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Using Quick Response Codes with Videos in the Laboratory

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ABSTRACT

Using QR codes to access low-cost, educational, short videos in engineering laboratory classes might be a successful way of building a bridge from concrete to digital content. With QR codes placed on the apparatus, students will know exactly which video to watch. The scanned QR codes can be saved, enabling students to watch them again while performing the experiment or at home. Low-cost videos do not require expensive equipment and software, and keeping the videos short assures a minimum download time, making them compatible for use with smartphones and tablets. The aim of this research is to evaluate the importance undergraduate engineering students attribute to these videos and their reaction to the possibility of accessing them with QR codes scanned by a smartphone or a tablet. Results show students attributed some importance to the videos, and that the QR codes are very helpful as means to quickly and easily access the videos.

KEYWORDS

Educational Videos, Engineering Education, Higher Education, Laboratory, Low-Cost Videos, QR Codes, Short Videos

INTRODUCTION

Active learning in engineering is impossible without laboratories, and the recognition of their importance by engineering teachers dates back to 1980 (Fishenden & Markland, 2006). From the earliest days of engineering education, instructional laboratories have been an essential part of study programmes (Feisel & Rosa, 2005; Pandermarakis, Sotiropoulou, Passa, & Mitsopoulos, 2012; Surgenor & Firth, 2011). This is expected because the overall goal of engineering education is the preparation of students to practice engineering and because students' understanding of a domain can be enhanced when they engage in laboratory experiments (Litzinger, Lattuca, Hadgraft, & Newstetter, 2011). In addition, many studies have emphasized the role of laboratory education in students' motivation, which is particularly important considering 'the continuous drop in student numbers taking engineering and science courses' (Abdulwahed, Nagy, & Blanchard, 2008, p. 2).

Krivickas and Krivickas (2007) argue that engineering education is inconceivable without laboratory instruction, but the modernised laboratory presents a challenge to the academic staff in developing new and more effective instruction and facing the 'many disadvantages such as constraints on time, resources, maintenance, expensive equipment, and safety hazards' (Abdulwahed et al., 2008, p. 2).

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Undoubtedly, the massification of higher education is a challenge as laboratories requiring human and material resources depend directly on the number of students. But if, as Feisel and Rosa (2005) mention, this works against a quality laboratory experience, the introduction of Information and Communications Technology (ICT) works for it.

The broad use of ICT, which can be seen as an obstacle to conventional hands-on classes in the laboratory, really is an opportunity because almost every student has the technological means to access the World Wide Web, having technology that 'walks in' classes (Gradel & Edson, 2013). Students are used to accessing information with a click or a slide, and laboratories must keep up to date and not be restricted to the physical space of the laboratory itself.

The great majority of higher education students are what Prensky (2001) describes as *digital natives* because of their familiarity with and reliance on ICT. They live immersed in technology, 'surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age' (Prensky, 2001, p. 1). Bennett, Maton, and Kervin (2008, p. 776) point out that 'they are held to be active experiential learners, proficient in multitasking, and dependent on communications technologies for accessing information and for interacting with others', but this might not be entirely true, as students' everyday technology practices may not be directly applicable to academic tasks. In their literature review, Halupa and Caldwell (2015) highlight the difficulty in implementing new methods and technologies in the classroom and the resistance of students to learning in a new way. Rogado et al. (2015) also report the difficulties students have in incorporating new technology in their learning.

It therefore is important that ICT is used in the laboratory with moderation and in an integrated way, blending it with hands-on experimental activities. Resorting to new and current devices and applications that students use in their everyday life and recognize as good practices (Ricoy & Couto, 2014) might be a good way to capture their interest and increase motivation, and by doing so, improve learning.

This purpose is well served by low-cost, educational, short videos that can be used to explain operational procedures, show what is expected to happen during a certain experiment, and allow students to watch them over and over again while performing the actual experiment. As these videos can be made available in a platform like YouTube, it is important that students know exactly what video to watch when in the laboratory. That is why the possibility of accessing videos with Quick Response (QR) codes is essential to building what Gradel and Edson (2013, p. 62) designate as a 'bridge from concrete to digital content'.

The aim of this research is to evaluate the importance students attribute to low-cost, educational, short videos that explain the operating procedure of laboratory apparatus and the students' reaction to the possibility of accessing videos with QR codes by using a smartphone or a tablet.

The rest of this paper is structured as follows. The next section addresses the state of the art regarding the use of videos and QR codes in higher education. In the third section, we describe a case study. The fourth section addresses the methods used in this research while the fifth section presents the results. The final section presents a discussion of results and conclusions.

VIDEOS AND QR CODES

Teaching and Learning with Videos

Although the use of educational videos has been widely employed in past years, recently interest in their use has increased incrementally because of platforms such as YouTube (Chan, 2010; Giannakos, 2013), video-based learning systems such as Khan Academy and edX, new for-profit companies such as Coursera and Udacity (Giannakos, 2013) and new teaching/learning models such as flipped learning (Fulton, 2014; Observatory of Educational Innovation of the Tecnológico de Monterrey, 2014).