Using Video Conferencing for in–classroom teaching of a networking course

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The use of video conferencing and blended learning in higher education has been a topic of discussion for many years and while there are many proponents for the use of video conferencing for distance education, there has been less emphasis on the use of such technology inside the classroom. The ubiquity of computer aided technologies and the decreasing costs of cloud–based video conferencing solutions beyond those modules offered through traditional LMS environments, such as Blackboard Collaborate, were instrumental in driving this case study. Such dynamics in the evolution of video conferencing technologies created the interest for us to use a particular video conferencing solution, namely ZOOM in the delivery of a computer networking course where Cisco Packet Tracer network simulation tool alongside traditional presentation tools are used to deliver the content as well as give the students the learn–by–doing opportunity to practice their network configuration skills. In this study we will evaluate the benefit of using ZOOM to facilitate synchronous online learning inside the classroom and see whether the interaction between teacher and students as well as amongst the students have any significant pedagogical consequences. The video conferencing session will be recorded and made available to students as part of the asynchronous online learning resources. We hope the study will help us understand better the effectiveness of combining (traditional) online synchronous learning where students and teacher are physically in different locations compared to synchronous online in–classroom learning.

Key words: Video conferencing, Interactive classes, Synchronous learning, Collaborative learning, Blended learning

Introduction

Technology integration in the classroom requires a careful consideration of both the technical and pedagogical aspects. Video conferencing is one of the many tools that can be utilized for education. Traditionally, video conferencing tools have been used when the teacher and the students are not physically in the same location. However, little is known about the impact of such tools when the teachers and the students are physically co–located. Therefore, the focus of this case study is to better understand how a video conferencing tool can be utilized in Computer Information Systems' courses.

Computer Information Sciences and Applied Communications is one of the Colleges, also known as Divisions. Often college wide meeting across the 12 campuses in UAE involved travelling, which also affected student learning. Therefore, the division adopted a video conferencing tool, known as ZOOM, in order to make meetings more effective by cutting cost and travel time. This also promoted green IT policies.

It was not surprising that faculty were soon to be encouraged to use the same video conferencing tool with students as well as in academic divisional meetings. For many teachers, the use of Blackboard Collaborate in conducting online classes was becoming more entrenched

in their classroom delivery methods. When delivering classes to PM (afternoon/evening) students who work during the day (with a typical working day from 7am to 3pm) and come to classes from 3pm or 4pm and finish daily any time from 7pm to 9pm, it makes a lot of sense to use a blended approach in teaching and to conduct some of these classes in an online environment, be it in a synchronous (which accounts for most online classes) or in rare occasions, in an asynchronous approach to delivering content and assignments.

The focus of this study was to better understand the uses of such video conferencing tools within the classroom. The primary pedagogical approach behind using ZOOM inside the classroom is to encourage learning-by-doing. It is generally agreed that "most educators consider learning-by-doing the most effective way to learn" (Lombardi, 2007, p.2). The study aims to better understand how ZOOM can be used as a tool to promote collaboration and if ZOOM recordings have an effect on student learning.

The Tool

Here we will introduce one specific video conferencing tool called ZOOM, the tool which has been recommended for all academic meetings for the division since the start of the academic year in September 2013. While it is not our intention to base our research on a particular video conferencing tool, it is however important to note that this study assumes the availability and use of a video conferencing tool that facilitates an environment where users are able to experience

the following:

- High definition video quality

- Real time interaction among participant

- The ability for the host to share his/her screen whilst running various applications in the background without detrimental effect on the video quality. For the purposed of this study, this included the sharing of Cisco Packet Tracer, a simulation application essential in delivery of Cisco networking course.

- All of the above is achieved using a relatively average internet connection speeds accessible to most students from home or through 3G/4G connections, we may not have been so successful

Now that we have set the technical requirements and expectations of the video conferencing tool, we hope to demonstrate in this paper that using online synchronous teaching inside the classroom has added value to the teaching and learning experience and encouraged a higher level of collaboration amongst the students and their teacher.

Traditional Blended Learning Model

A significant amount of research went into studying alternative methods to face-to-face meetings and traditional teacher led classrooms (Wang, Jaeger, Liu, Guo and Xie, 2013; Arispe and Blake, 2012; Oztok. Zingaro, Brett and Hewitt, 2012; Stevenson and Hedberg,

2013; Dawson, 2010; Melville, Bowen and Passmore, 2011; Warden, Stanworth, Ren abd Warden, 2012; Macdonald and Cambell, 2011; Nedungadi and Raman, 2012; Roseth, Akcaolu and Zellner, 2013; Monteiro, Leite and Lima, 2013; Revels and Ciampa, 2012; Koenig, R. J. 2011; Chao, Hungt and Chen, 2011). An important conclusion from all of the above research and case studies carried out by academics all over the world is that the use of technology in a hybrid/blended classroom setting has become an established and favored component in the pedagogical design of course delivery. Whether it is synchronous or asynchronous online learning, a common feature of all of the above work is an agreement that distance education is now accepted as one of the delivery methods of course content alongside traditional face–to–face teacher–led classrooms.

The extent to which technology and its use in higher education has been the subject of numerous publications. "Higher Education, which was once dominated by an exchange between the instructor and the students in a classroom, has expanded to include a variety of delivery systems" (Renes & Strange, 2010, p.203). The benefits of technology in a hybrid or blended environment has always focused on the distance learning approach to synchronous and asynchronous teaching methods. According to the National Centre for Education Statistics, distance education is defined in the following way (2008, p.1):

Distance education was defined as a formal educational process in

which the instructor and the student are not in the same location. Thus, instruction might be synchronous or asynchronous, and it may involve communication through the use of video, audio, or computer technologies, or by correspondence (which may include both written correspondence and the use of technology such as CD–ROM).

Hybrid/blended online courses were defined as a combination of online and in–class instruction with reduced in–class seat time for students.

Another interesting outcome is that the use of video conferencing as an alternative method of communication is well established and has long been seen the best of such alternatives. Video conferencing has many benefits over auditory methods of communication as the visual dimension that is added to the conversation creates an environment closest to that felt in face–to–face communication (O'Conaill, Whitttaker and Wiber, 1993).

Clearly the whole emphasis here is on the use of technology and specifically video conferencing in a blended environment where the students are physically in a different location from the teacher for the duration of the online class.

Digital natives and blended approach

It goes without saying that young students belong to what many people call digital natives who are very comfortable with the use of

technology. Digital natives are more capable of multitasking. Older generation (including most teachers of today) are digital migrants as they had to come to terms with technology later in their life and perhaps not as comfortable with it. Digital migrants are most likely used to performing a single task at a time (Rodgers, Runyon, Starrett and Von Holzen, 2006).

Therefore, using of video conferencing tool which embeds amongst others, a chat tool will not pause much of a challenge to most students and likely they will find the experience quite enjoyable. Since we started using ZOOM for synchronous online teaching, whether in the traditional sense of remote access or inside the classroom, there has been positive response from students and generally requested to have all of their classes conducted this way and for all of their course.

METHOD

The students were all invited to join a ZOOM online session. There are a number of different ways which can be used to organize a video conferencing session (see Figure 1 below).
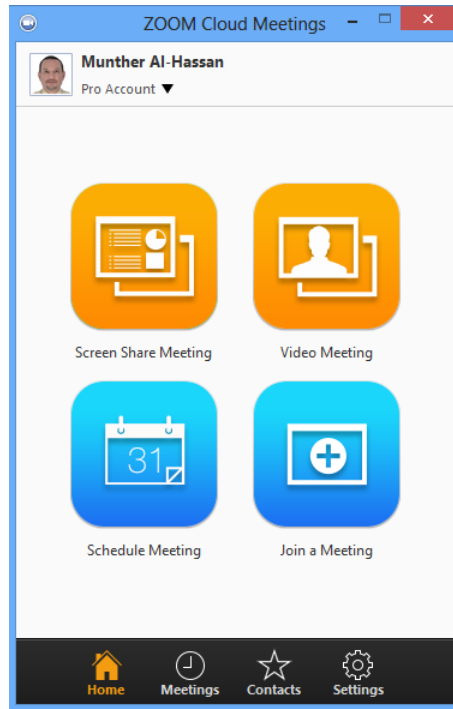
Figure 1: ZOOM control panel.

The teacher may elect to start a Video Meeting at the start of the scheduled class. Alternatively, the teacher may elect to send an invitation to the students by using the Schedule Meeting method either at the beginning of the class or even at a prior date before the scheduled class. With the latter method, the teacher is able to select the appropriate date and time. The teacher will then be able send the invitation using Outlook, Google Calendar or any Other Calendar. As both teachers and students use Outlook, choosing Outlook to send the invitation will automatically save the ZOOM session in the students' calendar and the students will get a pop–up to remind them of the ZOOM meeting at a pre–set time chosen by the teacher.

For in–classroom video conferencing, prior to starting the ZOOM session, the students are reminded to mute their microphone and speakers to stop audio feedback from the teacher's machine. Initially, a few minutes were wasted until the students get to mute their audio but with time the students become aware of those instructions and the teacher only needs to give a quick reminder.

As with other traditional synchronous online teaching tools, the teacher would have planned the lesson which would include sharing content with the students. For our study, the content is primarily Cisco Packet Tracer simulation application. However, this could be Power Point slides, browser window or a Word document. Irrespective of which specific content the teacher intends to share, it is recommended that the teacher launched the relevant application prior to starting the ZOOM session. This way when the teacher choose the ZOOM option to Share Screen, he/she only needs to select the appropriate window from the list of open windows on their machine.
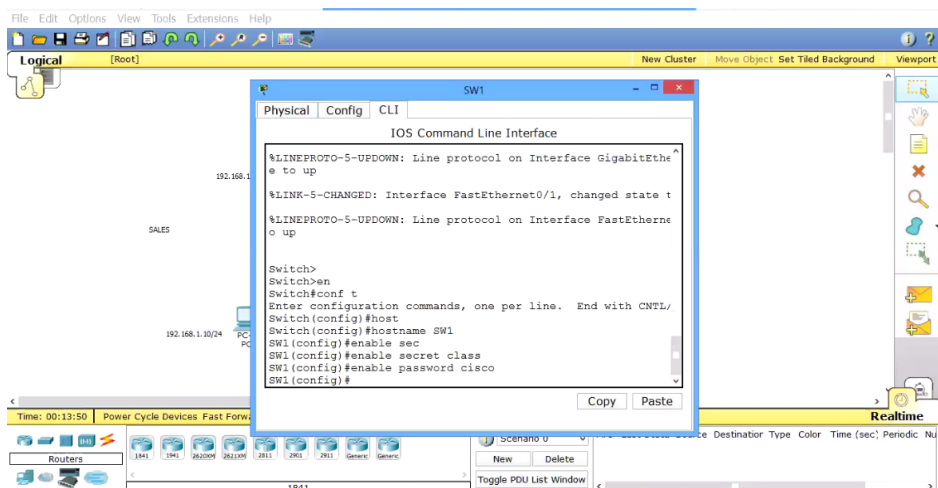

Figure 2: Cisco Packet Tracer application window shared through ZOOM.

Students are invited one at a time to participate in the configuration of the devices in a given network topology. Students like to participate rather than just listen (Lombardi, 2007). Depending on the level and prior knowledge, the student will even participate in the design and building of the network topology. Other students will, if needed, step in to give help to the student who is doing the configuration.

The overall experience results in higher levels of student engagement, collaboration and stimulates of their cognitive abilities resulting in an improved learning environment.

Discussion

This now brings us to the focus of this paper. Our small study will tackle the benefits of using video conferencing inside the classroom.

In–Classroom Video Conferencing Model

As we mentioned above, there is a lack of information when it comes to evaluating the benefits or otherwise of using video conferencing inside the classroom.

Our study focuses on discussing results based on the following two pillars:

- The of ZOOM as a collaborative tool for in–classroom teaching, and

- Recording of the ZOOM sessions and making the recording available to students on Blackboard Learn as asynchronous learning resources

We have also used ZOOM in synchronous blending learning setting where students and teacher are involved in a "traditional" online setting, in other words, they are all in different physical locations. Our study focuses on the use of ZOOM in a classroom setting and will not discuss any further the hybrid/blended use of online video conferencing technology as defined above. We will now discuss each of the above two pillars.

ZOOM as a Collaborative Tool for In–Classroom Teaching

There is always a little bit of humor the first time students experience the online sessions. Normally, the teacher would explain the tools available to the students, which for ZOOM are quite limited compared to, say, Blackboard Collaborate. Whereas this phase is true for both remote and in–classroom online sessions, it is perhaps a little more exaggerated in the latter because of the close proximity of students to each other inside the classroom. We believe this close proximity also gives rise to an enhanced collaborative environment where students are encouraged by peers to take a more active role in the class discussion which increases the level of student engagement and therefore stimulates their cognitive abilities leading to a better learning experience.

The use of a video conferencing tool brings the content closer to the student as opposed to sitting at a distance and following the content displayed on the classroom projector. This by itself raises the level of student engagement as is the case with certain content and especially

Cisco networking simulation application such as Packet Tracer, can be sometimes a little frustrating to students because of the small fonts (see Figure 2). Yes, the fonts can be enlarged, but only a portion of the network diagram will be displayed and the student loses the overall picture. As the network topology becomes larger and busy with more networking devices, seeing only part of the network topology will make it difficult to follow what is happening from end–to–end.

While this is a good reason to have each student accessing the teacher's screen, it is not the main benefit. We believe the combined action of teacher seeing each of the students in close proximity and asking them to take control of the teacher's screen to carry out certain tasks brings an all–important learning–by–doing element into the classroom experience. In contrast to a traditional synchronous online setting where the students are accessing the course from many different locations, the students here get the encouragement as well as a bit of added pressure understandably arising from the competitive nature of students wanting to perform and succeed. All of this comes with immediate satisfaction which can be detected and seen on the faces of their classroom peers. All of these emotions are being felt instantaneously in an atmosphere that is lacking from a traditional synchronous online class.

Recording of the ZOOM sessions

As soon as the ZOOM session is over, an MP4 video file is generated by the application. As well as the full session recording file, sometimes the online session is broken into a number of smaller files, each of which corresponds to the duration over which the host's screen is shared. Every time the host stops sharing a window, say of a Packet Tracer simulation exercise or a Power Point presentation, and starts a new screen sharing, then a new and separate MP4 file is created associated with that particular screen share.

The file is subsequently uploaded to Bb learn and made available for students as part of their course resources.

Putting it All Together

Our study has demonstrated that student learning experience has improved through the use of ZOOM as an in-classroom teaching medium. The final exam results for two sets of student cohorts from different semesters are compared. For one student cohort, ZOOM was not used at all, whereas for the second cohort, ZOOM was used in the way described above.

The following results relate to the other main pillar of this study which is about making the recording of the video sessions available to students as part of their course resources.
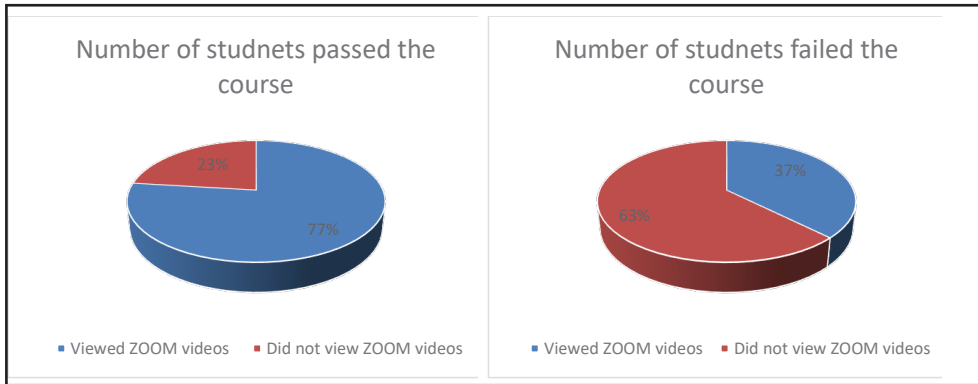
Figure 3: Comparison of student passing rate with reference to viewing the ZOOM video recordings

We can see from Figure 3, that **63%** of students who did not access the recorded ZOOM sessions failed the course, compared to **77%** of students who accessed the recording and passed the course. It is fair to say that the above results are based on a small sample of students relating to two cohorts and further study will be required before the results can be seen as conclusive.

Conclusion

The study has in general been successful in demonstrating that using video conferencing as synchronous online tool inside the classroom has been effective to a great degree. The results have been overall quite encouraging but we believe there is still a lot of work and more data is required before the results can be seen as conclusive. The data we collected were from two semesters and form one particular course. It

will be desirable, probably essential, that data is collected from more semesters and for a variety of courses before we are able to reach a clear conclusion.

About the Author

Munther Al–Hassan joined DMC in September 2002. Munther is currently the ASCTL for the BAS Bachelor Networking program. Munther has taught in Diploma, HD and BAS degree Networking courses specializing in Microsoft Windows and Cisco Networking courses. Munther is the co–manager of the Cisco Instructor Training Centre (ITC) and Academy Support Centre (ASC).

Munther has a degree in Electronics and Electrical Engineering from University College London and a Master's degree in Satellite Communications Engineering from Surrey University.

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