Video-Based Learning in Higher Education: The Flipped or the Hands-on Classroom?

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Abstract

Higher Education is adopting new ways of teaching, such as Video-Based Learning (VBL) approaches, with the aim of moving away from traditional classroom methodologies towards enhanced learning. The most broadly known method that uses video as a tool for learning is Flipped Classroom. In many cases, the result of introducing videos in a learning design eventually converges in this type of methodology. This research presents a case study that uses a combination of VBL and Project-Based Learning methodologies. The course is face-to-face but there are no lectures; students develop small projects in labs. A set of teaching explanations is recorded in videos provided together with the descriptions of the projects. The objective of this research is to study the behaviour and satisfaction of the students using the videos, their utility as well as the position of the professors. The study was conducted following a mixed methodology, using five different instruments to gather qualitative and quantitative data. Results indicate that the use of video-based learning may not necessarily converge in the use of the flipped classroom methodology. Videos can be used during a hands-on classroom as a support tool that encourages a more autonomous, flexible and significant learning.

Abstract in Spanish

La Educación Superior está adoptando nuevas formas de enseñanza, tales como los enfoques de Aprendizaje Basado en el uso de Videos (VBL), con el objetivo de mejorar las metodologías tradicionalmente utilizadas en el aula. El método más conocido que utiliza el vídeo como una herramienta para el aprendizaje es la clase invertida (Flipped Classroom). En muchos casos, el resultado de la introducción de vídeos en un diseño de aprendizaje converge eventualmente en este tipo de metodología. Esta investigación presenta un estudio de caso que utiliza una combinación de VBL y la metodología de aprendizaje basado en proyectos. El curso es presencial pero no hay clases teóricas. Los alumnos desarrollan pequeños proyectos en el aula. Juntamente con las descripciones de los proyectos a

realizar, el alumnado tiene a su disponibilidad un conjunto de vídeos didácticos que pueden consultar durante el curso. El objetivo de esta investigación es estudiar el comportamiento, la utilidad y la satisfacción de los estudiantes en relación al uso de vídeos, así como la posición de los profesores. El estudio se realizó siguiendo una metodología mixta, utilizando cinco instrumentos de recogida de datos cualitativos y cuantitativos. Los resultados indican que el uso del aprendizaje basado en vídeos puede no necesariamente implicar una metodología del aula invertida. También es posible que los alumnos decidan utilizar los vídeos durante las clases prácticas como una herramienta de soporte, fomentándose un aprendizaje más autónomo, flexible y significativo.

Keywords: video-based learning, VBL, flipped classroom, FC, higher education

Introduction

Nowadays Higher Education is adopting new ways of teaching such as ways of Video-Based Learning (VBL) with the aim of moving away from the traditional classrooms. Video lectures have been growing in popularity and their use is increasing both inside and outside classrooms (Giannakos, 2013). "Many higher education institutions and educational technology companies are using them as a main of self-study medium or as tool to enhance the learning process" (Vieira, Lopes, & Soares, 2014).

Despite VBL has a long history as a learning method in educational classes in the past decade, the interest in VBL has increased as a result of new forms of online education, most prominently in the case of Massive Open Online Courses (MOOCs) (Yousef, Chatti, & Schroeder, 2014). VBL has unique features that make it an effective Technology-Enhanced Learning (TEL) approach. Furthermore it seems to support a rich and powerful model to improve learning outcomes as well as learner satisfaction (2014).

Despite this, it is important to note that the mere use of videos in class is not by itself an improvement, since it is necessary to choose an appropriate instructional approach when designing VBL environments (Seidel, Blomberg, & Renkl, 2013). One of the latest methods that use video as a tool for learning is Flipped Classrooms – or inverted classrooms – and, in many cases, it is showed that the result of introducing videos in a learning design eventually converges in this type of methodology.

Flipped Classrooms

The flipped classroom is an instance of VBL model that enables to save time in the classroom by discussing only difficulties, problems, and practical aspects of the learning course (Tucker, 2012). In the flipped classroom model, learners watch video lectures as homework. The class is then an active learning session where the teacher use case studies, labs, games, simulations, or experiments to discuss the concepts presented in the video lecture (Herreid & Schiller, 2013).

Regarding learning theories, Lowell et al. (2013) suggest that flipped classrooms represent a unique combination of these theories once thought to be incompatible. Firstly, active, problem-based learning activities founded upon a constructivist ideology and then instructional lectures derived from direct instruction methods founded upon behaviourist principles. Despite of this, Mason et al. (2013) add that an inverted classroom can play a key role in a modern engineering education by freeing time for learner-centred activities and encouraging students to become independent self-learners. The question that our study lays out here is whether a student-based learning system without using inverted classroom would do emerge unexplored students behaviours.

Effectiveness of VBL and Teaching Methods

The analysis of the VBL research of Yousef, Chatti and Schroeder (2014) showed mixed results in terms of learning outcomes in VBL environments. Despite possible advantages as the high user's rate interaction and learner satisfaction in VBL environments comparing to traditional classroom environments, authors pointed out that several aspects concerning effectiveness in VBL need further investigation:

1. What are the positive and negative attitudes towards using video lectures?
2. How can VBL motivate learners?
3. How can a MOOC as VBL environment personalize the learning experience for learners?

Seems that, a way to improve the effectiveness of the learning experience – with videos or not – is to provide students with a greater degree of freedom to select the educational resources and the learning style that meets their characteristics best. But instead, the previous study showed that most of the reviewed VBL studies followed a teacher-centred approach and only 15% of studies focused on student-centred learning.

According to this, authors denoted that additional research is needed to investigate the benefits of new ways of VBL based on new concepts such as personal learning environments (Greenberg & Zanetis, 2012) and networked learning.

Purpose of Current Study

To explore this context, this research presents a case study that use a combination of the VBL and Project-Based Learning (PBL) methodologies. The classes are face-to-face but there are no lessons: the students develop small projects in labs. A set of teaching explanations are recorded in videos provided together with the descriptions of the projects. The objective of this research is to study the behaviour and satisfaction of the students using the videos, their utility as well as the position of the professors.

Methodology

This research was conducted using a mixed methodology, an option that was considered appropriate because we were faced with complex processes such as behaviour (Creswell, 2005). In the next paragraphs it will be introduced the context of the study as well as the instrumentation, data collection and analysis.

Participants and Sample

Participants were the students of the course "Wireless sensor networks". This was designed as an optional subject in the 3rd and 4th year of the Bachelor Degrees in Computer Engineering, Electronic Engineering and Audio-visual Systems Engineering within the Engineering School of the Universitat Pompeu Fabra (UPF).

The course is quarterly and with a load of about 100 hours of study per student. It took place in April to June of 2014 and the number of students enrolled for that academic year was 17, of which there were only 3 girls. In class the students worked in groups of 2-3 people, specifically there were four groups of two and three groups of three. Two professors were in charge of the course, one of them acting as a coordinator and other as a teaching assistant.

The sampling technique used was not probabilistic due to the participation in the course was not random. The participants were the units available to the investigator: the students enrolled in the course, so the samples of the study are accidental and therefore biased. Hence, there is no guarantee that they represent the entire population to which they belong. Moreover, the size of the sample, as mentioned before, is 17 people and it will not be enough to draw general conclusions. These two issues

must be taken into account in the possible generalization of the results (Yin, 2009). However, the main purpose of the study is to have the maximum guarantees to be able to set affirmations from the field work. The aim of this research is not to maximize external validity – generalization to the population reference –, the intention is to maximize internal validity since it is a case study (Yin, 2009).

Procedure

This subject had been conducted in prior academic years without the aid of videos, but during the year of the study the professors developed a MOOC of the course and they decided to use the videos of the online program as part of the traditional classroom. It was a practical course, divided in 7 projects, where students had to develop seven Arduino circuits. Each project had a video composed by three possible parts (Figure 1): (a) Short explanation of the theory by the professor, (b) Demonstration of how the circuit is built, (c) Instructions of how to program the circuit.

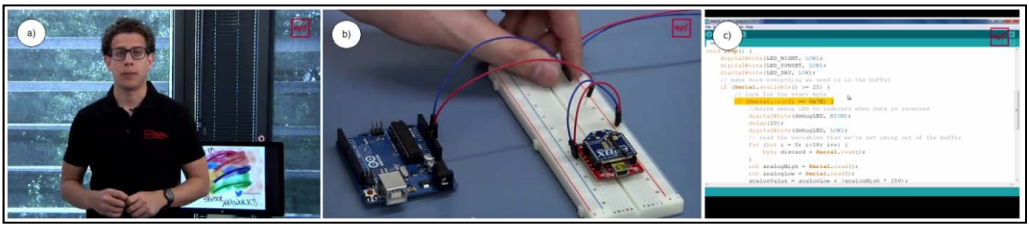

Figure 1. Screenshots from a project's video, where it is showed the three possible types of content explanation: (a) professor's explanation (b) circuit demonstration and (c) programming instructions.

In addition to videos, students could consult a text guide of the course. That document explained all the information of the videos; in fact, it was the basis for audio-visual material. Both course materials were available in a learning environment: Moodle. Students had free access to the environment and they could connect to it by logging in and outside class times. The students were also allowed to consult external material to the subject.

The instructors did not lecture during the classes and they tried to assume the role of facilitators (Smyth, 2011). During classes, the students worked at their pace developing the circuits done in the video. When they needed help, they could request help from the teacher or consult other classmates. When they had completed the circuit example, they had to develop an improved circuit and propose some innovative applications of it.

Every two weeks the video of a new project was published in the Moodle. Despite this, students could work at their own pace, without strict delivery deadlines. The course did not include a written exam. The participants submitted their work as a post entry in their blog and were awarded a badge for completing the project.

Instrumentation, Data Collection and Analysis

The current study used five instruments to gather data from the field work: two surveys, an interview, an observation protocol and two automatic registers. The first online survey instrument utilized for this research was designed to collect information from students regarding the utility and their interaction with the content in the online learning environment: text material and videos. Students answered this questionnaire once for each completed project.

The second online survey was developed to collect general information from students at the end of the course. The objective was to know their satisfaction with the course, especially with videos, as well as their perspectives about the utility of the face to face classrooms. Last survey question referred to whether the use of videos helped them to become more autonomous. All these survey items used a 5-point Likert-type multiple choice response format.

To gather the professor perspective about the course dynamics, the educator was interviewed in the middle of the course. Moreover, the researcher recorded all classrooms in order to observe the participants' interactions off-line. Basically, two kinds of interactions were observed: students with students and students with professor.

Finally, two automatic registers were used to collect quantitative data. On the one hand, the data from the Moodle Log Files have allowed to obtain all times that students have accessed the course materials through the learning environment – date and time were recorded, in addition to indicate what material was accessed. These results could be downloaded in Excel format to facilitate further analysis. On the other hand, the YouTube Analytics tool has led to the number of visits for each video and information related to the corresponding withholding public.

Note the importance of being able to have more than one view of the object of study, from the integration of the two methods in terms of equality – quantitative and qualitative. This study uses triangulation (Neuman, 2006; p.149) to analyse the data.

This is a process that combines strategies, methods or techniques in order to obtain a more accurate – more exhaustive- representation of the phenomenon.

Results

Most of the Interaction with Content (Videos) Occurs within Class

Figure 2 presents the number of student's Moodle actions per hour depending on the project. Two time zones are distinguished, within or outside campus classes. The graph shows that the interaction with the course content – access to videos and text material – mainly occurs during classes' hours.

The graph shows that the actions/h decrease as the course evolves. However, there is an exception to this trend in Project5. The reason for this increase may be due to the content level of this project. Until Project4 students had programmed Arduino IDE and the Project5 first introduced the Python programming language. This new development was associated with an increase in the difficulty of assessing the project and can be one of the main reasons for the rise in the number of interactions with the course content for this particular case.

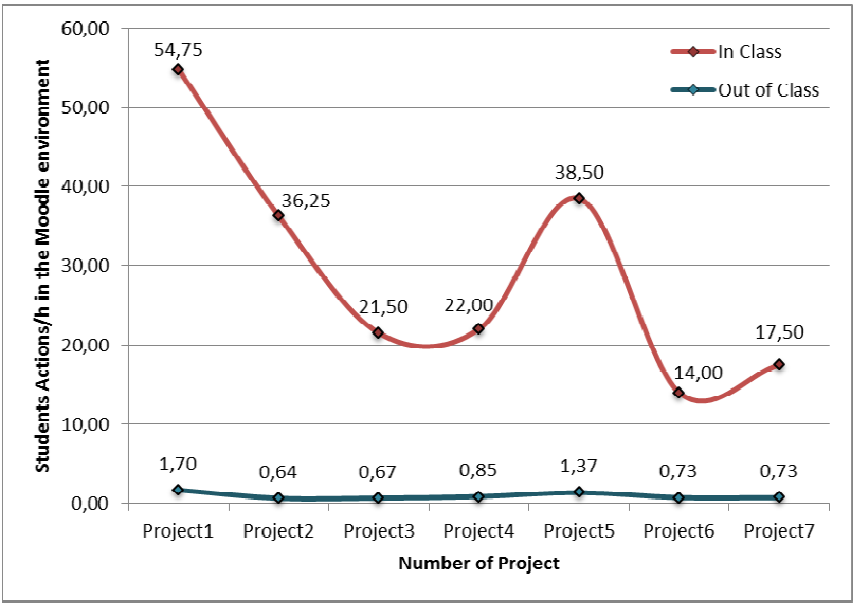

Figure 2. Students actions per hour in the online Moodle learning environment depending on project.

Flexibility in Viewing Videos

Figure 3 reflects the time when the students watched the videos of each project. Every row is a student and the group number to which belongs is also indicated, there are seventeen students divided among seven groups of work and in addition, legend shows which colour represents each video project. The data of this plot was collected from YouTube Analytics tool and from the Moodle Log Files.

Nearly all the students affirm in the surveys that when they watched the videos within class they did it together with another classmate. This would explain that some student have not seen all the videos, because, when they viewed a video with a classmate, a unique student registration of view is shown in the graph.

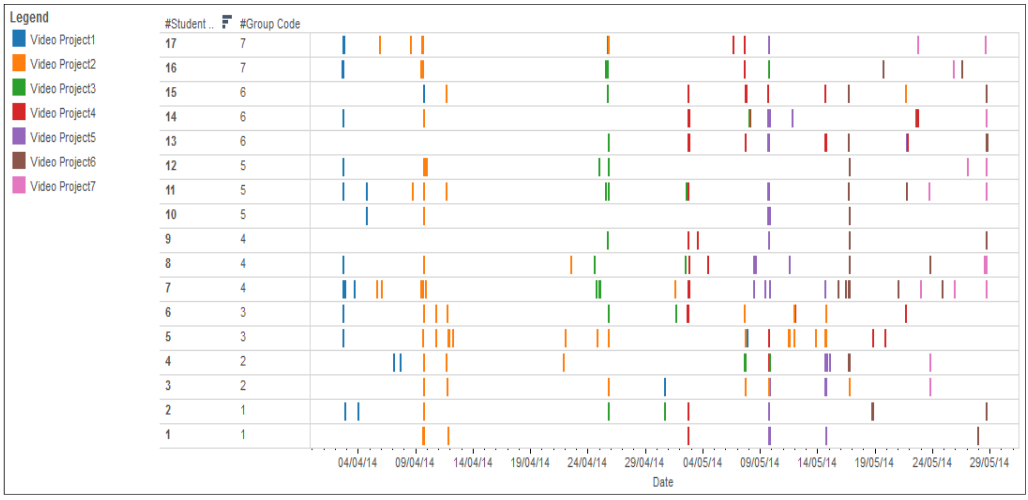

Figure 3. Video views of the students in time depending on project

The main result observed from the figure is the difference in the times at which the participants watch the videos. Each student has seen the video at different moments – even on different days – and most times she or he has displayed the same video more than once. Students show to take advantage of the flexibility in viewing videos, according to their pace when completing the projects (being able to self-organize their schedule depending on their duties in the others subjects, etc.).

Videos have Increased Student's Autonomy

Most of the students stated that the videos have helped them to become more autonomous (Table 1). The main professor also reaffirmed the result during the interview. He observed that the students of this course were more autonomous due to

the videos: dependence of the students towards the teacher was lower than in previous editions of the course.

Table 1: Relationship between videos and autonomy of students

Videos have helped you to become more autonomous?	
Strongly agree	73%
Agree	20%
Indifference	7%

The results of the observation protocol, in addition to the surveys indicate that the interaction between the different working groups was low. Interaction mainly occurred among students of the same group or with the teacher. The most frequent questions to the professor were related to the practical course content or programming questions. Finally, student satisfaction results with the course indicated that 93% of students have fulfilled all or practically all their initial expectations as well as they assessed the utility of the videos in 3.64 out of 5.

Discussion

Students interacted with the course content mainly during class hours, despite the fact that they had the opportunity to watch the videos before the sessions. Hence the flipped classroom was not present though it was the expected situation. Students used videos as support material within class while they were working on the projects at their pace.

On the one hand, the incorporation of videos in class allowed students to enjoy a great flexibility to access the professors' explanation. The advantage of this flexibility questions the use of oral teacher presentations in class because of the latter are governed by schedule that means that the students cannot access to this explanation beyond the class in the moments when their application is more significant. These conclusions are somehow in line with claims by other researchers saying that the role of presence-based learning may be re-thought, standard lectures do not take advantage of having the students personally present in the class (Marwedel & Engel, 2014). However, the use of video allows access to content *on demand*. Moreover, the use of videos has helped students to become more autonomous.

In a learning design based on the student as in our case, the flexibility and autonomy that provide videos – used as support material during classes – help students to have more control over their own learning process and, therefore, the role of the teacher as facilitator is reaffirmed.

Limitations

Above mentioned findings must be interpreted in light of limitations of the study. The first limitation of this research is that this is a case study and therefore it is difficult to extrapolate the findings and generalize. In order to counteract this limitation, it has been placed emphasis on achieving a good internal validation of the results. The second limitation is the type of course of our case: a subject in electronics and programming - essentially practical. Classroom attendance facilitates the resolution of practical problems related to circuit assembly and programming more effectively than virtually, since they are very specific problems, difficult to predict. This conclusion is reinforced by the data obtained from the interviews and online surveys.

Other limitations are due to instruments used in research, basically derived from the surveys. This research study required from the volunteer participation and involvement of the students. Every effort was made to reduce the burden on the students. The questionnaires were integrated in the online learning environment to make them easily accessed. In addition, the instructors periodically reminded the importance of collaborating with this research.

Conclusion

Contrary to common belief, the use of video-based learning may not only converge in the use of flipped classroom methodology. It is also possible to use the videos in a hands-on class as a support tool that encourages a more autonomous, flexible and significant learning. The application of a flipped or a hands-on classroom approach depends on diverse aspects, including the nature of the course (with practical or theoretical orientations), the behaviour emerging from the students (depending on their needs and preferences, time constraints, etc.) and the design of the activities proposed by the teachers (strongly requiring students to watch videos in a certain timeframe, e.g. previously to the class, or offering flexibility). Future research considering variations of these parameters will help to understand the benefits and limitations of both approaches and to what extent they may coexists in VBL.

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