or is delivered through local cable channels as in the case of the US or public broadcasting TV channels. The distance learners have the opportunity to make a phone call to the instructor in the classroom studio to ask questions and interact with the instructor provided they are attending the class synchronously. If the distance learners are to view the class video asynchronously at a different time, the distance learners have to record the class video for later viewing. With the recording, this form of distance education falls essentially into the one-way delayed video and audio mode. In the case of some universities in Malaysia, the mode of delivery is quite unique where distance education courses are delivered through regional centres having classrooms with video-conferencing facilities. The video-conferencing facility is to be used almost exclusively to deliver lectures via one-way live video broadcast for synchronous learning or to be recorded and be made available for asynchronous learning of regional learners. This also applies to video recordings of lectures made at the main campus by instructors and then physically transported to regional distance education centres due to the lack of high bandwidth to these centres from the main campus. A limited two-way live and interactive video-conferencing is possible but most of the time it is not implemented due to insufficient bandwidth; which will be enough to allow only one-way video-conferencing with marginally acceptable audio-video quality.

As bandwidth becomes readily available and affordable to many homes, many colleges and universities began the delivery of the distance education video via web-streaming (Shephard, 2003). The implementation of web-streaming or webcasting distance education falls mainly into the one-way video and audio mode as this is the most cost-effective in the present situation. Lectures were typically recorded using video cameras in a classroom setting together with on-campus students, and it can either be live-streamed synchronously to awaiting students in another place or post-produced digitally and deposited in a streaming server for pre-recorded streaming at pre-determined time or VOD where the announcement of the availability of the recorded lectures is posted on the class web site a few hours after the recording. The distance learners can then view the recorded lectures by streaming it from the class web site and interact with the instructor asynchronously, for example via e-mail, instant messages, web-based discussion boards, or possibly Short Message Service (SMS) or even Multimedia Message Service (MMS) on mobile devices.

In this paper, we define webcast technology or simply web-casting as delivering video via web-streaming. Lectures were conducted via three different modes of webcasting: 1) Live streaming; 2) Pre-recorded (Delayed) streaming; and 3) Pre-recorded Video-On-Demand (VOD)). Many earlier studies focussed mainly on the effectiveness of the technology towards students learning. Here, we report the

issues relating to the experiences and lesson learned on implementing the technology in teaching and learning from the perspectives of the instructors who participated in the study.

## **2. Objectives of the Study**

The objectives of the study were as follows:

- (i) To investigate issues faced by the instructors in the course of delivering webcast lectures;
- (ii) To examine the problems faced in the administration of webcast courses; and
- (iii) To determine issues on the technical aspects relating to the delivery of webcast lectures.

## **3. Research Method**

Two undergraduate courses, namely, BTK4003 (Bioinformatics) for BSc (Biotechnology) programme at the Faculty of Food Science and Biotechnology, and DCE 3301 (Learning at Workplace) for BSc (Human Resource Development) programme at the Faculty of Educational Studies at the Universiti Putra Malaysia were selected for the study. The study was carried out only on a part (one-third) of the entire course for both. Evaluation (marks for pre-tests and post-tests) for the part of the course under this study was counted as part of the final grade to ensure students' seriousness in participating. This is part of a major study on the effectiveness of using webcast technology implemented at the university. The respondents of the study comprised of 224 students in science and 212 students in social science. They were randomly selected and assigned to each of the four different groups: the live face-to-face (control), and the three streaming modes namely live-streaming, pre-recorded (delayed) streaming and pre-recorded VOD. The face-to-face mode and live-streaming mode were synchronous in nature whereby the lecturer gave a lecture directly to the students face-to-face as in normal lectures and at the same time this lecture was web-casted live to the live-streaming group in the next room. The asynchronous approach was applied through pre-recorded streaming mode and pre-recorded VOD mode whereby in Phase 1 of the study, lectures were recorded live and then transferred into post-production to be made available for viewing in pre-recorded streaming and VOD modes. Improvements were made in Phase 2 of the study where instructors did the recording in the studio without any student present.

Lecturers and students who participated in the study were asked to give their opinions concerning their experiences throughout the duration of the two phases of the study. Observations were also noted by facilitators during the actual exercise and reports were relayed back to the research team to be compiled. General improvements over the initial experimental design (Phase 1) were made as follows: (a) The manner in which the study was conducted, (b) The preparation of pre-recorded lectures, (c) The presentation material of the lectures, (d) The overall state of readiness on the technical and supporting staffs during the delivery of the lectures. Issues arising from the study according to the perspectives of the instructors are elaborated here.

## **4. Results and Discussions**

### **4.1. General Observations of the Study**

In conducting the study for the second in Phase 2, the research team was generally better prepared compared with the previous exercise (Phase 1). The team had ample time to create the pre-recorded lecture materials for the VOD mode and the quality of the lecture presentation materials was greater. This is due to the general improvements made in response to difficulties and shortcomings encountered during the Phase 1 of the study. Phase 1 was indeed a learning experience for all the team members and many of the problems faced were unanticipated despite all the preparation and well-thought out implementation plan.

Experiences relayed by the instructors who participated in the study touches issues relating to their general states of readiness to be involved in the study, the non-familiarity of the different modes of web-cast technology, the overall administration of the courses and the management of the students themselves.

#### **4.2. Issues Faced by Instructors During Delivery of Webcast Lectures**

The state of readiness and perceived feelings of the instructor in taking part in the study is hereby described. In Phase 1, despite several rounds of briefings on the experimental design of the study, technical seminars explaining the various modes of web-casting technology, and dry-runs on the lecture deliveries, the instructors still felt a certain degree of anxiety and generally not fully ready to participate in the study. Instructors were requested to pass their lecture materials to the technical team who will then made it available for use in the actual scheduled lecture delivery. The materials were mostly in presentation format (Powerpoint slides) although some of the materials were still in textual format (Word documents). Through our teaching experiences, textual format may affect students' perception and decrease their attentiveness to the materials presented. In the actual lecture delivery however, LCD projector was used to display the lecture materials of both formats. Live video recordings were made during the lecture, both for the live streaming of the lecture in a nearby classroom and also for the preparation of the video for the pre-recorded streaming and VOD. In the presence of the cameras and cameramen, the instructors were camera-conscious throughout the period and were unable to act naturally as in a normal lecture in a classroom.

Learning from the first phase, improvements over the general implementation of the lecture delivery were made especially in terms of lecture materials as well as the video recording of the lectures. In Phase 2, all lecture materials were in presentation format (Powerpoint slides) which negates the anticipated lower students' perception towards textual format (Word documents) of lecture materials used. During the actual lectures, this time in a much larger classroom, the instructors were more at ease with the presence of the video cameras and cameramen positioned in a much more comfortable distance compared with Phase 1. The instructors were more natural in the delivery of lectures and are able to move around. In response to the feedback made by students concerning the quality of the video in the pre-recorded streaming and VOD, the research team decided to pre-record the lectures and have the instructors deliver their lectures in front of the camera in an empty classroom. With this implementation, the instructors expressed the sense of oddities and artificial feelings in not having students in the classroom during the recordings and ended up looking straight into the camera most of the time. In this case, although we managed to overcome the problems associated with the poor quality of the pre-recorded lectures of Phase 1, we were met with another issue on the differences between the pre-recorded videos and the actual live lectures. Gestures made during live lecturing to emphasize certain points are not the same, if not totally absent, as what was recorded earlier (in the absence of students). Instant positive feedbacks from students' facial expression and body language are extremely important in ensuring lively, responsive and good delivery of lectures.

#### **4.3. Problems Associated with the Administration of Webcast Courses**

In this study, two problems were encountered in the administration of the two courses: 1) class scheduling and 2) managing students' behaviour.

In the case of class scheduling, we find it difficult to find two classrooms at the same lecture timeslots around UPM campus during the day; one ordinary classroom large enough to allow comfortable camera position (for live face-to-face) and another classroom or rather a computer laboratory equipped with 30 multimedia PCs complete with headphones (for live streaming). Furthermore, two more computer laboratories with the same facilities were needed for the pre-recorded streaming and VOD classes at different timeslots. As lecture rooms and timeslots were a scarce commodity in UPM, it was decided that the study be conducted at night for both Phase 1 and 2 in order

to overcome some of these difficulties. As has been mentioned earlier, in Phase 1 of the study, the limited choice of the classrooms and computer laboratories forced the study to be carried out in a much smaller classrooms and this has caused some of the shortcomings described in previous section. Better scheduling and access to a much bigger classrooms and computer laboratories with better computers were subsequently achieved in Phase 2 of the study. However, the study was still being conducted at night due to the non-availability of timeslots for the respective classrooms and computer laboratories. Class scheduling continued to be a problem and must be carefully considered for the implementation of webcast courses.

The second problem was on the task in managing students' behaviour during the running of the three modes of streaming where the classroom were located elsewhere. It is therefore impossible for the instructor to keep a watchful eye of the students while delivering the lectures. Here, the instructor needed the help of teaching assistants to mind the students and manage their behaviour during the running of the streaming classes. As examples, it was reported that a few students in the VOD group actually did not even download the pre-recorded VOD to their desktops and play them; instead, they did other activities like surfing the internet, emailing, doing class assignments for other courses, and so on. Students are not easy to control and close supervision is difficult. Therefore, in ensuring its effectiveness, classes for the three streaming modes must be closely monitored by teaching assistants or perhaps a close-circuit camera or web-cam with two-way audio communication.

#### **4.4. Technical Issues on the Delivery of Webcast Lectures**

A number of technical issues have arisen during the study; these include:

- 1) the preparation of the video recording of lectures,
- 2) the availability and quality of the network, and
- 3) the requirement of technical personnel.

During the recording of the lectures in Phase 1, two cameras with two cameramen were involved with another technician manning the video-mixer for recording. One camera focused on the instructor while the other camera focused on the projected screen. This was made worst by the fact that the classroom size was too small and there was not enough room for the cameras to maneuver and have good shooting angles and positions. In some of the video recordings made, the camera were focusing on the body instead of the face of the instructor and such recordings will easily distract the attention of students who watched the recorded lectures and may affect learning. For the second camera that records the presentation displayed on the screen, the quality of the recording was poor due to the usual problems associated with video-recording a TV screen (recurring horizontal lines) using ordinary non-synchronous video-camera. Lectures were recorded live with minimal post-production before compression and digitization in MPEG-2 format and ready to be streamed from streaming server. In Phase 2 of the study, the cameras were used exclusively to record the instructor while the presentation slides were added later during post-production of the pre-recorded lectures.

Streaming modes requires high bandwidth and stable network. The study was carried out in a stable, high capacity bandwidth (655Mbps) of UPMNET. It is anticipated and assumed that problems associated with the network should not occur. However, during the course of the study, especially in Phase 1, the network congestion did occur even with the network technicians on standby because of the simultaneous multiple of only one server that contained the pre-recorded streaming video. The technical team decided to add a second server in Phase 2 and changed the video format and the client software for accessing the streaming video from Media Player /Real Player to Quicktime in order to solve the network congestion problems. With all these technicalities in the production and delivery of the pre-recorded lectures, the instructors, with poor knowledge of such technology, were in a situation of complete and total reliance on technical personnel for technical supports. The instructors were really overwhelmed by the highly technical nature of delivering webcast lectures so much so that they became really nervous and apprehensive when delivering their lectures knowing that at anytime, their

lectures could be interrupted due to equipment or network failure. With the slightest interruption, instructors will lose students' attention and consequently can affect the teaching and learning process.

## **5. Summary and Concluding Remarks**

In this study, the instructors were aware from the beginning that there should be an equal treatment for the four groups and as such, the flexibility in conducting lectures both in the live face-to-face and pre-recorded sessions was very limited. The lecture method was effective in facilitating students' learning in order to change their knowledge and attitude if it is conducted in a careful and systematic manner. The lecturer should begin his lecture with imparting the learning objectives, move around the room, use visual aids, make eye contact, pay attention to body language, summarize the lesson and encourage student interaction. The interaction factor is the most important factor to ensure effective learning. Interaction includes those between the instructor and students, students and students as well as student and learning material/notes.

In conducting both live and pre-recorded delivery of lectures, both instructors admitted that they were in a tensed situation. They could not carry out the normal lecturing activities as what they are used to do in a normal lecture session. Instructors take the cue from the students and react accordingly during normal lectures in a normal classroom environment. During the live face-to-face session, their states of mind were continuously conscientious of the situation and to ensure that the lecture delivery should be as close as possible to that of pre-recorded video in Phase 2 of the study. Instructor's flexibility in teaching was thus limited. Interruption during the lecture occurred occasionally such as the live streaming class was not able to receive video or audio signal due to the video equipments not functioning properly or the network was not stable. These interruptions affected the smooth flow of lecture delivery and possibly the teaching and learning process on that occasion.

The application of webcast technology can certainly enhance learning among students in higher education. Among the advantages of webcast technology are:

- 1) presentations can be streamed and made available over the Internet without requiring lengthy downloads prior to viewing;
- 2) streaming can be made either live or on-demand;
- 3) access to streaming materials are not restricted to a limited number of students, and
- 4) reasonably large media files can be delivered to learners.

However, these advantages can only be realised on the condition that factors that facilitate learning are correctly addressed as mentioned earlier with the purpose of encouraging interactions between instructors and learners. In this study, the webcast technology allowed students to actively interact with learning materials which can be assessed and downloaded at any time and at the student's own pace. Unfortunately, there was no active interaction between the instructors and students as well as between students and their fellow course mates. The only learning experience that the students have were listening to the instructor's voice through headphones as well as seeing their faces and the presentation materials on the computer screen. Consequently, the students became very passive in the teaching and learning process.

The focus of the students on learning during the asynchronous approach was always interrupted either by technical problem of the computer or audio system as well as the absence of management or controlled mechanism of students' activities as they were unaccompanied by the instructors in the computer classroom.

From the present study, several suggestions on the effective application of technology in higher education can be made as follows:

1. The instructor is taught on the appropriate knowledge and be given training on skill in conducting lecture for the live streaming and prerecorded session either in terms of technical and pedagogical perspective.
2. The experiment should be conducted in the real situation during the normal lecture hours.

3. The students can access the learning materials from anywhere at anytime either from home, office or university.
4. Motivation courses for the lecturers so that they have the confidence and belief that the webcast technology can enhance learning.

Finally, it can be said that, in the present study, webcast technology was not utilized to its full potentials in facilitating the students' learning due to various factors ranging from the instructors' perception and state of readiness to the technology itself where it still has not reached its maturity.

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