Using instructional videos for the laboratory sessions of Control Systems 354

Faculty of Engineering | Department of Mechanical and Mechatronic Engineering

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Module: Control Systems 354
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Blended Learning Coordinator: Dr Moira Bladergroen mbladergroen@sun.ac.za

Learning activity:
Practical assistance

Learning technology:
Videos

Context

Background

The module Control Systems 354 is facilitated by the Department of Mechanical and Mechatronic Engineering.

Subject area

The module focuses on the theory and application of control systems for typical engineering systems and processes. The module consists of theory (lectures, tutorials and tests) and laboratory sessions – the latter being the focus of this case study.

Intended learning outcomes

The module aims to equip students with an understanding of the control theory and the implementation of the theory in real-world applications.

Established practice

For the laboratory sessions, all instructions (for the setting up of the equipment and the steps of the assignment) were previously presented as documents. Students were required to study the documents, which were published online, prior to the laboratory sessions. The documents presented step-by-step guidance for the setting up of the laboratory equipment and could thus be consulted during the sessions.

The challenge

The setting up of the equipment for the laboratory sessions requires a large quantity of information for both the step-by-step instructions and for the explanation of the role and workings of each component. The challenges lie with the conveyance of this information to students in a manner that is clear and understandable. The description of the laboratory setup relies on visual clarification, which is limited when using a static picture in a document – the pictures become too detailed when adding the necessary labels. Also, the back-and-forth between the lengthy descriptions and the pictures hinders the coherence of the explanations.

Advantages associated with the integration of technology

The integration of video technology, as is the case with the laboratory sessions, enriches the medium of information transfer. The use of screen captures and camera footage provides visualisation of all the steps required for the setting up of the equipment. This is accompanied with a narration that conveys the detailed information required to understand the workstation fully. The videos provide the students with an opportunity to replay, pause or rewind; the students can then learn at their own pace.

Student overview

The module is taken by third-year Mechanical and Mechatronic Engineering students. In 2015, the class consisted of 195 students, of whom 160 were non-repeating students. In previous years, the general feeling among students was that they felt they understood very little of what was being done during the laboratory sessions and therefore did not feel that the sessions added much value to their experience of the module.

Other relevant role-players

The laboratory sessions are facilitated by a lecturer, who is assisted by a laboratory technician and a student assistant. Their responsibility covers the answering of questions related to both the hardware and the theory involved in the sessions.

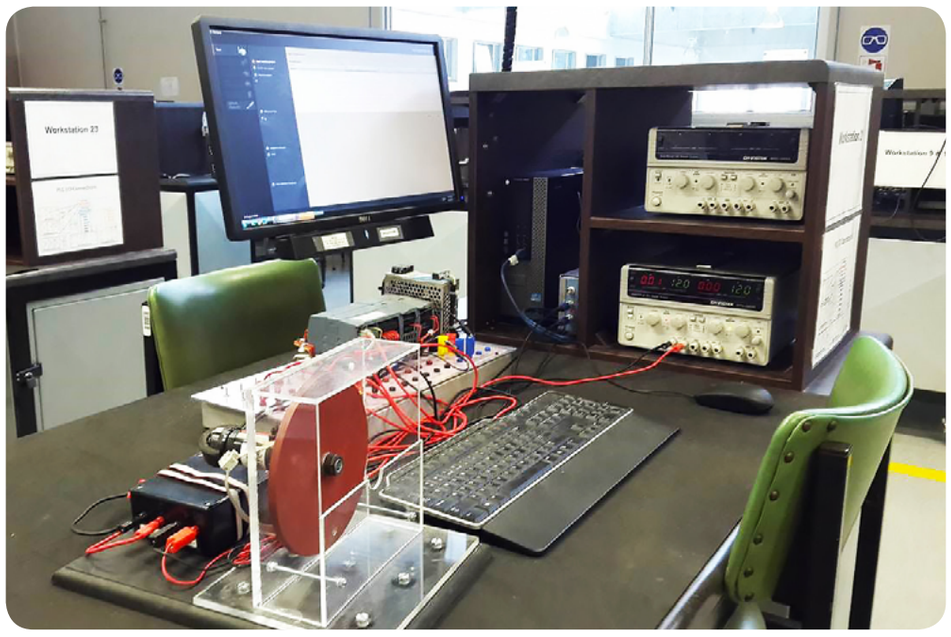

Figure 1: Equipment available at each workstation in the laboratory

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Learning and assessment activities

Learning activities

The students were required to complete three laboratory sessions utilising the same practical setup for each session but covering different parts of the theory. The students were divided into two groups, alternating among the sessions in subsequent weeks. Two videos, which could be used during preparation for the sessions, focused on the description of the setup and a demonstration of its working. Two more videos, which could be used during the sessions, provided instructions for setting up the laboratory equipment.

Assessment activities

The laboratory sessions were assessed through a design report that was submitted by each student. The report consisted of the work done during the laboratory sessions and the interpretation of the results, based on the students' theoretical knowledge.

Feedback practices

The students received feedback during some of the usual module lectures.

Student self-regulation

The lecturer was available for questions regarding the laboratory sessions before and after lectures and after the laboratory sessions.

Learning environment

Learning setting

The sessions were held in the mechatronics laboratory of the Department of Mechanical and Mechatronic Engineering. The laboratory was equipped with 22 workstations on which the equipment for the sessions were set up. The videos were made available online before the first laboratory session and remained available throughout the semester.

Collaborative setting

Due to the limited number of workstations and module contact time, the students were divided into groups of two, these pairs of students then working together at the workstation.

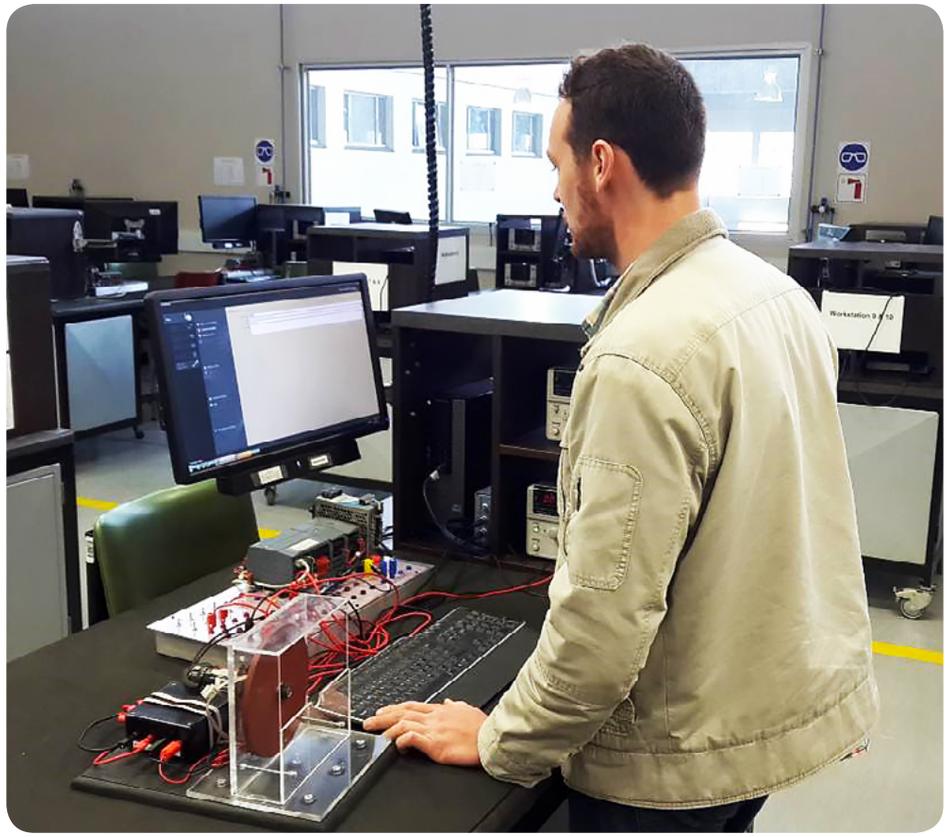

Figure 2: A student working at the workstation in the laboratory

Technology resources

The students had access to the videos via SUNLearn and also used the facility to upload their work after each session was completed.
The videos were created using Camtasia video editing software. The software was used to integrate graphical information (in slide form), screen and camera recordings and voice narrations.

Student experience

Student feedback on the learning experience

A formal feedback survey was done on the student experiences with the implementation of the information and communications technology. The

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feedback showed that the majority of the students found that the videos added value to their learning experiences. The statistics of the number of views per video also indicated that the majority of the students watched all the videos, sometimes more than once.

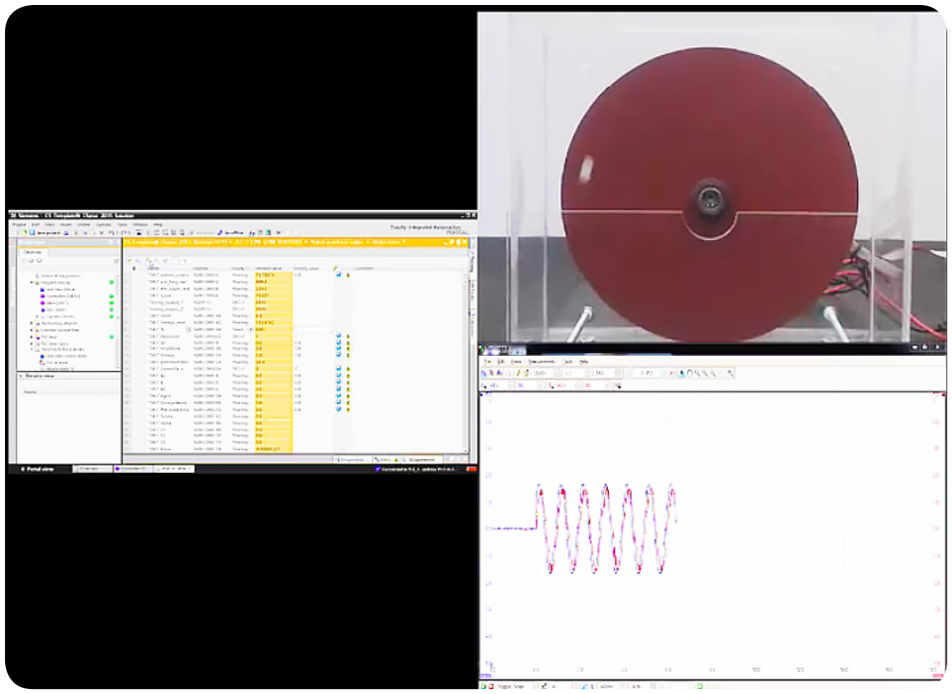

Figure 3: Screenshot of one of the videos available to students during laboratory sessions

General

Opportunities

The general impression is that the videos helped the students to get going with the laboratory work much faster than in the past. With the students spending less time on setting up the equipment, they could spend more time on understanding the work done during the sessions. This led to more insightful questions asked by the students during the sessions.

Challenges

The greatest challenge lies in the quantity of information that must be conveyed. A balance must be found between providing the students with the detail for a complete understanding of the setup and making the videos short enough so as not to overwhelm them. The videos also take a long time to produce and it furthermore seems that some students still remain reluctant to utilise the resources provided because they are not obliged to do so.

Advice

Time must be taken to analyse the material and identify the parts of the work that are critical to understanding the module and that lend themselves to implementation with a selected technology.

To motivate students to watch the videos, it might be effective to have "access tests" to the laboratory sessions. This could entail the students answering one or two questions about the content of the videos. The students who answer the questions correctly in two attempts gain access to the session, while those who do not answer the questions correctly have to watch the videos and then retry the questions to gain access to the session.