EVALUATING THE USE OF SELF-VIDEO TEACHING IN A FLIPPED CLASSROOM

J. Taverner, C. Marco-Detchart, J. Jordán, T. Vos

Universitat Politècnica de València (SPAIN)

Abstract

New generations are increasingly becoming more familiar with consuming audio-visual material through online platforms. Consequently, learning through IT-based tools is becoming more and more common. Nowadays, learning platforms (e.g., edX or W3Schools) or content platforms (e.g., YouTube) containing vast amounts of courses and video tutorials are becoming increasingly popular among students. The main advantage of online learning is that students can access the content from anywhere and whenever they want, being able to revisit the content to review concepts and improve their level of knowledge. In this way, learning based on a deep approach and self-learning is promoted since students are the ones who regulate their learning process by deciding how much time to dedicate and when to do it. Appropriately using this type of resource can become a very effective tool applied to a flipped classroom model.

In the flipped classroom model, students are active learners since they are in charge of developing the lesson material both in class and at home. In this type of learning, the teacher assumes the role of guide assisting during the learning process. A standard methodology in this flipped classroom model consists of students preparing different parts of the course content and then explaining those parts to their classmates. In this way, students develop a sense of responsibility toward the rest of their classmates, creating an environment where they can recognise their shortcomings and take control of their learning to teach others. In addition, the acquisition of transversal communication skills is encouraged.

With all this in mind, in this article, we describe a case study we are currently carrying out with students enrolled in the programming course at the Universitat Politècnica de València. Our proposal combines the flipped classroom model with access to online resources. In this first approach, we have proposed that the students record a video explaining a part of the lesson or how to solve at least two exercises step by step. The explanation must be done as if they were content creators, and their audience were beginner programmers. The students will upload the videos to a private YouTube channel that will only be accessible to their classmates. In the classroom, the teacher will encourage students to share their stories and experiences while learning, editing, and recording the videos. This proposal's main objective is to promote students' engagement in the learning process and offer them learning alternatives through online content with a closer language that they can access whenever they need it. To motivate participation, students and teachers will choose the three best videos from all the videos. The three winners will receive extra points in the evaluation of the course.

Keywords: Flipped teaching, video, video creation, online resources.

1 INTRODUCTION

New technologies have gained attention in education innovation [1, 2]. The introduction of Massive Open Online Courses (MOOC) has opened education and eased access to educative content for everybody [3, 4]. Video broadcasting is one of the leading technologies that have stood out to a bigger audience [5]. The use of videos can be a very useful channel to improve the student's learning process. This is because the audio-visual content allows explaining things by supporting the speech with explanatory images making the learning process experience more attractive, entertaining, and interactive. In addition, videos provide a flexible and accessible learning medium that allows students to learn at their own pace [6].

Typically, the use of technology, in particular the use of video, is focused on teaching a recorded lesson and sending it to students so that they have the opportunity to review a particular lesson in an in-person class [7]. In other words, it is a one-way communication way in which the teacher prepares and records the lessons. In addition, this type of video tends to have more or less moderate success since they tend to focus on the master class model, with the advantages but also the disadvantages that this type of teaching has.

One of the recent innovations in education has been the flipped classroom [8, 9]. In a flipped classroom, students take the leading role in their own learning process. Class materials are given to the students so that they can prepare the syllabus before going to class. Therefore, the students are in charge of preparing the contents of the subject before going to class. Inside the classroom, the teacher is dedicated to solving doubts and offering support. In this way, the learning experience is more interactive, fostering an environment based on two-way teacher-student communication.

The flipped classroom model has been gaining more and more popularity and has proven its effectiveness in motivating students in the learning process [10,11,12]. Currently, there are several methodologies that use the video format in flipped classroom models [13]. However, these proposals use videos as an asynchronous form of learning, in which classes are recorded so that they are available for students to watch at any time and at their own pace. This produces a unidirectional type of communication in which the teacher is the one teaching the students through the videos [14].

In this paper, we present the results of an experiment in which we have combined the flipped classroom model with the creation of audio-visual content. However, in our proposal, the videos are generated by the students as part of their learning process. It is common to find flipped classroom proposals in which students must expose part of the syllabus to their classmates. The responsibility of having to make a public presentation motivates them in their learning process as they need to understand the underlying logic of the concepts to be explained. This has several advantages, among which are a greater capacity to acquire knowledge of transversal competencies related to effective communication, the capacity for synthesis, or creativity.

This first conceptual test was carried out with first-year university students. For this, we have followed the usual scheme of the subject, but we have added a video explaining one of the topics. In this way, students will produce a short video pill on selected subject content. The central part of the experiment measures how students research autonomously and at their own pace to produce the video material for themselves and for other students in order to explain the content of the lesson. In this way, students must recapitulate the lessons received in class, revise the content, and increase their research to understand the subject better and explain it in their own way.

2 METHODOLOGY

In this paper, we investigate the influence on the learning process of videos in a flipped classroom model. For this purpose, we develop an experiment in which we ask students to prepare a video explaining a part of the content of the subject. As it is a first proof of concept, we only use a topic of the computer science subject of the first year of engineering at the university. Specifically, the selected topic was "using the iteration as a design strategy".

The experiment was conducted with 53 students (13 female and 40 male) of the first-year university in the subject of computer science. We asked three volunteer students to record a video explaining one of the didactic units of the course. To facilitate the elaboration of the video, each participant was provided with the didactic material of the subject together with articles related to the topic. These three students were also encouraged to complement the provided material by researching it on their own. To motivate the search for content, participants were informed that the best video would receive a reward in the form of points for the subject. The rest of the students together with the teachers of the course, were in charge of voting for the best video. On the other hand, the remaining 50 participants were divided into two groups: experimental and control. Both groups followed the course schedule with practices and lectures, as is usually done in the course. However, only the experimental group had access to the newly generated videos made by the other students to reinforce their learning. This is then observed experimentally to check if there is a significant difference between the two groups, that is, if the learning process of the students has some benefits for them, thus improving their results and reflecting in the students' grades.

To measure the influence of the videos on the learning process, we performed a multiple-choice test in the classroom for both groups. In this test, a collection of questions related to the didactic unit presented in the videos were asked. Once the tests were completed, we analysed the average grade of the participants of both groups, experimental and control, to check if there were significant differences in the obtained grades between the two groups, which will prove if the proposed approach is more useful for the students.

3 RESULTS

In this section, we present the obtained results of the performed test by the students regarding the contents of the subject in which three volunteer students produced video content to teach the other students. We separated the class into two groups, i.e., the experimental group, which had access to the newly created videos by other students, and the control group, which did not have access to the new videos.

Once the tests were completed, we performed an analysis of the data. First, we estimate the mean and standard deviation of the scores obtained in the tests in the experimental and control groups. The results are shown in the following table:

Table 1. Samples description.

	Mean	***Sd***
Experimental	7.76	1.53
Control	6.44	2.05

As can be seen, the mean score of the experimental group was significantly higher than the control group. In addition, the standard deviation of the experimental group was lower than the control group. This is evidenced in the boxplot shown in Figure 1. As can be seen, 50% of the sample, which corresponds to the boxes, has a smaller size in the experimental group than in the control group. This indicates that, in general, the scores of the experimental group were higher and with a lower dispersion, that is, with a greater proximity between the scores than the control group. This result seems to indicate that the videos had a positive impact on the learning process of students, favouring the acquisition of knowledge.

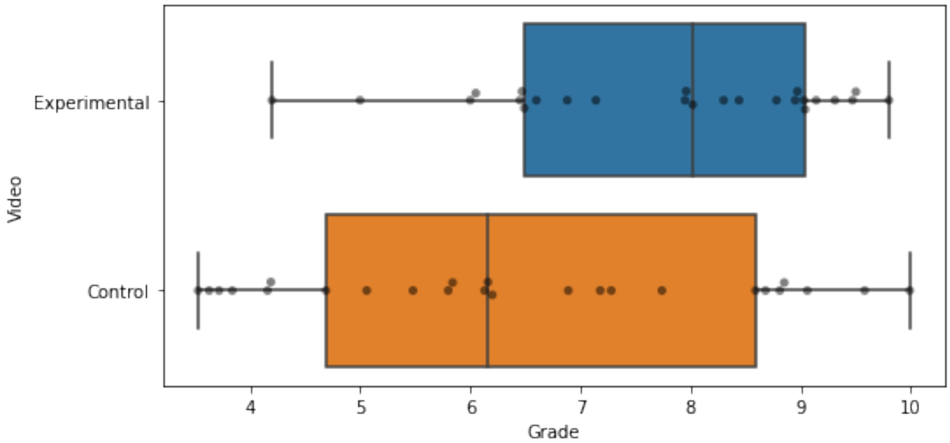

Figure 1. Boxplot of the two groups.

Nevertheless, in a study like this, it is necessary to check whether the results of the two groups have a significant difference. Therefore, to test the significance of the differences between the two groups, we performed a static t-test analysis based on the following hypotheses:

- H_0: there is no difference between the means.
- H_1: there is a difference between the means.

In order to perform the test, it is necessary to check that the samples have a normal behaviour. The test for normality of the samples gives the following results shown in Table 2:

Table 2. Result of the normality test.

	Result	***p-value***	***Normal***
Experimental	0.93	0.07	True
Control	0.94	0.13	True

As can be seen, according to the test both samples appear to come from a normal distribution. Continuing with the normality test, Figure 1 shows graphically the results of this test. The bar graphs on the left of the figure show the distribution of the samples. The blue line shows the normal behaviour of the data. Here it can be seen that the distributions follow normal behaviour. It is necessary to clarify that, being a small sample, it is normal that the distribution of the data does not seem to follow the normal behaviour according to the bars. However, if we look at the blue line, certain normal behaviour can be seen. This means that, if the sample were enlarged, it would tend towards a normal distribution. Even so, there is some asymmetry in the data, especially in the experimental data set. The graph on the right shows the fit of the data. Ideally, the data should be remarkably close to the line in such a plot. Again, there is some imbalance here, but it is still within what can be considered normal.

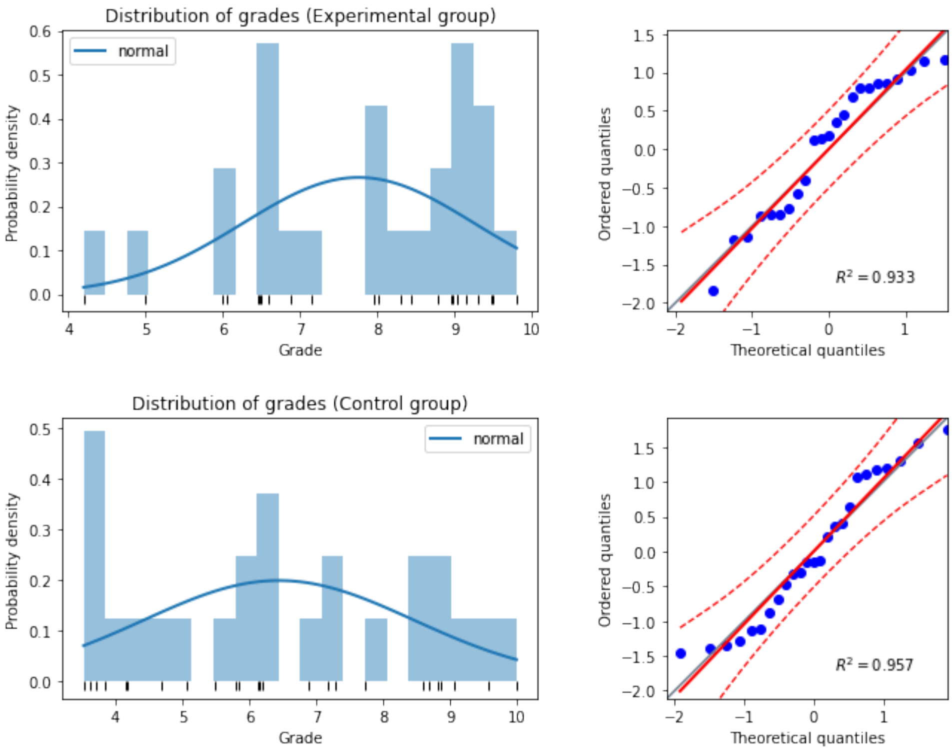

Figure 2. Normality test results.

In summary, both samples appear to fulfil the condition of normality. However, considering the size of the samples, we can observe that there are certain asymmetries, especially in the data set of the experimental group.

Once the normality test has been passed, it is necessary to check the homoscedasticity of the data. The homoscedasticity test, or homogeneity of variances test, assumes that the variances of the samples are equal. The condition of homoscedasticity is necessary for the performance of parametric tests to avoid bias. In this case, if we check homoscedasticity by means of the test of equality of variances, we can observe, in Table 3, that there is no significant statistical evidence (α= 0.05) to affirm that the variances are different in both groups.

Table 3. Results of the homoscedasticity test.

	Result	***p-value***	***equal***
Experimental	2.51	0.12	True

Once the conditions had been checked, we performed a two-tailed t-test. The two-tailed t-test is a statistical method that allows us to examine the hypothesis of the similarity between two samples. To do this, the similarity of the samples is studied by comparing them on both sides of the distribution. The results of the two-sided t-test are as follows:

Table 4. Results of the two-sided t-test.

t-test	*dof*	*p-value*	*equal*
2.56	48	0.01	True

Since the p-value (0.01) is less than the statistical significance level (α= 0.05), we can reject the null hypothesis H_0 and therefore assume that both samples are different. Therefore, we can affirm that there is a significant difference between the experimental group and the control group. This seems to indicate, as mentioned above, that the videos had a positive effect on the students' grades. However, this is the first proof of concept of the study. Further testing will be necessary, expanding the sample size and testing with more subjects, in order to be able to clearly state that the videos recorded by the students themselves are able to improve the educational experience.

4 CONCLUSIONS

Information technologies are increasingly present in our daily lives. Taking advantage of these new technologies can help to modify the educational paradigm adapting it to the new social reality. In this paper, we present the results of a proof of concept for introducing videos in a flipped classroom model in the field of computer science. As this is the first proof of concept, we have proposed the use of a single topic. The innovation is that the students themselves prepare the videos. This has several advantages in the learning process. From the side of the students who prepare the content, their learning experience is enhanced, as they feel responsible for explaining a lesson to their peers. In addition, they acquire other transversal skills related to research, communication, creativity, and the ability to synthesise. On the other hand, students who watch the videos experience an asynchronous teaching model that is more accessible and flexible, allowing them to learn at their own pace. Moreover, as videos were made by their peers, the language and expressions felt closer and more natural to them than if the videos were edited by a teacher.

The results of the experiment are promising and seem to show the existence of a significant positive difference in the obtained students' grades between the experimental group and the control group, that is, the experimental group that consumed the videos generated by their peers and the control group that did not have access to the new videos. The mean score of the experimental group is significantly higher, and the standard deviation is lower than that of the control group. This seems to indicate that those students who had access to the videos could retain and understand the concepts of the subject better.

Therefore, our main conclusion is that this type of teaching might increase the learning of the students as well as improve other transversal skills. However, more experiences should be done to confirm our hypothesis using other subjects, other degrees, and different levels of students.

In future work, it would be desirable to extend the experiment with more participants. It would also be interesting to study the differences in the learning process between the students who develop the videos and those who consume them.

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