

Impact of Video Recorded Lectures on Learning at Radboud University, Netherlands

by

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Abstract

Due to the continuous emergence of new technology, more and more students want to use technology for learning. Digital technology has become part of students' life today, hence the term Digital Natives in reference to today's students. A pilot survey was carried out at Radboud University, Netherlands to determine the impact of video recorded lectures on the students learning process. We present the findings from the survey indicating that students benefitted from the videos. The results we present reveal that the videos are often used to prepare for exams, future classes, catch up with missed classes, among others. The students appreciate the immediate availability of the information on video, the fact that they are able to make the most of micro moments; and they believe they perform better with the recorded videos, among other benefits. The researchers also give some recommendations for introducing the video recorded lectures in Least Developing Countries (LDCs).

Keywords: Videos, Video recorded lectures, Learning, Learning Styles.

1 INTRODUCTION

Learning occurs when information is input, processed, output and stored, and can be applied in novel situations. The learning style is the composite of the learners' motivation, information-processing habits, cognitive, affective, and physiological characters that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment while engaged in the learning process (Akdemir and Koszalka, 2007; Baykan and Nacar, 2007). Learning Style theory suggests that knowledge of students' learning style is important because they learn in different ways and it can be used to guide instructors in the selection of learning and assessment strategies. The individual learners have a preferred mode of learning. Learning styles indicate the success of the learning process by providing useful information about the individual's preferred mode of learning (Fleming, 2008). The instructor's role is to assess, teach knowledge, attitudes and skills to meet the students' educational needs for effective learning by matching the learning styles with the instructional style. The authors' state that students' motivation, achievement and performance improve when instruction adapts to learning styles. The traditional teaching and assessment methods are being replaced or supplemented with Information and Communication Technology (ICT) due to the problems of student numbers and lack of attainment of the Higher Order Cognitive skills required by the employers (Bagarukayo and Mbarika, 2008). Learning styles are increasingly being integrated into computer assisted learning with the advancement of technology. In order to improve learning it is therefore important to provide content that appeal to the students learning style.

1.1 Learning through Videos

Digital media has become a part of students' daily life due to the dissemination of digital technology (Ficheman and Lopes, 2008). Due to the continuous emergence of new technology, more and more students want to use hi-tech electronic devices for learning. Digital media can be used to support learning activities in and out of school in both formal and informal situations (Ficheman and Lopes, 2008). The authors further state that the digital natives are accustomed to speed, multitasking, random access, graphics-first, active, hyperlinked, connected, interactive, fun, video games, television (MTV) and the internet. Typically students are interested in using new technology like mobile phones, tablet computers, game computers, iTunes, video recordings, iPhones, iPods, iPads and social

media programs like Face book, Twitter, YouTube and Flickr. Therefore there is a demand for creation of tools that enable students to learn according to their current habits, at their own pace and time.

According to Ficheman and Lopes, (2008) it is believed that using new technology for learning may enhance the students' learning interest and motivation since it is easy to use and enables students learning outside the classroom. Today's students engage in learning activities in different spaces, time and situations. These can therefore be supported by digital media, which also support anywhere, anytime, learning, whether they are alone or with other learners. Digital media is believed to motivate the learners and engage them in the learning process. The use of digital technology may also make teachers work easier since teaching overcrowded classes is an uphill task (Ficheman and Lopes, 2008). As previously noted, students have different learning levels, learning preferences and styles, which may be addressed on an individual basis by digital technologies, thereby enhancing learning. The technology uses different types of (multi) media; text, videos, audios, among others and therefore addresses the different learners interests, needs, goals, preferences, styles and motivation. Past research highlights the importance of persona, defined as the user description and their goals (Blomkvist, 2002). It is therefore important to cater for the individual's learning goal during content design. The personalization concept is very important for students to attain the knowledge, skills, attitudes and competencies required for the work environment. The acquisition of knowledge, skills and attitudes also ties in well with Blooms taxonomy of learning (Bloom, 1956).

There are a growing number of universities worldwide recording lectures on video for students to access at their convenience. There is a great increase in the amount of audiovisual teaching resources freely available on the Internet which is usually very interesting, allowing students to attend a class regardless of time, pace and place (Arias *et al.*, 2011). Lecture recording before a live audience and providing the recorded audio stream, video stream and slides over the web is becoming more and more popular, because it provides for time independent learning (Zupancic and Horz, 2002). Previous research highlights several video recording techniques like the virtual videography, Authoring on the Fly system (AOF), among others. The AOF allows automatic production of a multimedia document with an

HTML overview, by automatically recording courses and transmitting live to other universities while holding the lectures in front of a live audience (Zupancic and Horz, 2002). The presentation is automatically recorded in the background as the teacher explains using the face to face (f2f) method on an electronic blackboard. There is no need for manual recording and post processing; therefore the recorded lectures are available on the local intranet in about an hour after the live presentation. Thus the students can use the recordings immediately for homework or exams preparation. The students can also use the content to comprehend and discuss what was hard to understand and carry out problem solving in their free time.

The Virtual Videography approach uses computer vision and signal processing methods to gather information about the lecture, a planning algorithm to choose appropriate shots, and image synthesis methods to generate new images from the original source footage (Heck *et al.*, 2006). The approach offers several advantages of providing effective, inexpensive, archiving of traditional lectures with an unobtrusive process which does not require the instructor to alter his or her lecture style for the camera; requires no special equipment for setup, works without calibration in a wide variety of classrooms; and editing requires little to no human input. The system can produce multiple videos of the same lecture, each tailored to a specific need or viewer preference. Berkeley, Stanford and Michigan are some of the universities that have made videos available to the students through podcasts on iTunes (Dijk *et al.*, 2010). Therefore, students are able to access the lectures anytime, anywhere and can study at their own pace.

Massachusetts Institute of Technology (MIT) is leading the trend in distribution of Open Courseware (Ficheman and Lopes, 2008). The university creates and avails course materials freely on the internet in a virtual learning environment. Video recorded lectures provide a convenient and effective way to archive lectures for future reference (Heck *et al.*, 2006). The videos are a permanent resource for students who enrol for the courses even after several years. The videos offer a self learning alternative to traditional classes (Arias *et al.*, 2011). In a study carried out (Arias *et al.*, 2011) students were required to learn theory on their own by watching the videos, to solve exercises assigned in advance. The students further explained their solutions on the blackboard as part of the evaluation method in the classroom. The lecturer only intervened to complete explanations, correct mistakes and give insights into the

previously digested material. The method also benefitted the teachers because they got feedback from the students, which helped them detect common difficulties in the subject. The results from the study showed that students using the video approach performed better than those using the f2f. The results further indicate that the video approach influenced the students' learning process more positively.

In the Netherlands, three technical universities, TU Delft, TU Twente, and TU Eindhoven, are currently using this new video technology (Dijk *et al.*, 2010). The University of Delft has 8000 hours of lectures on the Internet, with 30 employees to record and upload the videos online. Some universities are using shredded video lectures spread over several departments. At Radboud University Nijmegen (RU), video recording of lectures started in 2007 at the Faculty of Natural Sciences, Mathematics and Computer Science (FNWI). The social science faculty also introduced video recordings for their therapy lectures. The educational centre of the FNWI decided to record the lectures on video to determine whether they would improve the learning process. The recorded lectures are placed in the respective courses in the Blackboard (Bb) Electronic Learning Environment (ELE). At the beginning, there were 300 video recordings which have now escalated to 1200 new videos every year.

The hardware, software, internet and power are the main requirements for a successful video recording session. The video recording boxes are the hardware where all the necessary equipment is stored. The recordings were initially done using simple cameras with a tape to record the classes. The videos are stored on the server, which currently has approximately 6000 hours of recorded lectures on the intranet for students to access. The analogue signals are converted to digital signals and it is possible to choose the recording to make. The current recordings are High Definition recordings concurring with the advancement in technology. Compared to the recording capacity, it is not possible to record all the 550 courses every year, so the video recordings are done in turns. The criteria used to choose which class to record is based on when it was last recorded. For example, if a class is recorded this year, it may be skipped next year to give other courses a fair chance. The Bb user statistics and the web server statistics are used to determine how often the video recordings are used.

Learning videos provide content in different formats like text, audio, sound, pictures among others, thereby providing multimedia content. The content can therefore address students'

different preferences and styles and therefore enhance learning. Video recorded lectures offer flexible education tailored for increasing academic success since the conceptually difficult courses are recorded enabling anywhere anytime access at any pace, thereby enabling students to study difficult concepts of the courses repeatedly. The videos are effective because of their convenience since the students can choose the time, pace and place and repetition, since students can look at content over and over again if it was confusing the first time. The videos enable students to watch a lecture they were unable to attend, understand difficult concepts and to further process material from the lecture. The students who watch videos again have more time on task and are more motivated and interested in the first place than those that do not. Research done on the effects of video lectures shows that video lectures have a positive effect on the motivation and success of students (Arias *et al.*, 2011). They indicate that students pay more attention, are more involved, better prepared for exams and get better grades. Since the videos offer the advantages above, this indicates that learning is enhanced. The ability of students to view the content repeatedly and at their convenience also enhances learning. However, research at the University of Florida also shows that the learning efficiency of students, who attend classes only once, is lower than that of students who were in the lecture full time. Therefore the students should be encouraged to attend class even though the videos will be available on Bb.

The aim of this paper is to assess the impact of Video recorded lectures on learning. The paper reports about a pilot survey that was carried out to determine whether videos have an impact on the way students learn. It is hoped that it will provide knowledge that instructional designers, researchers and academics can use to design content, improve teaching methods and research to enhance students learning. In this paper, investigation on how multimedia content, in particular, video recordings support students during the learning process, is undertaken. The layout of this paper is as follows. First we describe the underlying technology and the infrastructure of the Electronic Learning Environment (ELE) in section 2. In section 3 we look at the methodology followed, we present the findings from the study in section 4 and conclude with the discussion and recommendations in section 5 finally.

2 TECHNOLOGY AND INFRASTRUCTURE

2.1 Blackboard Electronic Learning Environment

Blackboard (Bb) is a tool that aids teaching, learning and assessment and therefore impacts on learning in the classroom. It is a way of communicating to students inside and outside the classroom. The functionalities that Bb offers include digital testing, discussion forums, advanced statistics tracking, wikis, and chat rooms, among others. The use of the Bb as the ELE at RU started in 2000. RU has been using the new Blackboard version 9.1 since 2010. The look, feel and the user friendliness have been improved a lot compared to the initial versions. The teachers that have problems using Bb 9.1 can use the RU Bb blog and the video recordings training. The Bb is the medium in which the videos are presented. There is a link to the video recordings server on Bb for students to access the videos within a particular course for which they are enrolled. If a teacher agrees to record their course, the recordings are made available as M4V and / or Flash movie. The teacher can display the recordings in QuickTime, Windows Media Player etc. Some teachers may not want to be recorded for different reasons e.g. they may not want the materials to leave the classroom for copyright issues. In case the teacher does not want to show the videos, he is allowed to remove the code linking to these files by choosing 'Course Materials' and 'Video Recordings' in Bb. The teachers have the ability to remove the videos from Bb, but not from the server. However, the teachers need to realize that the students do appreciate the video recordings because of the benefits highlighted in the results section.

2.2 Flash player of the first generation

Bb has a flash player that offers online viewing of video files in the MV4 format. The videos can also be downloaded onto the PC for offline viewing. Bb checks that the flash player supported on the server system can handle older versions. The folders contain a combination of files generated from the recordings arranged by date. In Bb the videos are shown in a sub frame on the screen, using the iframe technique from html. The old flash player shows the single view video, with the recording of the teacher on the blackboard without extra functionalities.

2.3 Flash player of the second generation

A new flash recording player is available in Bb, although, the old recordings can still use the first generation recording flash player. The new flash player brings new advanced options, combining video, slide presentation and some extra functions to ease the usage of this facility. With the new flash player the videos can be downloaded but cannot run standalone. The students can use a button, which shows a chapter index, to zoom the video or slideshow. The student can skip to another part of the video using the chapter list or a button in the scroll bar; however, they cannot skip to a slide which is not yet downloaded. The new flash content enables the student to access different views of the video. It shows the teacher and the power point presentations at the same time. Therefore the students can switch screens between the power point and the teacher on the blackboard. There is a window that displays the chapter or the power point slides outline, which enables the students to switch between slides. The slide outline view enables the student to view the different presentation slides. Therefore, the student can select the slide they want to view without having to go through the entire presentation. Currently the students can choose to view either the power point presentations or the teacher on the blackboard.

The player has a search field on top of the chapter index that enables students to search for text in the PowerPoint slideshow. Therefore, students have the ability to search for a particular slide or topic by typing the key words, to search for the video they want to access. This view also maintains the teacher explaining about the exact topic that the student has searched for. This makes it very user friendly since the student does not have to go through the entire presentation each time. The new flash player uses XML files generated from the video recorded files to make this search functionality possible. The search uses Optical Character Recognition (OCR) to scan for text in the power point presentation and saves the XML file on the Podcast server. OCR techniques are used to disclose information contained in slides. The Multimedia department at the FNWI strongly recommends using text and not images at the beginning slide, to improve the OCR processing. With the new format, a video file can be downloaded and accessed from anywhere without necessarily having internet access. For the power point, the VGA signal is captured, copied and converted to another signal to scale it down to a smaller signal. It compares the difference in signal between the first and second slide.

2.4 Video Recording Lay-out and Processing

There are two types of videos the student can view i.e. where three quarters of the screen is the power point and the teacher on the blackboard is on a quarter of the screen. The second is where the students can view only the teacher on the blackboard. There are two cameras used during the recording sessions; one is for recording the power point presentations and the other records the teacher explaining on the traditional blackboard. The two types of video recordings taken at RU are elaborated below:

2.4.1 Single: Teacher Only Recorded

A remote controlled camera which is controlled by a student usually records one video. The recording is stored on the recording system. The robot zoom camera rotates by using the controller to capture all the different views of the teacher in class when recording the video signal.

2.4.2 Picture in Picture (PiP): Teacher and Power-point (computer display) both recorded

Two videos are recorded where the first video is the recording with a remote-controlled camera of the teacher explaining on a traditional blackboard. The second video is created by capturing the VGA / DVI output of a PC also connected to some beamer to display the power-point presentation. The remote-controlled camera is controlled by a student, who is in charge of starting and stopping the recording. Both recordings are stored on a dedicated recording system, a Macintosh laptop or MacMini with two fire wire Interfaces. The recording system requests for its schedule from the server once a day. Once the schedule is known, the system is capable of creating and storing the recording for that day without being connected to the network. Once reconnected to the network the system will send its recordings back to the servers for further processing.

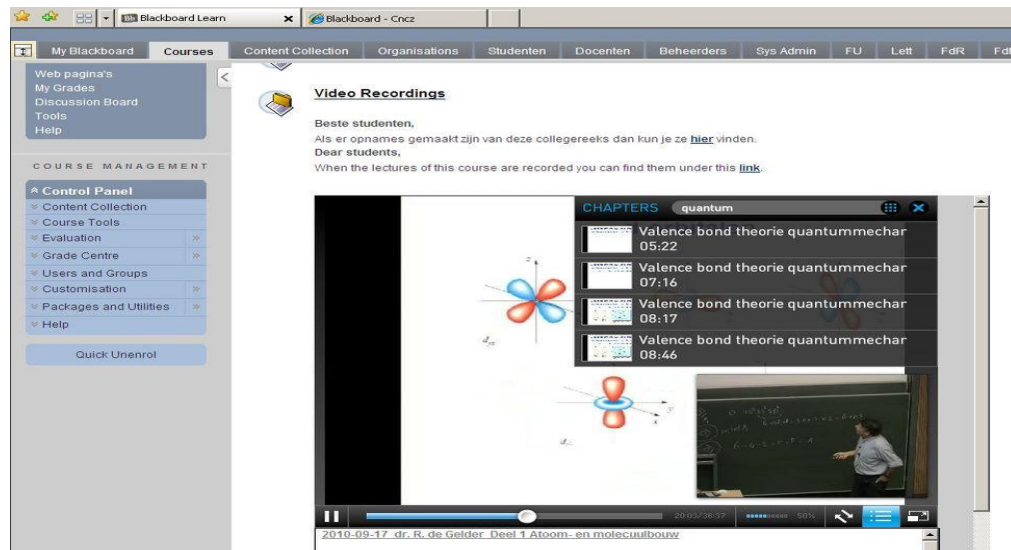


Figure 1: Video Recording Screen shot on Blackboard

2.4.3 Post Processing

Processing is converting the analog signals to PiP recordings. Once a recording is sent to the Servers, it is scheduled for post processing. The post processing depends on the type and version of the schedule selected when starting the recording, called work-flows. There are several work flows: one for 'Single' recordings, one for PiP recordings and some special purpose and test work-flows. The result of this post processing is usually three movie files: a MPEG4/H.264 movie with a resolution of 640x480 pixels specifically used for download, a flash video movie for displaying inside websites using JW Player and finally a proprietary XML/H.264 video to be displayed inside the website using the proprietary recording player. The PiP version is a single video built from two sources showing a small rectangular video at the lower left corner, with the video recording of the teacher and the Power point presentation (VGA capture of the laptop / beamer) in the main parts of the video.

The XML version is a MPEG4/H.264 video combined with pictures captured from the movie created from the VGA output. Changes in the VGA output usually trigger taking some snapshots. The snapshots taken are run through OCR software to capture the title of that sheet. The movie file, snapshots, time stamp and title are entered into some XML indexing file. The recording player uses this XML file to display the recording and the snapshots of the Power point presentation. After post processing the recording, the movies are automatically published on the web server. Data of the recording like author, title, course ID, dates and the URLs of the recordings are stored in a MySQL database. The web server itself then has scripts that use the course ID to select all recordings of lectures belonging to the course.

2.4.4. Draw Backs of Video Recordings

On the whole, there are fewer errors today as compared to when the video recordings began in 2007. The layout of the 'flash' videos needs more in built interactivity like a search engine. There is also need to fully automate the process from ingest to the delivery of the videos. Some of the problems faced with the video recordings include wrong course names on the videos. If the Power point slide presentation starts with a picture on the first slide, this also causes problems for OCR processing. If the teacher forgets to repeat a student's question for recording purposes, this creates a problem because the question will not be captured in the video recording.

3 METHODOLOGY

3.1 Video Recording Process in general

The entire process of the video recording is automated. The recorded videos are sent to the servers which process them by rendering them and generating the different flash versions which are stored on the Redundant Array of Independent Disks (RAID). The current flash player identifies the course numbers and automatically puts the video on the Bb link under that particular course. The students can access the video on Bb within an hour(s) after the class has taken place, depending on the type of recording. The recording box application shows the schedule, recording dates and the status of the video recordings which are edited when a recording is completed.

There are different views in the recording application software including the single view – with the teacher on the black board, and the PiP view where the power point presentation and the teacher on the black board are recorded. When a lecture is recorded, courses have two links on Bb for the two different videos formats – Shockwave Flash and M4V video files. The teachers have the right to remove the links to the video in Bb, for whatever reason. A single recording where only the teacher using the traditional blackboard and chalk is available on Bb within an hour, and within two or three hours for the PiP recordings. The server receives the recorded videos automatically, which are then converted into the different formats and sent to Bb, where the students can access them. Since all the lecture rooms have

internet, the recorded videos are automatically transmitted to the server for conversion to the different formats that students can view. Teachers are encouraged to repeat the questions student ask in class to capture them in the recording. The videos are not edited because the cost of hiring people for that purpose is high. There are rare occasions when editing is done, for example, if the recording started before the students had settled down. There are three different kinds of software used during the video recording process

1. The software on the laptop for recognizing and capturing information from hardware
2. The software on the server for recognizing the recorded lectures
3. The software for starting and stopping the video watching sessions

The videos are stored on the server, which has a backup server to avoid disruption in service and rebuilding, in case of failure which may lead to information loss. The backups are incremental; the backup system uses software solutions, and is independent of hardware. The backup software was compiled and installed on the servers. The Macintosh backup server uses free Open Source Software called Amanda, to back up the videos, in case the server collapses or information is lost. The RAID discs are mirrored so that if one breaks down, the synchronizing software copies the information from one disc to another. In the beginning all movies were stored, processed and published on the Macintosh server and its RAID Array. As time passed space requirements made it necessary to fork the web server and move storage to a 'bigger' machine. The Computing department chose to offload these functionalities to a Linux Server.

3.2 Monitoring a Video Recording Session

The researcher visited a class where a lecture was being recorded on video. The equipment is made up of a recording box, with a robot camera and a laptop. The teacher was using the traditional chalk and blackboard method to teach the students. The person recording therefore focused on the teacher's explanations along with the notes she made on the blackboard. The person recording kept moving the recording stick or controller to capture the different teacher views, since she was mobile. The noise students make can interfere with the recordings but the microphone, the teacher wears on the chest, is specially made not to capture sound far from the teacher's mouth. The microphone type picks only the nearby signals. The audio signals from the microphone are sent to the recording box. When the recording session or the class is done, and the person recording clicks 'stop', the video is automatically sent to the

server. The recording box software on the podcast system captures the videos from the server on the link <http://recordingserver.science.ru.nl/>



Figure 2: Video Recording Session

3.3 Survey

A survey was carried out on the use of video recordings during lectures at RU. Out of the 2100 students contacted by email to take part in the survey, 994 started and 911 completed all the questions which approximates to 43%. The students from FNWI took part in this study since it is the only faculty with video recorded lectures currently, apart from the therapy lectures in the faculty of Social Sciences. The questionnaires were hosted on a website, from where the students filled and received feedback. The student population was from several backgrounds of Biology, Information Science, Medical Biology, Physics and Astronomy, Chemistry, Mathematics, Molecular Life Sciences, Natural Sciences, thereby representing the entire faculty. 29% were first years, 19% second years, 19% third years, 12 % were fourth years and 21% were from 5th year and above.

4 RESULTS

The responses to the questionnaires filled by the students in indicate that 69% of the students had viewed the videos on Bb and 31% had not watched the videos in the academic year 2010/2011 and the previous years.

	#	Yes	%	No	%
1st year	272	216	79%	56	21%
2nd year	173	128	74%	45	26%
3rd year	181	138	76%	43	24%
4th year	117	82	70%	35	30%
5th year & above	200	91	46%	109	55%
average %			69		31

It is noteworthy that the number of students in the '5th year and above' that have not seen the video is high. Among the 69% who watched the videos, 52.2% said they look at the videos sometimes, and 47.8% look at them regularly.

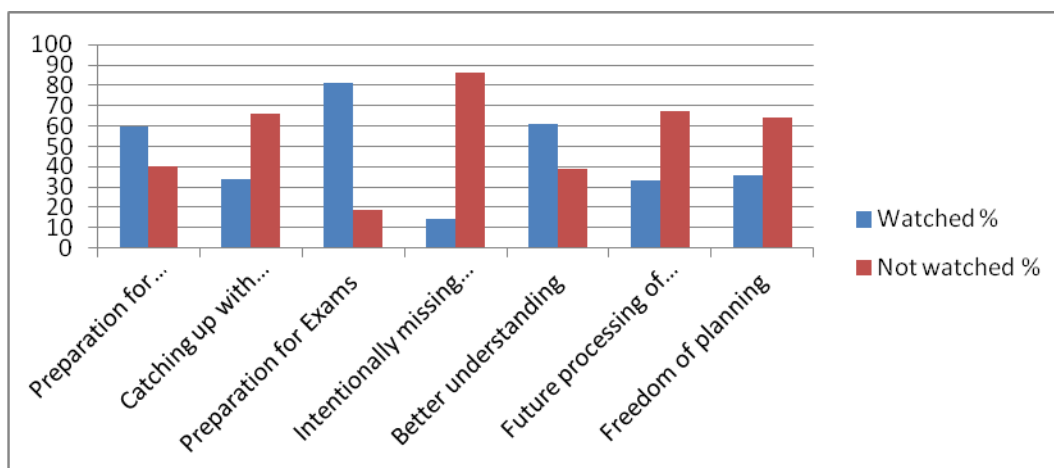
	#	sometimes	%	regularly	%
1st years	215	125	58%	90	42%
2nd years	128	71	56%	57	44%
3rd years	138	76	55%	62	45%
4th years	82	36	44%	46	56%
5th years & above	91	44	48%	47	52%
average %			52.2		47.8

There is a high number of 4th and '5th year and above' students that regularly view the lectures on video. The following section details the students' reasons for watching the video content.

4.1 Reasons for Watching the Video Recorded Lectures

The students had several reasons for watching the video recordings after the lecture had taken place.

Item	Watched %	Not watched %
Preparation for Coming Lectures	60	40
Catching up with missed lectures	34	66
Preparation for Exams	81	19
Intentionally missing lectures	14	86
Better understanding of difficult concepts	61	39
Future processing of notes	33	67
Freedom of planning	36	64
Increase exam grades	72	28



We summarize the results above as follows:-

4.1.1 Preparation for Coming Lectures

The students were asked how the videos helped them to prepare for the upcoming lectures. 46.4% said the videos help them to get better prepared for the next lecture, 7.8% said the videos helped them to make less notes, 7.2% said the videos enable them to ask more questions and 38.6% had other reasons.

	#	Better prepared	%	Make Less notes	%	Ask More questions	%	others	%
1st years	215	88	40%	21	9%	9	4%	97	47%
2nd years	128	62	48%	6	5%	13	10%	47	37%
3rd years	138	65	47%	13	9%	5	4%	55	40%
4th years	82	41	50%	4	5%	9	11%	28	34%
5th years	91	43	47%	10	11%	6	7%	32	35%
Average %			46.4		7.8		7.2		38.6

4.1.2 Freedom of Planning

36% of the students said the videos allowed them more freedom or option for planning and 64% did not think the videos allowed them planning freedom. Since the videos are available on Bb, this helps students to plan for their revision and prepare for exams and future classes. The videos are intended to improve the students' flexibility in the learning process.

4.1.3 Preparation for Exams

On average 81% of the students said they would continue watching more lectures on video to prepare for the exam and 19% would not use the videos for exam preparation.

Exam preparation	#	Yes	%	No	%
1st years	211	170	81%	41	19%
2nd years	127	107	84%	20	16%
3rd years	137	112	82%	25	18%
4th years	81	66	81%	15	19%
5th years	91	70	77%	21	23%
Average %			81		19

4.1.4 Further Processing or Completing the Notes

Sometimes during class the lecturer may be too fast for the students taking notes or certain concepts maybe hard to grasp at the time. The students have the ability to watch the videos, further process and complete the notes they may have missed taking in class. 33% of the students said that the videos enable them to further process or complete the notes they took during the lecture therefore 67% did not think the videos helped them complete and further process notes. The videos therefore help the students to understand better at their pace since they can revisit the lecture anytime from anywhere.

4.1.5 Better Final Exam Score

73% of the students said that watching the videos made them get a better final exam score and 27% did not think so. Therefore the videos improve the students' performance and exam results, and therefore are used to prepare for the exams.

Better Exams Score	#	Yes	%	No	%
1st years	211	145	69%	66	31%
2nd years	127	94	74%	33	26%
3rd years	137	97	71%	40	29%
4th years	81	65	80%	16	20%
5th years	91	65	71%	26	29%
Average %			73		27

4.1.6 Opportunities to Catch Up with the Missed Lectures

Sometimes students miss lectures for different reasons. 79% said they watch the videos to catch up with the class they missed and 21% did not watch the videos to catch up for missed classes. The videos therefore help students to compensate for the classes missed.

4.1.7 Better Understanding

61% of the students had a better understanding gained of the difficult subject and 39% did not think so. The students said the videos enabled them to understand the difficult concepts in the courses they were taking. Therefore the videos are very important because they enhance the understanding of difficult concepts.

4.1.8 Missing Lectures Intentionally

14% of the students felt that they did not have to attend the lecture because the videos would be available on Bb while 86% do not miss the lectures intentionally. 14% of students feel that they may stop coming to lectures because they are available on video. Therefore the number of students missing classes intentionally because of the videos in Bb is not big. The critics of the video recordings think that they may encourage students to dodge lectures, but as observed from the results, the students intentionally dodging class are few. Therefore the availability of videos in Bb is not encouraging students to dodge lectures.

4.2 Reasons Why Students Had Not Watched the Videos

The reasons why some students had not watched the videos include the following: -

- 16.2% of the students lacked the internet at home,
- 59.4% of the students said not all courses for which they registered were recorded,
- 3% of the students were not aware that lectures were recorded and
- 21.4 % of the students had other reasons.

Reasons	#	Lacked internet	%	Unrecorded Courses	%	Unaware	%	Others	%
1 st year	291	69	24%	85	29%	7	2%	77	45%
2 nd year	188	31	16%	122	65%	5	3%	26	16%
3 rd year	185	26	14%	109	59%	7	4%	44	23%
4 th year	123	16	13%	90	73%	1	1%	20	13%
5 th year & above	207	28	14%	148	71%	11	5%	38	10%
Average%			16.2		59.4		3		21.4

Therefore from the results in the table, the biggest reason for students not having watched the videos is because not all courses are recorded. The second reason is the absence of internet at home.

4.3 Teacher Interaction

73%, 68%, 73%, 67% and 55% of first year, second year, third year, fourth year and 'fifth year and above' students respectively, said the videos did not reduce the personal contact with the teacher. On average 67.2% said the videos did not reduce the personal contact with the teacher. However, 16.4% thought the videos reduced teacher interaction, 8.6% thought that there is more teacher interaction and 7.8% thought otherwise. The relatively high percentage of the 'fifth year and above' students who feel that there is less contact with the teacher as a result of the videos is outstanding.

	#	Yes	%	No	%	More interaction	%	others
1 st year	291	17	6%	213	73%	28	10%	11%
2 nd year	188	26	14%	128	68%	12	6%	12%
3 rd year	185	25	14%	135	73%	16	9%	4%
4 th year	123	22	18%	83	67%	10	8%	7%
5 th year & above	207	62	30%	114	55%	20	10%	5%
Average		16.4			67.2		8.6	7.8

4.4 Availability of Video Recordings from the Previous Years

Students were asked if the video recordings of courses from the previous years should be available for students interested in taking the course that year. 40.8% felt that they should be available on Bb in the context of that course, 32.2% felt they should be available outside of the Bb with an index and a search function, 19% said they should not be available and 8% thought otherwise. These results show that the students think the videos enhance their learning and therefore the university should have all courses video recorded. As part of future discussions with the Executive Board on participation in iTunes U, an inter-university repository of video material with index and search, i.e. "open courseware" (Dijk *et al.*, 2010), it is important to note that the number of senior students' interest in materials offered outside of Bb is increasing.

	#	Yes, relevant course in Bb	%	Yes, outside Bb with index and search	%	No	%	Others
1 st year	291	115	40%	62	21%	80	27%	12
2 nd year	188	82	44%	52	28%	33	18%	10
3 rd year	185	87	47%	63	34%	26	14%	5
4 th year	123	51	41%	42	34%	22	18%	7
5 th year & above	207	67	32%	91	44%	38	18%	6
Average			40.8		32.2		19	8

4.5 Video Lectures in the Coming Years

When asked about the future, 81% of the students said they will continue watching more lectures on video in preparation for the exam, and 56% said there are lectures they would have wished were recorded. Therefore the video lectures are important for the preparation of exams, classes, higher exam scores and to encourage the learning process. Students expressed the interest in videos, therefore indicating that they enable them to learn better.

5 DISCUSSION, CONCLUSION AND FUTURE RESEARCH

5.1 Discussion

The students' concerns and challenges about the new layout of the videos are elaborated below:

- The students had complaints about inability to view / read the blackboard when accessing the videos on Bb because the camera follows the teacher and therefore lacks a good overview of the blackboard.
- When using the projector, students need to visualize the speaker and the power-point slides. This is currently being addressed with small speakers on the screen and slides, which the students are very receptive of.
- The ability to 'skip' to a chapter is a great facility. However, some students feel that the operation is difficult and unclear sometimes.
- Students would like the rate at which the video is playing to vary e.g. they want to watch the videos at higher or lower speeds.

These concerns can be met with additional investments like an interactive whiteboard.

5.2 Students and Teachers

Students appreciate the immediate availability of information on video to make the most of micro moments. Based on their perceptions, the students believe the videos are a good supplement to the f2f classes. The benefits students highlighted include the ability to make up for colliding classes; catching up with missed lectures, preparation of class and exams,

among others. Some students use the videos as an insight to choose an elective to take in the coming academic year. As noted, most of the students said they would continue watching the videos in preparation for the exam, they would have a lower exam result without the videos and they wished all courses would be recorded. There is a need for more public relations and good prospects for the students to use the videos, since some of the students claimed that they were not aware that the videos existed.

On the other hand, the teachers feel that the videos are a good addition to the traditional classroom but should not replace the f2f classes. There is also need for the teachers to cooperate and support the students and facilitators to increase students' interest in the videos. Teachers should encourage students to attend lectures because the act of attendance is as important as the content of the lecture, especially in terms of motivation. Attending a lecture is a far bigger commitment than watching a video, especially where there are other distractions, which might show greater motivation in the first place. The lecture may provide motivation and focus to students who might otherwise lack it. The presence of fellow students in class affects motivation and provides opportunities to discuss topics that are confusing. Therefore the teachers need to highlight the importance of attending lectures to students.

5.3 Technology

The recent developments include the introduction of a new Flash Player using XML for extra functionalities and the removal of the audio files, because students hardly use them. The team would like to add the videos to iTunes, but there is still a long way to go because of copy rights issues and the costs involved. Once the files are added to iTunes, the teacher will not be able to remove them. The team wants to implement H.264 soon so that only M4V files can be generated and not Flash files as well. In future, the team intends to implement neat error handling by integrating the recording process and changing the course agenda so that there is a course view in Bb. The team also intends to integrate the recording agenda in the recording box application. The team is looking for more interactive TV displays to make the entire process electronic and also wants to introduce technology that enables a student to attach a question to a video so that the teacher can respond to a post that has been made at anytime.

The team is looking at introduction of the smart board 8070i interactive display system for business solution. This technology has the facility of enabling more than one person writing on the board simultaneously. It also supports the ability to move objects from one part of the screen to another, and has digital vision touch technology.

5.4 Policy

The video recordings started as a trial and error approach. However the university needs to make an organization-wide policy that goes beyond the technology. There is need for the central policies and central control to be clear. The university and the faculty boards should make policies for the videos to be compulsory in order to encourage the teachers to cooperate. Management should identify needs and how to carry out the processes. The four in balance monitor highlights the roles of leadership, cooperation and support of the staff in achieving the use of ICT for educational purposes at an institution (Tondeur *et al.*, 2009). The four in balance are the technology and social building blocks, including the vision, ICT infrastructure, expertise (knowledge, skills and attitudes) and the digital learning materials. The four elements together with the cooperation and support of the human resource, the pedagogical use of ICT for training and leadership will make the videos successfully. Therefore it is important that the leaders implement policies that work hand in hand with the teacher to support the video recording process and implementation.

5.5 Equipment cost

The video recording process is labor intensive and expensive. There is need for a server, storage, software, cameras, among others. The faculty records 140 hours of lectures every month, and charges the same for 10 to 20 students per working hours for 10 months per year, which is approximately 28,000 Euros. Approximately 16,000 Euros is required for five recording sets and infrastructure, therefore totaling to about 44,000 Euros for the audiovisual department to record all the lectures. The cost that the university incurs is approximately 60,000 Euro yearly to enable the video recordings. Therefore there is a need for finances to be set aside annually for the entire video recording process to be sustainable. This requires budgeting and the central administration's involvement to make the process effective and efficient. There have been a large number of measures and investments in both equipment and man power as a result of the need for quality videos to support the students.

5.6 Recommendations

RU can introduce the virtual videography approach because it offers several advantages like producing videos in a chosen editing style from limited inputs. As noted by (Heck *et al.*, 2006) the approach requires little to no human intervention, the system produces videos containing a variety of different shots and visual effects that serve to guide the viewer's attention and maintain visual interest, without violating the rules of cinematography. This approach does not require special equipment but creates effective lecture videos with much lower expense and intrusion. The approach also creates novel videos from archived lectures since the system is capable of producing videos of the same lecture at different aspect ratios. It is able to produce several different videos of the same event tailored to specific needs since the system postpones the video planning process until after the lecture. The ability to deal with this type of data will become more useful in the future since High Definition videos are becoming increasingly popular because of their high resolution.

Management is therefore encouraged to invest more in recording lectures on video since the results highlight the benefits. This will encourage more students to watch the videos. Management can also encourage the parents to subscribe for internet at home, to encourage students to study more at their own pace, place and time. They should also sensitize the students and staff on the importance of the videos and therefore encourage them to use them.

The introduction of Video recorded lectures in developing nations is currently a challenge because of the initial cost of investment for the equipment. Therefore researchers, academicians and content developers need to find methods for using use these instructional technologies to provide low cost distance learning course delivery in developing nations. One way of creating cheap videos is by recording lectures and saving them on CDs and / or DVDs. The course material for the university lectures can be recorded and stored on CD and / or DVD which can be used by students to learn from anywhere at any pace during their free time. This may reduce on the initial cost of the equipment for the video recording process. The materials can be transported from one institution to another and this may favor rural areas that still lack infrastructure. Since these materials are multimedia, they address the different learning styles and therefore are able to accommodate students from developing

nations with learning styles that require visual aids such as videos. This is important given that developing nations there are more dire priorities at accommodating such students.

5.7 Conclusions and Future Research

The survey indicates the students' strong demand for the video lectures; therefore there is need to increase the number of courses being video recorded. There is also need for quality of the videos to match the students' needs. The four building blocks of vision, educational software and content, ICT infrastructure and Knowledge, skills and attitudes (professionalization) need to be well balanced for ICT infrastructure to work efficiently and effectively (Tondeur *et al.*, 2009). There is also need for the cooperation, leadership and pedagogical use of ICT for learning, for the efficient use of the video recordings. Therefore for the success of the video recorded lectures at the institution, there is need for effort from the teachers, students and leadership. The technology and infrastructure is not enough on its own, there is need for cooperation and support of the staff to realize the vision of the institution. There is also a need to measure the extent to which all actions and investments in addition to better study ability can lead to better study results of courses with video recordings. In Future we intend to determine what makes video lectures educationally effective. We also hope that RU will launch the video recording of lectures for the entire university.

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