

Networked Teaching. The story of a success on creating e-learning content at Universitat Politècnica de València

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1. ABSTRACT

At year 2006, the strategic plan of the Universitat Politècnica de Valencia created an initiative, called Networked Teaching aimed to encourage the production of high quality e-learning materials as a companion material for the standard lectures. Since then, the combination of teachers, technical and pedagogical resources has produced more than 10,000 video learning objects, from more than 1,400 teachers, 1,200 virtual labs, 3200 hours of recorded lectures, 120 OpenCourseWare sites and 41 MOOCs, leaving the UPV brand as a top participant in the Spanish Speaking e-learning scene. A key factor in the UPV strategy is the combination of flexibility for the teachers, technical standardization and the requirement of pedagogical review, which makes the produced content reputable for the use both for individuals and for any Higher Education institution.

2. INTRODUCTION

In the strategic plan of 2006, the Universitat Politècnica de Valencia created an initiative, called Networked Teaching aimed to encourage the production of high quality e-learning materials as a companion material for the standard lectures. The idea behind that plan is to find ways to coordinate and produce useful results from all small-scale initiatives from teachers and staff that had been developed in the previous years.

A key concept in the plan is the integration of the different units of the University in the process. For instance, to create a Video learning object, the IT department should be involved, but also the institute of Education, the Library, and the Legal department shall take part in the definition of the process. At the end all these interactions should be hidden to the teachers, so they find a clear and easy path to produce the content.

This document describes the overall experience, as well as the technical resources used. In Section 3 we will depict the plan and the overall results in numbers. Section 4, 5 and 6 are devoted to the most remarkable technical deployments, being the Video Learning Objects production, the Virtual Labs, and the Lecture recording plan and platform. Section 7 describing the MOOC experience in the last two years. Finally, section 8 gathers general conclusions about the whole plan.

3. THE “NETWORKED TEACHING” PLAN

In 2005 the Universitat Politècnica de Valencia started a plan for supporting and encouraging the production and usage of Digital Learning Objects. This plan recognized the need from teachers of an adequate support, both pedagogical and technical and also that there should be a clear path to increase the number of teachers involved.

So the plan designed a yearly iterative process for obtaining results, guided by a University commission as follows:

1. The commission gathers informal wishes and requirements from teachers, students, pedagogical and technical staff about what things could be done.
2. The pedagogical and technical staff prepare a (reduced) set of “learning products” that can be made with the available resources and that can be also sustainable in time.
3. There is an open call from the commission for teachers wanting to join for any of the learning products. So, any teacher can apply for making any quantity of them. There is a small incentive for teachers joining the plan.
4. During the year, teachers can prepare (and use) the content with the active help of the pedagogical and technical staff.
5. When the content is made, there is a technical and a pedagogical evaluation. If both are passed, the commission assigns the incentive to the teacher and the content goes to the University’s repository. The license of the content is decided by the author.
6. There is a yearly evaluation on the usage of the learning objects produced. The University gives prizes to the best, considering both quality and usage.
7. Finished the year, there is a global evaluation of the process, and a new round starts.

As 2013, the didactic materials covered by Networked Teaching are:

- Learning Objects: Video Learning Objects (Polimedia) which are small self-contained recordings in a high quality screencast format (see more on next section)
- Standard video recordings, with free format
- Virtual labs, which are small applets that helps students to interact within the courses
- Homemade Screencasts (from 2010)
- Learning modules (from 2008), which are structures containing different learning objects with companion material.
- OCW courses (from 2008), published under the guidelines of the OCW consortium
- Automated Lecture Recordings (from 2010), full course recordings using the tools developed with the Opencast Matterhorn consortium (more in section 4)
- MOOC courses (from 2012)
- Transcription and Translation of video lectures (from 2012) within the EU FP7 TransLectures project

Each didactic material has its definition, resources and has got different results. Anyway, a common characteristic is that all the content approved by the reviewers is published into the Library Dspace site, and is also available for teacher’s usage in the University’s LMS. Also there is a Youtube and an iTunes channel that include the content suitable for these sites with teacher’s consent.

A bird’s eye view of the content production within the years of the plan is depicted on the next table.

	2007	2008	2009	2010	2010 - 2011	2011 - 2012	2012 - 2013	TOTAL 2007 - 2013
Objects								
Polimedia	1626	979	1124	1144	1353	1846	2102	10174
Standard video recordings	144	135	100	37	39	33	33	521
Virtual Labs	188	261	202	138	132	106	108	1135
Screencasts				66	48	37	66	217

Learning Modules		51	42	34	25	21	23	196
OCW sites		30	34	26	9	10	10	119
Lecture Recording hours					144	512	2486	3142
Transcribed Recordings							10174	10174

Table 1: Result of the “Networked Teaching” plan at UPV.

4. VIDEO LEARNING OBJECTS PRODUCTION. POLIMEDIA

Polimedia is a relatively recent service developed and implemented at the Universitat Politècnica de Valencia (UPV) for the creation and publication of educational multimedia content (Polimedia (2007)). Launched in 2007, it is primarily designed to allow UPV lecturers to record pre-prepared mini lectures to be used by students as a supplement to the traditional live lecture. For the most part they consist of concise overviews of a given topic and have a typical duration of around ten minutes. They are also accompanied by time-aligned presentation slides, or a time-synchronous live screen capture.

So far some 1,373 lecturers have recorded 10,174 video lectures. This translates into a total running time of 1,633 hours of educational material across the wide range of subjects taught at the UPV, all published online via the Polimedia catalogue. Detailed statistics year on year since 2007 are shown at Figure 1.

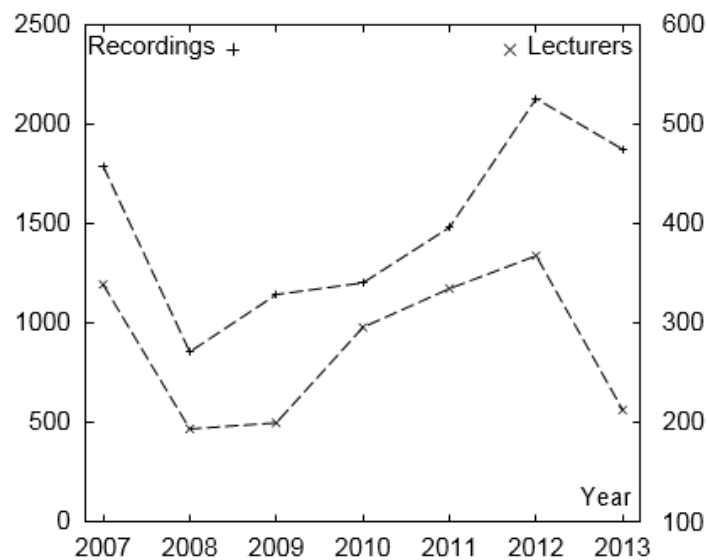


Figure 1: Video lectures recorded (left y axis) and lecturers (right y axis) involved until April 2013 with Polimedia.

The production process for Polimedia repositories was carefully designed to achieve both a high rate of production and an output quality comparable to that of a television production, but at a lower cost. A Polimedia studio consists of a 4x4 square meters room with a white backdrop, video camera, capture station, pocket microphone, lighting and AV equipment including a computer to capture and

mix the video and audio noise gate. The hardware cost of this studio stands at around 10,000 euros. Figure 2 shows a picture taken at the Polimedia studio during a recording session.



Figure 2: A typical Polimedia recording session at the UPV.

The recording process for Polimedia is quite simple: university lecturers are invited to come to the studio with their presentation and slides. They stand in front of the white backdrop and deliver their lecture, while they and their computer screen (presentation slides) are recorded on two different video streams. The two streams are stacked side-by-side in real-time to generate a raw preview of the Polimedia content, which can be reviewed by the lecturer at any time. These streams are then post-processed; they are cropped, joined (with some overlap) and h264 encoded to generate an mp4 file, which can be distributed online via a streaming server. All of this is fully-automated and the lecturer can review the post-processed video just after finishing the recording.

The resulting video lectures have a resolution of 1280x720 or 1920x1080, depending on the configuration. A typical Polimedia video would look something like that shown in Figure 3, though a number of alternative layouts are available for the user to choose from.

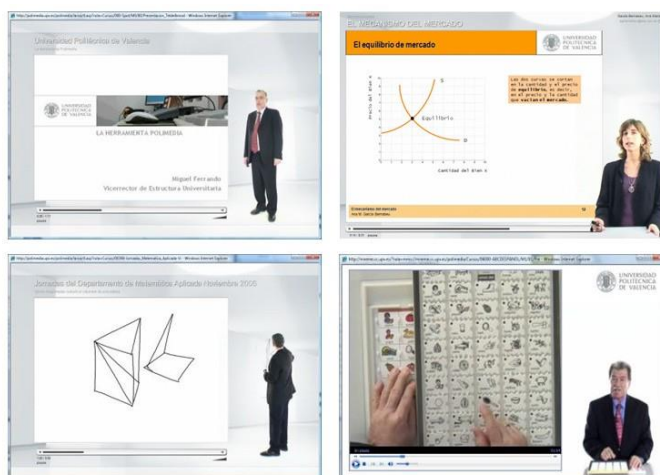


Figure 3: Alternative video lecture layouts for Polimedia. l-r, t-b: full-body shot with presentation slides, half-body shot with slides, whiteboard shot and bird's eye view.

Also is worth noting that from 2013 on, all recordings have been transcribed within the transLectures project.

5. VIRTUAL LABS

Virtual labs are intended to give an interactive online learning experience to students. They are small pieces of software, made with different technologies that allow publishing content on the web with a high level of user interaction in real time.

The technologies used to deploy the virtual laboratories have been chosen so that the learning experiences are completely on- line, using only a web browser, avoiding at all times that the students have to install software on their computers.

The technologies selected to create virtual laboratories are commonly used tools among teachers. Here a key point is that following the development guidelines of the “networked Teaching” program teachers have a strong and specific support from the technical team. Specifically the following types of laboratories can be included:

- Laboratories created with Matlab
- Laboratories created with Mathematica
- Laboratories created as Java Applets
- Laboratories created with Adobe Flash

The most common format of a virtual laboratory is a simulation consisting of one or more graphics that react to the interaction of certain buttons, sliders or parameters that the user can modify, checking how the change of these parameters affect the simulation, like the next example in wich the student can manipulate a mechanical joint.



Figure 4. Mechanical joint Virtual Lab

6. AUTOMATED LEARNING OBJECTS (VIDEOAPUNTES)

In 2011, the Polytechnic University of Valencia joined the international consortium Opencast [1], currently consisting of more than 30 universities interested in video resources for education, one of whose objectives is the joint development of open source software for recording lectures. This system, called Opencast Matterhorn, is the equivalent video recording equivalent of a CMS, and integrates all the features needed to manage this assets: capture, processing, indexing, and rich publishing in a corporate CMS.

Thus, a university can have a working Matterhorn system deploying capture agents in the lecture halls to record simultaneously the teacher’s video, audio and the screen that the teacher shows in the computer in the classroom, creating a multi-track recording, which can then be ingested and published through the core system.

We first made a pilot in the last semester of the 2011-2012 academic year recording in nine classrooms with 15 teachers, with 400 hours recorded. The production phase started in September 2012 has continued the installation of classrooms up to a current number of 36, with over 1500 hours of teaching recorded, at a peak rate of 150 hours/week. The local nickname of this project in Spanish is Videapunttes.

The installation of this equipment has been designed to be as unobtrusive as possible to avoid the distraction of teachers, so we use a ceiling microphone system that does not require teachers to wear anything. And for any teacher having a session recorded is just a matter of giving that lecture in a Videopuntes prepared lecture hall. Preparing a standard classroom costs around 3000 euros including equipment and installation.

When a teacher wants his/her lectures to be recorded, he/she fills a reservation through the university LMS. Then that recording is scheduled for capture from the central services and the recording starts and stops automatically. The next step of encoding and uploading to the LMS is done automatically through the Matterhorn system.

Once uploaded to the LMS, the teacher has four days to review the recording, trim the start and the end, if necessary, and publish it using a web tool that is also available. Finally the recording appears under the resources section on the course site.

Students access the content using a multistream player developed by UPV called Paella Engage Player. This player is an open source HTML5 player that incorporates features for teachers as selecting different viewpoints, slide navigation, cutting videos, choosing to make public the video, etc.

The Paella Engage Player is the UPV contribution to the Matterhorn ecosystem. It is a HTML5 multistream video player capable of playing multiple audio & video streams synchronously and supporting a number of user plugins. It is specially designed for lecture recordings, like Matterhorn Lectures.

By using Paella students can view both the lecture hall and the teacher's screen, get info about the lecture (slides, OCR, series videos, footprints) and interact with the lecture (views, comments). Teachers can also soft edit the lecture to set the start and end point or make breaks in the recording.

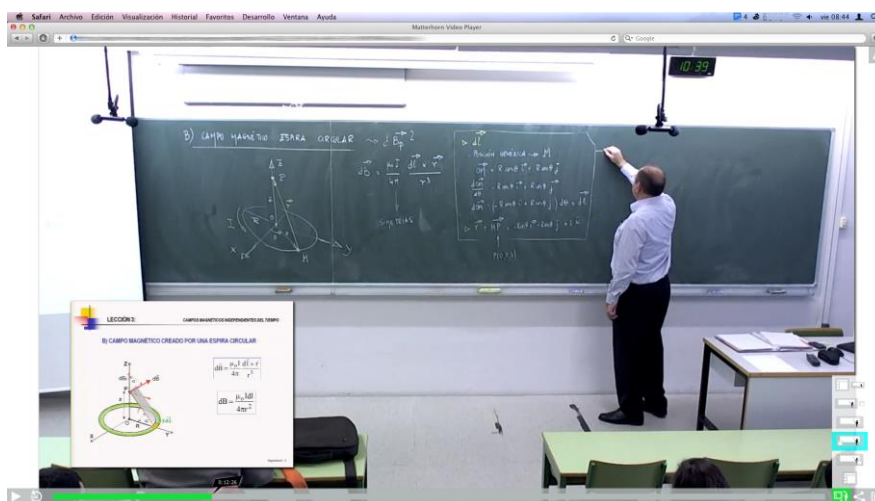


Figure 5. Videopuntes recording with Paella Player

7. Massive Open Online Courses

The pilot UPV MOOC edition was carried in January 2013 with 2 polimedia-based courses in our platform upvx.es, based in Google Course Builder (GCB).

In November 2012, while we were preparing the pilot edition, Universia and Telefonica launched a MOOC platform for the Spanish universities, miriadax.net and a contest with a prize for the best MOOC. The courses started in March 2013 and had to be prepared in 3 months. We launched a call for proposals to the teachers of our university and 14 courses were presented (including the 2 of the pilot edition) and prepared (in total there were 58 courses from 18 universities).

In July 2013 a new edition of 8 courses was launched in UPV[X]. 6 of them were the same as in previous editions, one was an expanded version and other was completely new and they were repeated in another edition in October 2013. We have launched a new round with 17 MOOCs in February 2014, being the University with the largest number of MOOCs in the Spanish speaking world.

Our prior experience in using video technologies for education has taught us an important lesson: you have to let teachers concentrate in what they do best, designing instructional material and lecturing, relieving them of the hurdles of multimedia content development and making the process as similar as what they do every day as possible. That is what is behind the Polimedia recording studio concept: the teachers come with their PowerPoint, computer demonstration or physical model and lecture in a small studio as if they were in the classroom, there is no editing and the recording is only repeated if there is a very big mistake, as there is no problem with correcting a small error while on camera. The assistant puts on them the wireless mic, gives them the start sign and that is all that they need to know about video technology. After finishing they give us the title and metadata and in a short time they have their video in the system. This, coupled with the idea: “one concept, one video”, that insists in the importance of short videos, lets us achieve a very high productivity in video recording.

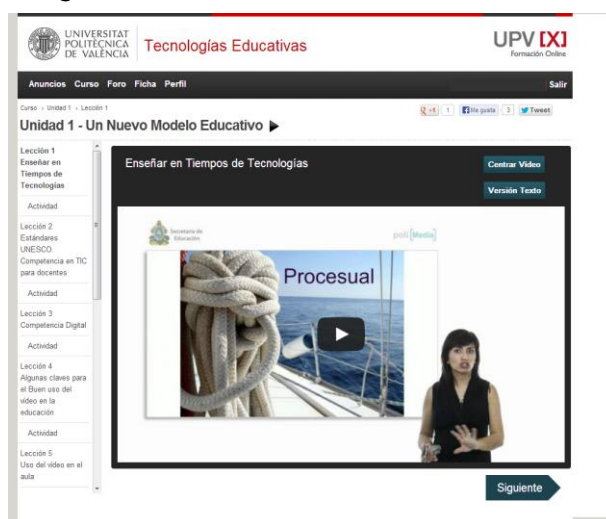


Figure 6. UPV MOOC

After the bandwidth problems we had in the pilot course made for Latin America with our LMS and the videos hosted in our platform, we decided that all MOOC videos should be in YouTube, as it manages very well the client's video bandwidth and most of computers are already well configured to use it, so we developed a set of php scripts to automate the uploading to YouTube of courses from our system with all metadata.

The excel file we created for the course has a sheet for the general data of the course (date, time to devote, teacher's biography, etc..), other for the unit and assessment listing, other for the lessons and their quizzes and other for the assessments questions, so it is very easy for a teacher to structure a course information and we have an intermediate format that we can use to upload the course to different platforms (with the proper scripts).

Following the same “simplicity for teacher” concept, we incorporated a VBA script to the Excel file to import quizzes from a text file with the same simple format they use to import assessments in our LMS and a query to our database that produces a listing of all the videos in their course with their corresponding YouTube codes, so they can copy and paste it very easily to the lessons and assessments sheets.

We also devoted one information technology student as teaching assistant to help the teachers in the course creation process. With all these, we let teachers to decide which level of support they want. Some of them completed the spreadsheet and uploaded the content to the platform themselves (with GCB they see it in local mode in their computers instead, using Google App Engine

SDK), some others fill in the spreadsheet and give it to us to upload, others have an appointment with the teaching assistant to help them fill the spreadsheet and others send us the listings of units and lessons and text or word files with the questions and the teaching assistant fills the spreadsheet. That way we were able to deploy 14 courses in 3 months with a project manager and a teaching assistant in the project (and the 2 teaching assistants we have recording in the Polimedia studios).

The process we followed to deploy the courses is:

1. Call for proposals (under the “Networked Teaching” framework) from the teachers and search of teachers available to make courses on topics of interest for the institution (for example the UPV was interested in subjects as “Basic Chemistry”, “Foundations on mechanics for engineers” or “Mathematical foundations” for first year students)
2. MOOC course selection. Some of them had video material already recorded.
3. Training lecturers. Those lecturers selected take a small training course to learn the guidelines to prepare a MOOC course.
4. MOOC design by teachers. UPV defines a template for their MOOC courses. UPV MOOC courses are divided into units, and then into lessons. Each lesson has an associated video followed by a short quiz. After each unit there is an exam.
5. Content creation. Polimedia video recording for each lesson, and quizzes and exams preparation.
6. Creation of MOOC metadata file. The lecturer (with the help of a teaching assistant) fills a metadata file that contains the syllabus and index of materials for the course. This metadata file is used to automatically generate the MOOC course according to the target platform.
7. Student recruitment. In the case of upvx.es, we used conventional channels such as the institutional web site and mailing lists to call for student participation. In the case of MiriadaX, the companies involved in the creation of the platform (Telefonica and Santander Bank) took over student recruitment and disseminated these MOOC courses through their own channels.
8. MOOC operations
9. Evaluation

To gather demographic data in the upvx.es courses we included an initial form that the students have to fill when they enroll. We asked them: their name, gender, birth year, education level, country of origin, city of residence and how did they know about the course, letting them choose which questions they wanted to answer. In MiriadaX we didn’t have access to the initial survey made by the platform, so we included a starter unit in the courses with our own survey that included the same questions plus how much time did they had to dedicate to the course and how good was their previous knowledge on the subject. In the last survey we included the Which is your motivation to take the course?.

To gather satisfaction data from the students we prepared an online survey with questions to evaluate the system, the courses and the platform. In the first edition on upvx.es the survey was sent only to the people that earned a credential as a prerequisite to download it. In the second edition the survey was sent at the end of the courses to all students by mail, as we didn’t have control on the issuing of credentials. In the third edition the survey was sent at the end of the courses to all students by mail and was a prerequisite to download the credential (if the student had passed the course).

EDITION	COURSES	Initial answers	Final answers	Enrolled	First exam	Credentials	Cred/First Exam
1	2	940	187	1171	295-25,2%	160-13,7%	54,2%
2	14	46341	8095	76459	57098-74,7%	11805-15,4%	20,7%
3	8	6700	850	5971	1416-23,71%	667-11,2%	47,1%

Table 2: MOOC usage.

We can see that in the MiriadaX (second edition) 75% of the students took the first exam and in the GCB editions only ¼ of them did (is the only way we have to know if they started the course or not). We think that the reason was the lack of email capabilities of GCB that didn't let us reach a lot of enrolled students. On the other hand the % of credential issued is similar in the 3 editions, so the retention rate of GCB is bigger.

Students enroll mostly from Spain (66%), next from Colombia (9%), Mexico (6%) and Peru (5%). When we consider the ones that earn a credential the % that comes from Spain grows to a number between 72% and 79% depending on the edition. In general there are more men than women (60/40%) but depends on the course, there are people of all ages but most students are between 20 and 40 years old.

8. EVALUATION

There are some difficulties in evaluation a large project like networked teaching. We can go for subjective metrics, like students and teacher's opinions, and we can count that for the overall project or for the individual actions. Here we have a pitfall in that students and teachers don't have to participate in all actions, because a student only participate in an action if his teachers apply, and usually teachers are willing to do that only for some. This don't happen in the objective metrics, related to marks, as all students are (usually) graded.

Another point to consider is that for some actions (Polimedia, Virtual labs), access is anonymous, so we can only get aggregate metrics. On the other hand, Videoapuntes and MOOCs has restricted access (in the sense that you have to validate your account to enter), so it is easier to know about the students' participation on that case.

So, also because of space, here we present an insight of the valuation we carried out, focusing on three topics general evaluation on the marks of the students using the Polimedia tool, objective results of the students using the videoapuntes tool and the student satisfaction in using the Videoapuntes and MOOC tools.

Regarding the usage the Polimedia we have got the marks given by the teachers that have recorded and we compare their student's behavior before and after they began recording. We believe that this is an interesting metric because by doing that we are able to lower the effect of that the best teachers tend to use more any new tool available, and we are able to compare one teacher with himself. Marks go from 0 to 10, being 10 the best. We have compared the years 2007 to 2011, because we need to be able to get the marks of the students that have viewed the videos, and we don't have the data available for 2013.

Year	2007	2008	2009	2010	2011
With Polimedia	7,69	7,59	7,55	7,21	7,07
Without Polimedia	7,42	7,48	7,32	6,79	6,88
Mark Increase	3,6%	1,4%	3,2%	6,1%	2,8%

Table 3: Marks comparison in using polimedia

So we see that there is a small advantage in the use of polimedia recordings to supplement learning materials. While the increment is small, it is worth noting that is a positive upgrade for all the years evaluated.

Regarding the videoapuntes tool we have conducted one study on 9 courses during the first semester of the 2013-2014 academic year. From that we can show that about 80% of the students make use of the tool, and the marks on the students using that are about a 10% higher (9,91%). Marks go from 0 to 10, being 10 the maximum. Totals have been computed over the whole sample.

Course	Videoapuntes	Not using	Percentage	Marks with Videoapuntes	Marks without	Increase
1	433	89	82,95%	5,82	5,76	1,09%
2	324	78	80,60%	6,50	6,46	0,63%
3	308	88	77,78%	6,28	6,36	-1,25%
4	298	78	79,26%	7,38	7,20	2,38%
5	264	1	99,62%	6,46	8,10	-25,39%
6	179	472	27,50%	5,78	5,37	7,15%
7	106	2	98,15%	7,13	5,50	22,83%
8	47	0	100,00%	6,62	-	-
9	38	30	55,88%	7,66	7,78	-1,57%
10	37	134	21,64%	6,50	5,92	9,02%
Total	2034	972	67,66%	6,44	5,80	9,91%

Table 4: Marks increase by using Videoapuntes

A more interesting result is that not all students benefit in the same way from using lecture recording. Students that are somewhere in the middle level benefit most from the availability of this tool, as shown in the next figure.

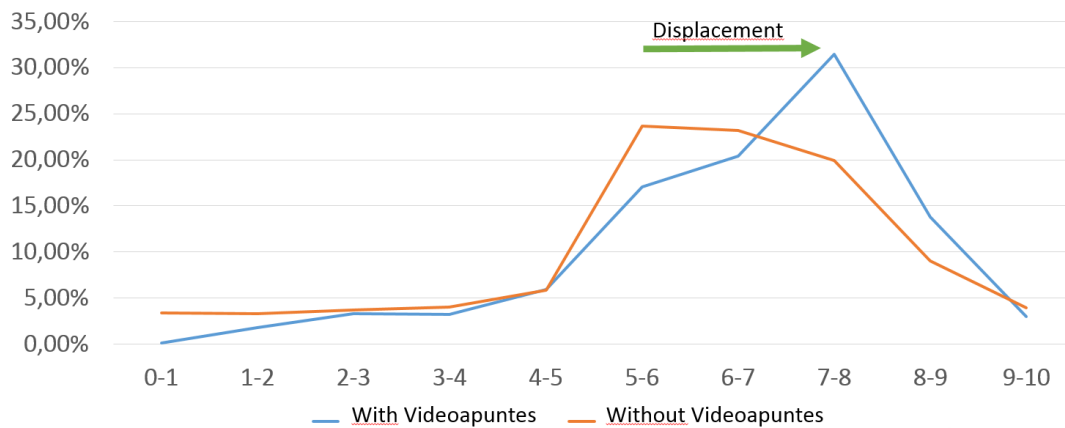
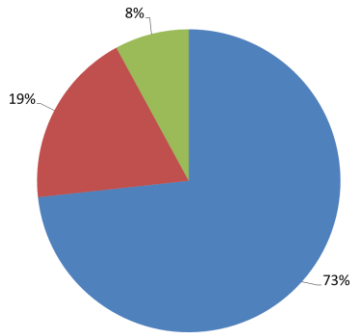


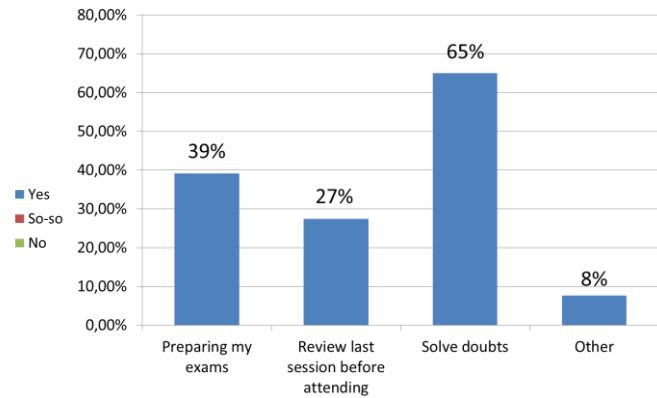
Figure 7: Distribution of marks with and without Lecture Recording.

For the subjective metrics, we conducted a specific survey within the students of Videoapuntes-enabled courses. Results are in line with the objective metrics just presented together with an interesting result saying that they attend more, not less, by having the ability to review the lectures.

I have found Videoapuntes' recordings useful for LEARNING



I have used videoapuntes for ...



Have you assisted to less lectures because of having the recordings available?

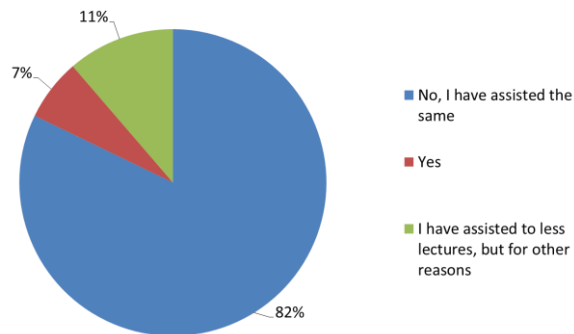


Figure 10: Results on the survey on Lecture Recording at UPV.

In the MOOC evaluation, we have conducted also a survey providing results on the success of the tool from the students' point of view, as depicted on the next table

	Yes		No
Do you like this way of learning?	96,90%		3,10%
	A lot	Yes	Not much
Do you feel you have learnt?	25,10%	52,90%	21,55%
Do you like the videos?	23,90%	63,60%	12,50%
Video scheduling (OK/Slow/Fast)	84,20%	2,40%	13,40%
Video length (OK/Short/Long)	89,40%	5,00%	5,60%
<u>Assesments</u> (OK/Easy/Difficult)	80,20%	16,50%	3,30%
Doubt answering (OK/slow/Not enough)	69,50%	22,60%	7,90%
Difficulty (OK/Easy/Hard)	90,90%	8,20%	0,90%

Table 5: Results on the survey on MOOC usage at UPV[x].

9. CONCLUSIONS

In the last 7 seven years, the Universitat Politècnica de València has made a big effort in encouraging teachers, and have available for them the technical, pedagogical and coordination services needed to run a successful content production.

Results of the plan have been quite a success, on one side because of the number of recordings and courses, but on the other side because now the University has a tool that allows to deploy easily any new learning technology.

We have also shown that there are objective and subjective metrics that point in the directing that having the plan and the tools available to the teachers have a positive effect on the learning process.

10. REFERENCES

Polimedia UPV open catalogue - <http://polimedia.upv.es/catalogo>

UPV Virtual Labs open Collection - <http://riunet.upv.es/handle/10251/11259>

MOOC UPV catalogue - <http://www.upvx.es>

TransLectures project - <http://transLectures.eu>

11. AUTHORS' BIOGRAPHIES



Dr. Carlos Turró is Head of Media Services at the Universitat Politècnica de Valencia. He has published more than 50 articles in international conferences and journals. His recent work on the design and development of Polimedia for Video e-Learning has received the Spanish FICOD award and several other international awards, including being finalist for the EUNIS ETLF award. He is also working on the transLectures project for transcription and translation of video lectures



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Prof. Jaime Busquets is the Head of the IT department of the Universitat Politècnica de Valencia. He is member of the EUNIS European Learning Task Force and is currently involved in the production and deployments of Massive Online Open Courses (MOOCs)