

Video is key for Flipped Learning: An experience at Universitat Politècnica de Valencia

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Abstract. Universitat Politècnica de Valencia is devoting a large scale effort in applying Flipped Learning to University's courses. For that there is a program that both encourages and support teachers in this educational technique. The program has been carried out as a pilot in two semesters of the academic term 2014-2015 and as a production service in the ongoing academic term 2015-2016.

So, by participating in this program teachers can choose between different kinds of Flipped Learning implementations, some use video as a learning tool and some don't. This has allowed us to make a comparison between the ways students use the educational content in both cases.

Result shows that students like video as their primary tool in Flipped teaching, and also that video-supported courses get better overall results in the appreciation and engagement from the students.

1 Introduction. Related Work

The Universitat Politècnica de Valencia (UPV) is a higher education institution with a strong history in applying IT technologies to learning processes. Beginning with the campus-wide LMS deployment in 2002, and then with the learning objects production with the "Networked Teaching" project, the development of the Polimedia system [1], the Videopuntes lecture recording system [2], and in the last years the integration of automated transcription and translation systems. Also the production of MOOC courses, being an active member of the edX consortium.

While these programs have had a remarkable success in terms of the amount of learning materials, their quality and the students' opinion, they have been mainly used in a blended-learning system, in which classical lectures are complemented with those learning objects. In other cases, as in the MOOC courses, that material has been used also to create complete online courses.

However, recently a new paradigm in pedagogy has been developed: Flipped Learning (FL). In Flipped Learning [3] [4] there is an inversion in the classical lecture system so that students receive in advance the theoretical content that they used to receive in the lecture hall and the time in the lecture hall is used to clarify, reinforce and practice the subject they are studying.

adfa, p. 1, 2011.

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By applying FL the learning environment moves from student-centered to teacher-centered. As Bishop proposes in [5], in the student-centered classroom, students share responsibility for their learning and become more engaged in the learning process. This typically means that students are introduced to contents prior to class in order to then practice what they have learned in a guided setting.

The popularity of the flipped, blended, or hybrid classroom has grown rapidly in recent years, due in part to the understanding that traditional methods of instruction are not always the most successful. Although teachers in traditional classrooms often work to differentiate lessons for students of different levels of interest and ability, it is difficult to help every individual student find his or her way.

This paradigm requires a change in the functions of the teachers, but also a production effort having that teaching materials before the assigned time in the lecture hall.

Following this idea UPV developed a project to both encourage and help teachers to join the FL methodology, and also to verify that the results presented in other experiences were, or not, applicable to its particular conditions. This project began as a pilot in the academic term 2014-2015 and is fully deployed in 2015-2016. During this time, several evaluations have been carried out, and we have obtained valuable data.

The objective of this paper is to present the experience and investigate the differences between video supported FL and non-video supported FL in the ongoing academic year 2015-2016. To do so the paper is structured as follows: In section 2 we will briefly review the related work about FL evaluation. In section 3 we will describe the experience for this year, and the available data from it. Section 4 will be for the analysis of that data and finally section 5 will be devoted to conclusions.

2 Related work

There have been quite a number of papers evaluating flipped teaching experiences, but as far as we have found there is no comparison between video supported FL and non-video supported FL. As a broad reference, Bishop et al [5] did a survey of 24 studies related to the flipped classroom, with the characteristics of each of those experiences, including the study type, sample size, measurement instruments, theoretical framework, in-class activities, and out-of-class activities. While this is a great reference, Bishop didn't consider non-video supported FL as a real experience, so this research lacks in that part.

In [6] Amresh et al. study the improvements of Computer Science abilities in a CS1 course. A correlation analysis between computing self-efficacy and students' perceptions of value toward the flipped classroom model was shown to be not significant. Authors' suggest that the course improved computing self-efficacy, but that the flipped classroom pedagogical approach was not the reason for this increase. Authors point to video length as a key factor in creating engagement for the students. A recent reference from Guo [7] supports also that finding that short length videos are a must for a successful engagement.

3 Flipped Learning experiences at UPV

With all these FL activity in mind, UPV feel natural to make a pilot test to know what would be the challenges and the results of actually deploying Flipped Learning in a wide scenario of courses. So, for the first semester of the 2014-2015 academic year, a group of students in two faculties (Computer Science and Business) received all their courses with Flipped Learning.

The results of that experience were great in terms of satisfaction of both the students and teachers, while there wasn't a significant improvement in the assessment. Those results were considered enough good to continue the project.

So, for the 2015-2016 academic term UPV moved a step forward in applying FL to his courses, by planning a large-scale deployment of more than 100 courses with around 200 teachers involved. Teaching is done on two semesters, and for the first semester 45 courses were flipped.

In our case we define the flipped classroom as an educational technique that consists of two parts: computer-based individual instruction before the lecture session and interactive group learning activities inside the classroom in the time that was set up for lecturing in standard courses. It's worth noting that we don't restrict this definition to employ videos as an outside of the classroom activity.

Teachers that apply for the flipped teaching project have a learning session in which they get the directions to apply FL in their courses. However, while they are encouraged to use videos they are allowed not to do it and rely in more conventional techniques like HTML content on the University's LMS platform or even PDF files. Nearly half of the teachers decided not to use videos and stick with that semi-traditional approach.

So we can classify the courses because of why they are distributing the previous content in 5 different groups, belonging to two main families: video and non-video. Usually video supported courses also includes HTML and PDF content.

Group	FL type	Description
Video	Screencasts	Homemade recordings made by the teacher commenting the slides and teacher's computer desktop
	Studio recordings (Polimedia)	Teacher + slides recordings done at UPV facilities, with the help of technical support
	Other videos	Video recordings in TV format, done by the teacher or recovered from other sources
Non video	Only HTML content	HTML text on University's LMS including quizzes and exercises
	Only PDF files	Just PDF files to be read by the students. May include problems or text questions

Table 1. Classification of Flipped Learning at UPV

The 2015-2016 experience, in the first semester, got evaluated 45 FL courses, with 2668 students involved. A summary of courses and students in each category is shown in table 2.

Group	FL type	Number of courses	Enrolled students
Video	Screencast	4	234
	Studio recordings (Polimedia)	21	1308
	Other videos	4	221
Non video	Only HTML content	14	657
	Only PDF files	2	248
	Overall	45	2668

Table 2. Courses in the 2015-2016 first semester experience

4 Data Analysis

In order to evaluate the experience we did an anonymous survey to the students of those courses, divided by courses. The survey included a broad number of questions, some related to the a priori learning beliefs of the students, some to the overall structure of the experience and finally on the students' perception on the value of the FL methodology.

The survey is not fully included because of space restrictions. It had 13 questions, in three groups

1. Questions Q1 to Q4, Q5 and Q12 were included to verify our information about the course and avoid duplicates.
2. Questions Q6 to Q11 are the valuating questions of the survey. Here is where we can gather info about the experience
3. Question Q13, with its sub questions, is designed to know the *a priori* beliefs of the student, and can help us to identify different learning styles.

There is some overlap between questions, and we have taken it into account. For instance, questions Q8, Q9 and Q10 have a high correlation value, which means that we may use Q8 as a proxy estimator for students' satisfaction. This data is shown on table 3.

- Q8 I'm very satisfied with this experience/methodology
- Q9 I would recommend this experience/methodology to my fellows
- Q10 I would like to have this methodology in more courses

	Q8	Q9	Q10
Q8	1,00	0,91	0,78
Q9	0,91	1,00	0,82
Q10	0,78	0,82	1,00

Table 3. Cross-correlation for satisfaction related questions

Beginning with the *a priori* beliefs, first we look at the question Q13_SQ23: I agree that I prefer assisting to lecturing than watching online videos (1 lowest - 5 highest).

Group	FL type	Mean (1..5 value)	Sigma	Mean(1..100 value)
Video	Screencast	3,57	1,13	64%
	Studio recordings (Polimedia)	3,24	1,41	56%
	Other videos	3,65	1,28	66%
Non video	Only HTML content	3,96	1,31	74%
	Only PDF files	4,33	1,03	83%
	Overall	3,63	1,34	66%

Table 4. Lecture/Video student preference

In this case we can see that there is no *a priori* preference for video content, apart from the small PDF group, so we can assume that the satisfaction differences are not based from sampling problems.

This can be compared perceived value of the students, the results that we get from question Q8 by type of content is depicted on table 5.

Group	FL type	Mean (1..5)	Sigma	Median (1..5)	Mean(1..10 0 value)
Video	Screencast	4,06	0,70	4,30	77%
	Studio recordings (Polimedia)	3,98	0,67	4,08	74%
	Other videos	3,32	0,73	3,41	58%
Non video	Only HTML content	3,27	0,77	3,26	57%
	Only PDF files	3,25	0,74	3,19	56%

Table 5. Perceived value of Flipped Learning

This table clearly shows a great difference between video and non-video supported FL. Acceptance rates for non-video are just fair, that means that video should be a must in considering FL experiences.

We want also to consider the student engagement. An estimator for that could be in the sub questions of Q6 *After your Flipped Learning experience, show your agreement with the following assertions (1 lowest - 5 highest):*

- Q00006_SQ001 I have done the required previous out-of-class work
- Q00006_SQ002 I have been more engaged on the course
- Q00006_SQ003 I am happy in this course
- Q00006_SQ004 I have needed a lot of time to comply with the work of this course
- Q00006_SQ005 Teacher has more time to solve doubts while in class
- Q00006_SQ006 There is more group work
- Q00006_SQ007 I feel well prepared for my final exams

It's worth noting that all questions but Q6_SQ4 can be considered positive, in the sense that the higher the better. Q6_SQ4 is negative, so the lower the better.

Here is the correlation matrix for Q6, So, we see that in order to estimate the engagement we may consider these questions separately.

	Q6_SQ1	Q6_SQ2	Q6_SQ3	Q6_SQ4	Q6_SQ5	Q6_SQ6	Q6_SQ7
Q6_SQ1	1	0,50	0,35	0,19	0,30	0,12	0,35
Q6_SQ2	0,50	1	0,75	0,17	0,52	0,33	0,67
Q6_SQ3	0,35	0,75	1	0,08	0,58	0,41	0,75
Q6_SQ4	0,19	0,17	0,08	1	0,05	0,03	0,08
Q6_SQ5	0,30	0,52	0,58	0,05	1	0,38	0,58
Q6_SQ6	0,12	0,33	0,41	0,03	0,38	1	0,40
Q6_SQ7	0,35	0,67	0,75	0,08	0,58	0,40	1

Table 6. Cross-correlation matrix for engagement questions

So, we present the mean results for Q6 on figure 1.

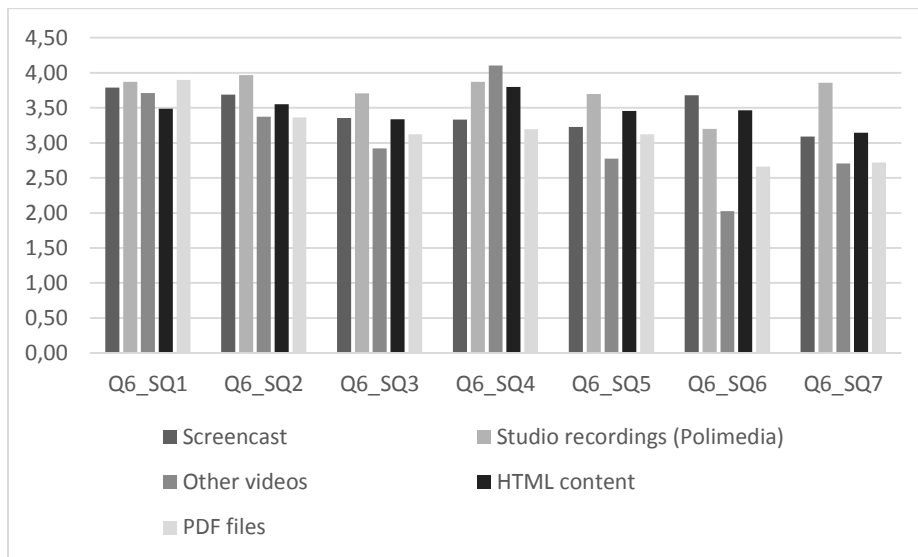


Fig. 1. Engagement value of Flipped Learning

Here we see again a slight constant advantage from video to non-video FL. While all students participate actively in the experience (Q6_SQ1), video students get more engaged (Q6_SQ2), are happier (Q6_SQ3), and require some more time to complete the out-of-class work (Q6_SQ4). Teachers have more or less the same in-class time (Q6_SQ5), but in the case of longer videos (Other videos), which also don't help in group work (Q6_SQ6). Finally, high quality studio recordings are viewed are the best in order to be prepared for the examinations (Q6_SQ7).

5 Conclusions

We have presented a large Flipped Learning (FL) experience with more than 2500 students in 45 courses that happened on the first semester of the 2015-2016 academic year.

This experience was designed in a way that allowed teachers to choose between different ways of implementing the FL methodology. Thus we have been able to compare between those different ways of doing FL, and we have centered our investigations in the role of video in supporting out-class learning activities.

The clear conclusion from this investigations is that video supported FL students get more satisfied and more engaged with a noticeable margin (around 20%), so there is no sense in trying to deploy FL without video support. Also, small on-purpose videos are much better than long classical TV documentaries in terms of engagement.

Also we haven't found significant differences between the videos recorded by the teachers themselves and the studio recordings. Our guess is that while the recorded videos are of more visual quality, they lack the capacity of be changed during the learning course, so in the Screencast paradigm, teachers can adapt faster to students' needs. In any case, this is a topic that calls for further investigation

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