

Laboratory Experiments Video Clips Students' Perceptions

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Abstract—The use of video notes, or lecture summaries is being used for a while now in higher education, either as a standalone assist to the students or as part of the Virtual Learning Environments (VLE) being widely used nowadays in both distance and on-campus learning, providing supporting tools and encourage independent learning which allow students to access learning materials, course work activities and submit assignments, however, when it comes to practical laboratories students still need to read the lab handout, follow the experimental procedure steps to carry out the experiments, and get results, these results in most of the cases will not be verified to be valid till the students start working on their lab report, and compare to references or published data. As an initiative to enhance the engineering students experience in Heriot Watt University Dubai Campus a short lab video clips were introduced which cover the experimental procedure to allow the students to see the experiment setup for real before they attend the lab, be familiar with the measurements', and where to get them while preparing for the lab., initial survey results indicates that students find these lab videos to be very useful for preparing for the lab as well as for their revision, and lab report preparation.

Index Terms—educational technology, student centered learning, enhanced students experience, virtual learning environments, student opinions

I. INTRODUCTION

Practical laboratory exercises and experiments are great tool for engineering students to get familiar with concepts, understand theories, and validate simulations, but due to the nature of some laboratory experiment setups grouping students for lab work is essential, which eliminate the one to one teaching experience, considering that students come from different backgrounds, interest, and level of lab. preparation, some students may feel less confident asking for procedures to be explained again within a group, and the increasing pressures on student time results in some students miss important explanations. In order to facilitate a more one to one teaching environment it was decided to investigate the use of short video clips to enable students to play and replay key experimental procedures in their own time, and convenient place. Videos of some laboratory experiments were created and uploaded to YouTube which then

distributed to the students who are enrolled to the subject courses.

This paper study the usefulness of producing short video clips to cover practical exercises in engineering laboratories as a research on an intelligent learning environment that investigates current uses and issues of learning environments, and information technologies that students use in their learning activities.

This paper describe the data collection process, then show the outcome of self-administered anonymous online questionnaire survey which was collected from mechanical engineering students in Heriot Watt University – Dubai Campus.

This study aims to evaluate satisfaction with the current use of the recently produced lab videos, and capture any issues or problems that the students had while using them, to understand the usefulness of virtual lab videos to enhance students experience, and to be able to use these data as a base for future development by producing more videos or other technology introduction to the practical lab work, requirements and issues relevant to the project.

This study is focused on the students' perception of the recently developed virtual laboratory videos for engineering undergraduate courses which add to the virtual learning environments and information technologies that students use in their learning activities. [1]-[5]

II. MOTIVATION

The author has spend several years coordinating, and supporting both staff and students of the engineering departments of Heriot Watt University Dubai campus in the preparation and explanation of laboratory practical exercises, and experiments, it was noticed that students come from different backgrounds, and understanding to course work in general, and the practical experiments in particular, despite the efforts of the academics and technical staff in lab preparation, and the careful editing, and rewriting of the lab handouts, some students seem to be less confident while carrying out experiments, and not sure if they are getting the measurements from the right place at the right time, taking in consideration the wide availability of mobile devices, tablets, and laptop computers with majority of students population, it was decided to make use of the available technology to enhance students experience, and prepare them to the

practical labs in modern way fall in line with their daily technology usage, with the introduction of the virtual lab videos, students can see lab equipments for real, and play experimental procedures in their convenient time, and place, and replay again before, and after the lab session, having said that the videos were not intended to replace the conventional lab handout or the lab demonstration, they were made to assist, and simplify lab work [6].

III. DATA COLLECTION

Data was collected using a self-administered anonymous online questionnaire survey of 12 questions, and one field for writing comments, the survey link was then shared with students of 2nd, and 3rd year mechanical engineering being the most students using the lab videos as of now, the survey got about 40 responses within the first week which is about 25% of the students mentioned earlier. Heriot Watt University currently provides virtual learning environment called "Vision VLE" which is implemented using Blackboard platform as a supplement to the traditional classroom learning, which allows students to access learning materials submit assignment and check announcement, the lab videos were either posted on Vision or sent to the students via email.

In addition to this survey result which is presented in the following section it worth mentioning that many positive feedback and interest in the videos was communicated to the lecturers, and other member of staff, students seems to miss the videos for experiments not yet covered, and ask specifically to produce more clips. [5]-[7].

IV. RESULTS AND DISCUSSION

The preliminary survey results showed a great deal of satisfaction between students, with a room for future development, the following figures 1 to 6 shows the percentage result for six of the survey questions, both "Strongly Agree", and "Agree" answers were combined as "Agree".

Fig. 1 below shows that about 92% of the students agree that the lab videos helped them to prepare for the lab ahead, and it helped them to know what they are going in for.

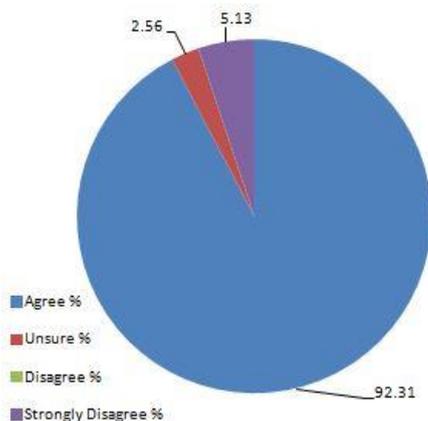


Figure 1. Answers to "Virtual lab videos allowed me to prepare ahead of the practical labs and prepare in advance; I knew what I was going in for when I went to the labs".

This is very important to save the time of the students during the lab, it is normally take some time to explain the apparatus to the students, discuss the procedure with them, and show them where to take measurements, which can take up to 20 min in a two hours session before the students can actually start with the experiment.

Fig. 2 below shows that about 80% of the students confirm that the lab videos helped them after the lab while revising, completing notes, or writing up the lab report, this was a side effect for the current project the main objective of the vedios was to prpare the students before they attaned the lab, and to get them familiar with the experimental setup ahead, however, it seems to be of great value as students get marked based on the quality of there lab report at the end.

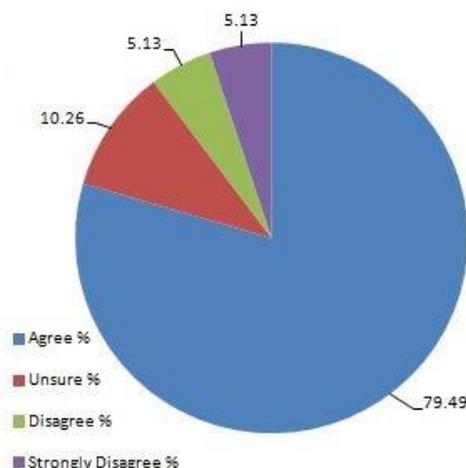


Figure 2. Answers to "Virtual lab videos helped me to revise after practical labs, to complete the notes that I took during the actual lab".

Fig. 3 below shows that about 85% of the students think that the lab videos helped them to be more effective as student weather knowing more about the module they are studying, or saving their time before, within, and after the lab to focus on other coursework, or attending lectures they would miss otherwise, it is noticeable that some students do decide to skip cretin lectures with the excuse of having a lab report due, or preparing for lab work coming soon.

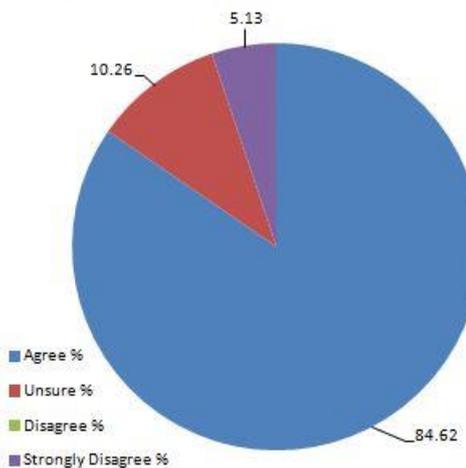


Figure 3. Answers to "Virtual lab videos have a positive impact on my effectiveness as a student".

Fig. 4 below shows that about 80% of the students prefer to watch the lab videos rather than reading the through conventional lab sheet, while these videos does not cover all the information provided in the lab handout neither the theory part of the experiment, it is important to keep this point in mind while planning any future development or produce similar videos, at the beginning and even in the introductory videos it was highlighted more than once that even if the students are watching the videos they still need to read through the lab handout being the main source for information, and detailed procedure.

The responses showed that with the presence of the videos students might decide to skip the lab sheet, and/or the theory behind the experiment, it is necessary to consider this in future production either by including in the video any important information need to be noted or by include notes, and reminders to read the lab sheet.

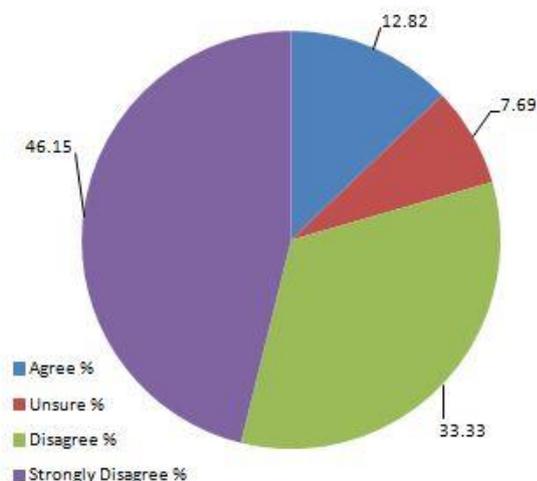


Figure 4. Answers to "I prefer and find it more useful to read the lab handouts rather than watching the virtual lab videos".

Fig. 5 next shows that about 90% of the students agree that the videos helped them make better use of their time during the actual lab, and to get more accurate results, this goes in line with the reason behind making these videos in the first place, which is to enhance the students experience while doing practical coursework, and perform experiments highlighting how, when, and where to get measurements, covering any hazards which might require any specific personal protective equipments, or health and safety measures, all was done with a single target in mind; to make practical labs enjoyable, safe, and informative experience for the students.

In many occasions students performing experimental work in rush due to the scheduled session limitations results in less accurate measurements, skipping some parts of the experiments, and/or performing less trials than required, which will reflect on the quality of their lab report, which is the main outcome of any practical exercise, where most of the grades weight goes. Reducing the time required for the students to get familiar with the experiment, and the measurements required considered an achievement and a step to the right direction by itself, and mean that students get more useful time in the lab.

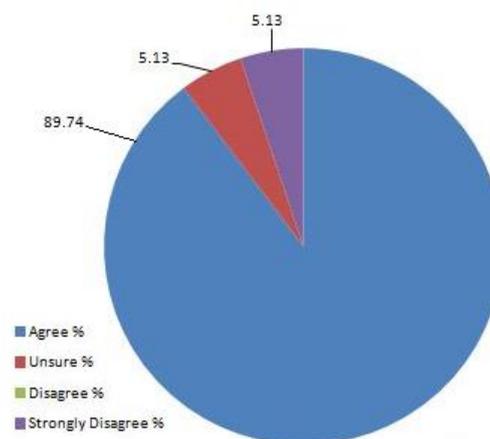


Figure 5. Answers to "Virtual lab videos helped me to make better use of my time during the lab, finish faster with the experiments, and get more accurate results".

YouTube (where the lab videos are currently uploaded) users always get suggestions' on what to watch next which could be from the same channel, from another channel that has the same tags to the watched video, or something totally different based on the individual preferences or watch history, Fig. 6 below shoes students response to weather after watching the lab videos they watched another experiment or relevant videos based on YouTube suggestion or just browse the same channel for more experiments in their major or any other engineering discipline (same channel currently cover experiments in mechanical, electronics, chemical, and civil engineering), it is important to note that more than 40% of the students seems to watch other videos which assist in enriching their general knowledge.

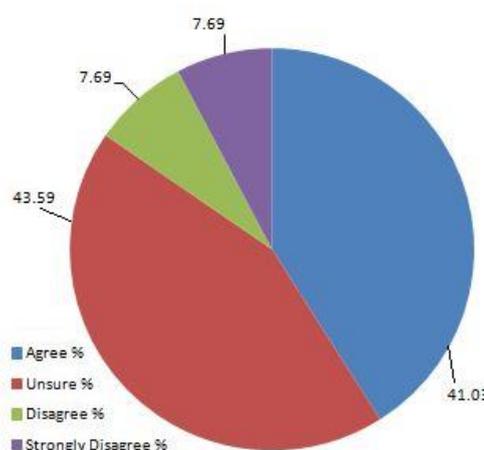


Figure 6. Answers to "Virtual lab videos encouraged me to view experiments not in my curriculum, from other engineering discipline available on the same channel, or other channels proposed by YouTube".

Students' answers above presented in the previous figures showed that they liked the videos, and the find them useful and helpful when it come to the practical laboratories, however, this require confirmation form academic staff, similar survey is being prepared to get detailed information from the academic staff who are involved in the labs, to find out if they noticed any change in students understanding to the lab work,

behavior while conducting experiments, accuracy while taking measurements, and overall benefit they have noticed due to the lab videos if any.

V. CONCLUSION

The initial exploration into the potential use of this video clips in preparation for lab works for engineering students technology to enhance students' laboratory learning experiences can be seen as successful with a room for future developments.

Survey results suggest that there are some potential improvements to the current available clips. The next phase includes similar survey which target academic staff, and lecturers, to find out if the videos helped in the students coursework quality compared to previous years when there were no lab experiments videos, then using these results as orientation data for the design and implementation of an improved virtual laboratory learning environment, students interviews might be considered to acquire more in-depth opinions on the existing videos, suggested improvements, and to validate this method contribution to the university students learning experience.

As educators looking for the best practice to support students in their learning is a main target, learning technologies is opening new doors to investigate how to assist students to learn better, faster, and the most important to remember what they learn as long as possible, practical labs meant to do so, to help student understand, verify, and remember theorems, and concepts, but only if the students has the chance to have a smooth, informative, unforgettable lab experience, virtual labs videos aims to develop a practical laboratory in the students pocket. [8], [9]

APPENDIX A STUDENTS' SURVEY QUESTIONNAIRE

A. Virtual lab videos allowed me to prepare ahead of the practical labs and prepare in advance; I knew 'what I was going in for' when I went to the labs.

B. Virtual lab videos helped me to revise after practical labs, and to complete the notes that I took during the actual lab.

C. Virtual lab videos helped me to understand practical experiments and/or procedures that I found difficult while reading the handouts alone.

D. Virtual lab videos helped me to communicate with other learners who are doing the same module

E. Virtual lab videos helped me to revise and learn at places and times convenient to me, enabled me to study effectively, and encourage me to learn independently.

F. Virtual lab videos improved the quality of my learning; I learn more with them than without.

G. Virtual lab videos are important and valuable aid to me in my studies when it comes to practical labs.

H. Virtual lab videos have a positive impact on my effectiveness as a student.

I. I prefer and find it more useful to read the lab handouts rather than watching the virtual lab videos, I find the videos boring and useless.

J. Virtual lab videos helped me after the experiment while writing up the lab reports by highlighting how to take measurements and/or to remind me of what I did during the lab.

K. Virtual lab videos encouraged me to view experiments not in my curriculum and/or from other engineering discipline available on the same channel, or on other channels proposed by YouTube.

L. Virtual lab videos helped me to make better use of my time during the lab, finish faster with the experiments, and get more accurate results.

Please write any comments that you may have on Virtual lab videos

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