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Perception and performance in a flipped Financial Mathematics classroom

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ABSTRACT

The “flipped” classroom model is a new organizational design for the teaching and learning paradigm, as its name transmits, stands for the pedagogical switch of the traditional academic procedure as students' first contact with the subjects is made outside the “four-wall classroom bounds”. Teachers' role is transposed into a kind of guide and facilitator, indicating the way to go, avoiding to walk in a parallel path, or even ahead, but indicating the way to go, motivating students in their own knowledge construction, letting them lead the way, following and supporting, constantly and carefully monitoring their learning outcomes. Classroom time is consumed with open discussions, solving tasks and application problems, clarifying the supporting fundaments, in order to improve students' engagement into their learning process in a collaborative environment. A flipped model was implemented into a Financial Mathematics Course at ISCAP and the sample of our study consisted of 803 students, enrolled in 2014, 2015 and 2016. The main purpose of this paper is to investigate how the incorporation of the flipped classroom model into a Financial Mathematics class, affected students' class training, learning, and achievement. The results obtained with this approach have shown a positive impact on students' achievement overall.

1. Introduction

It is commonly accepted that the “Flipped Classroom Model” was born, in the year 2000, by the hands of (Bergmann & Sams, 2012). These two chemistry teachers, lecturing then at the Woodland Park High School in Colorado, had to deal with high absenteeism rates, which promoted failure and the drop of students' success in their classes. Trying to deal with this issue, they started to record their lessons and display them online, offering students an open access to classes, outside the classroom walls, anytime and anywhere. This has led them to question whether class time was, in fact, the best way to “transmit” all the basic and supporting information to students at all. In this sense, Bergmann and Sams became dedicated to prerecording their “live” lessons for review outside the classroom, leaving class time for more significant learning activities, promoting a more natural approach of more advanced and difficult concepts (Bergmann & Sams, 2014). In this way, the central idea is based upon the “inversion” of the traditional teaching paradigm, where the main phases of the teaching and learning process such as classroom activities and homework are reversed. The flipped classroom is then settled as a different course organization, where instructional content (e.g., pre-recorded video lectures, readings, online presentations, sample applications) is assigned as “homework”, to be analysed before coming to class,

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and in-class time is spent working on problems, advancing deeper concepts, and engaging in collaborative learning (Findlay-Thompson & Mombourquette, 2014). The flipped classroom may contain a large array of out-of-class activities, as mentioned, and in-class activities may also include a wide type of activities such as role-play, debates, quizzes, and group presentations, amongst many others (O'Flaherty & Phillips, 2015).

Confronted with this pedagogical teaching methodology, as theoretical/supporting materials must be provided as a “pre-class” tool for students to take and analyze individually, it is essential to examine what “kind” of materials promote students' engagement, as they must be responsible for class preparation. In this sense, with all these inherent changes, instructors have been forced to adapt fast to this reality, creating and developing an extensive variety of tools to grab student's attention and to motivate them to support the knowledge in their own learning process enthusiastically. One of the most engaging resources is the use of video lectures, since, through them, instructors can provide multifaceted information to students and, if used creatively, videos can become a powerful technological tool in the global and self-enrolment educational process (Soares, Lopes, & Vieira, 2015, pp. 435–440). One must note that video lectures are different from other teaching and learning technologies as allowing the benefit of using visual perception - “that powerful but neglected sense” (Moss, 1983) - in new ways. The image associated with movement can be vital to realize a specific process or understand how something works, moves, or performs, which is much more complex to transmit with static images or text.

This and several other materials, were developed from the scratch when implementing a Flipped Model into a Financial Mathematics Course, in the Bachelor Degree of Accounting and Management from the School of Accounting and Management (ISCAP), one of the eight schools of the Polytechnic of Porto (P. Porto), a Portuguese HEI with more than 20.000 students, teachers, and researchers, within the Porto metropolitan area. This flipped classroom model was used as a pedagogical teaching strategy to be tested for future purposes and kept its global traditional format in a control group. In this paper, we try to establish the eventual relations that such strategy takes with active learning practices and discuss its success, analysing how flipping may influence student's achievement and contribute to a better and fruitful engagement in this course.

2. Literature review

Even though there is no single model (Tucker, 2012), the Flipped Classroom also known as the “Inverted Classroom” is frequently characterized as a procedure driven by technological innovations and the facility to share content online (Albert & Beatty, 2014; Berrett, 2012; Garver & Roberts, 2013; Kim, Kim, Khera, & Getman, 2014; Rivera, 2015). Many authors compare the flipped classroom model with the traditional classroom setting and examining the potential benefits of this pedagogical practice and show the results of their studies comparing the impact of a flipped classroom to that of a traditional one. Some of these studies reveal a positive impact of the flipped model since the enrolled students tend to score significantly higher than students in the traditional classroom (Albert & Beatty, 2014; Berrett, 2012; Rivera, 2015). The flipped classroom calls for students to learn by themselves at home using all the available and diverse learning resources. Basic course content is given outside class, allowing students to study the material and apply the concepts to several settings and actively participate in class, promoting effective classroom discussions (Gilboy, Heinerichs, & Pazzaglia, 2015; Lemmer, 2013; Schlairet, Green, & Benton, 2014). In a flipped model, the first step in knowledge transfer process can be readily accomplished by each individual student out of the classroom, and thereby leaves class time to focus on more in-depth and complex learning and skill sets (Arnold-Garza, 2014). The theoretical strong point of this new pedagogy seems to be the combination of constructivist and behaviourist learning theories working together, in a constant interaction (Bishop & Verleger, 2013). According to (Bishop & Verleger, 2013) the flipped classroom approach is “an educational technique that consists of two parts: interactive group learning activities inside the classroom, and direct computer-based individual instruction outside the classroom” (p. 5). Is a learning model which aims to increase students' active learning, collaboration and support during the learning process, through a better allocation of teaching time (Bergmann & Sams, 2012). In particular, this model suggests that teaching time within the face-to-face school sessions should not be spent on teachers' lecturing, but instead should be invested to provide students with unique learning experiences within collaborative activities with their classmates as well as receiving support by their professor (DeLozier & Rhodes, 2017). To achieve this, Learning Management Systems (LMS) as well as educational material (e.g., video lectures and online quizzes) can be used to engage students study “at home” and self-assessment, before their school classes. Thus, the principal idea comes from reversing the traditional teaching paradigm, where the main phases of the teaching and learning process, such as classroom activities and homework, are reversed.

As previously stated, pre-recorded video lectures or screencasts are one of the most common means of delivering instruction outside the classroom, in a flipped classroom format, requiring students to watch these prior to attending class (Abeysekera & Dawson, 2015). Video lectures can present in a clear and striking way descriptions to articulate tacit information and knowledge hard to describe through text (Goodyear & Steeples, 1998). Since the lecture is such a great portion of a class (even within the flipped classroom), it seems rational to observe whether pre-recorded lectures have any impact, negative or positive, on learning. In (Bravo, Amante, Simo, Enache, & Fernandez, 2011) we can find a study where “the effect of the use of videos for assessing the enhancement of students' learning motivation” is explored. Nowadays HEI are trying to get the best students and students search for the best learning experiences, so flipped classroom and, in this sense, the use of video lectures may be a particularly attractive tool to these students. Following this thought, HEI face some important challenges: support and offer high-quality engaging video lectures with the lowest possible budget and create and sustain innovative video platforms more interactive for students. This strategy, according with (Bergmann & Sams, 2014), aligns well with the flipped classroom, where “we don't want to encourage passive viewership; we encourage interactivity.” Even Harvard University, ever the academic benchmark, has succumbed to the allure of the flipped classroom. One Harvard physics professor not only employed the flipped model but has also developed an accompanying site entitled

Learning Catalytics, which distributes free interactive software for other instructors to use which facilitates student discussion and application of concepts covered in lectures (Educause, 2012).

Some studies report that the flipped classroom has a lot of benefits for students and teachers. For instance (Fulton, 2012), reported that students are able to make progress at their own pace. Moreover, doing homework in class provides a good opportunity for teachers to feel students' difficulties and to see their own different learning styles. This allows teachers to easily modify lessons according to students' needs within this model. Additionally, classroom time can be used more efficiently and creatively with a flipped classroom since students have the chance to study themselves the content before class sessions. In another recent study, two hundred science teachers applied the flipped classroom model into their Science, Technology, Engineering and Mathematics (STEM) classrooms and found it had a great impact on students' learning (Herreid & Schiller, 2013).

Among the 28 HE studies reviewed by (O'Flaherty & Phillips, 2015), only 11 reported measures of student performance, and among these, only 5 described comparisons to a traditional classroom with comparable exams and assessments (Hung, 2015) (Mason, Shuman, & Cook, 2013) (McLaughlin et al., 2014); (Missildine, Fountain, Summers, & Gosse, 2013); (Pierce & Fox, 2012). In general, most of the time outcomes normally reflected students' perceptions of their learning (Butt, 2014) (Critz & Knight, 2013) (Davies, Dean, & Ball, 2013) (Ferreri & O'Connor, 2013) (Forsey, Low, & Gance, 2013) (Gilboy et al., 2015) (Hoffman, 2014; Jamaludin & Osman, 2014) (Kim et al., 2014) (Lage, Platt, & Treglia, 2000) (McLaughlin et al., 2014) (Schlairet et al., 2014; Strayer, 2012; Yeung & O'Malley, 2014; Young, Bailey, Guptill, & Thorp, 2014).

Given the variety of approaches, flipped classrooms should be evaluated regarding the individual strategies used in creating the classroom flip, both for in-class and out-of-class activities, but there are several problems that must be mentioned. One of these evaluation difficulties in accessing the efficacy of flipped classrooms lies in the vast differences in instructor implementation of the classroom "flip". For instance, instructors might use a "partial" flip, in which only a portion of lectures reflect a flipped classroom approach (Seery, 2015), which is not easily comparable with a total flipped procedure. Some studies have also identified several challenges in the flipped classroom implementation process, like the significant amount of time needed to prepare all the offered learning materials, in particular, videos (Enfield, 2013; Lopes & Soares, 2016b). It is also referred that, for some students, the need for access to technology to view videos may be a challenge, it may even be an economically disadvantaged, moreover, video quality may be low, and students may not understand the video content and may not being well prepared for learning activities (Milman, 2012). These and many other constraints like students' attendance fluctuation, some lack of a responsible attitude towards knowledge construction, the difficult in coping with the continuous study pressure in the class preparation phase, are mentioned in quite a few of the articles analysed.

3. Research design

This paper reports an experience of a three-year study on supporting higher education students through the implementation of a flipped classroom in an undergraduate Financial Mathematics Course (FMC) in ISCAP at the P. PORTO. The course is a second-year one in the undergraduate Accounting degree. The project started with the course professor thinking deeply on the experience of teaching this course and from the comments of the students when filling out a survey at the end of the Winter 2014 semester.

Having some background analytics experience, granted by Moodle platforms and MatActiva Project (Babo, Azevedo, Torres, & Lopes, 2010; Lopes, Babo, & Azevedo, 2008; Torres, Lopes, Babo, & Azevedo, 2009), we have developed a FMC that used a flipped classroom model. MatActiva Project mission is to offer to ISCAP students a free, online tool, which stores wide variety of instructional Math resources, including video lectures and hundreds of exercises (all of them with a suggestion for the solution). It is a personalized learning platform in which students can individually and independently learn through an entire Math subject.

The sample of our study, from the Winter Semester FMC, in ISCAP, consisted of 803 students, 283 students enrolled in 2016, 262 students in 2015 and 258 students in 2014 semester. These students were divided in two groups: flipped and traditional group. In each year, the students from flipped group were the students of 2 classes from the total of 7 classes of Financial Mathematics. The flipped sample consisted of 80 students enrolled in 2016, 72 students in 2015 and 58 students in 2014 Winter semester. In both groups, approximately 90% of the students were attending the classes for the first time. The course entailed six subjects/sections (Simple Interest, Compound Interest, Ordinary Annuities, Annuity Due, Loan Amortization and Bonds) throughout the semester, and students were provided with flipped classroom model opportunities in five sections out of these six. It means that, five sections were flipped and only one section was traditionally taught during the semester. Accessing the MatActiva site www.matactiva.com, participants could access all the available sections in the FMC. In each section, students had at their disposal video lectures, reading, forms and sets of online exercises and online quizzes (all with solution), related with the topic.

The flipped classroom approach entailed three classes per week, with 1 h and 30 min duration. In advance of this class time, a set of short video tutorials, that covered the course content, were uploaded in the MatActiva site, for students to review in their own time. The first 20 min of the class involved skimming through the tutorials while addressing student questions on their content and any concepts they had struggle with. The remainder of the class time was spent explaining the subject by presenting PowerPoint slides, followed by exercises resolution and work activities either individually or in group. Each week a set of online assignments, from MatActiva Project, related with the subject they learned were given to the students to perform outside class. The attendance rate of students in the flipped classroom has been the same as the traditional class, without any drop-outs from flipped class.

One of the standard subjects for many HEI in any regular Economics/Accounting Degree, is Financial Mathematics. In this course students are expected to be familiar with certain mathematical skills from high school or previous Mathematics courses. Nevertheless, generally speaking, there is a frequent lack in what the needed basic skills is concerned. So, in many different moments, Financial Mathematics lecturers use class sessions in order to review these background materials. The ideal situation would be that students

should fill in this gap by doing the suggested research/homework before lectures, by reading related sections from a textbook in advance. Among new generation students, sad to say, this is not a common practice any longer (Hoeft, 2012). For all the reasons presented, we decided to use the flipped classroom model in an attempt to improve students' achievement in Financial Mathematics course through changes in the way they prepare before attending class sessions. We developed several video lectures (including some basic background material and a short introduction to the lecture) for students to watch before coming to class at different times during the semester and advised them to watch some particular educational videos from Khan Academy site and other opened educational resources available. Short tutorial video lectures allow students to move at their own pace, rewind to review portions, and skip through sections they already understand; they might view multiple lectures of five to seven minutes each. It was not a surprise when we realize that many students found watching a 10 min' video easier than reading a textbook about the same subject. Online quizzes and activities were combined to “test” what students have learned. Instantaneous quiz feedback and the ability to repeat lecture segments helped them to clarify some “grey” points in their minds. Inside classroom, students put into practice what they have learned from the video lectures and many other resources they previously came across, collaborating and creating meaningful work, developing some tasks through several discussions with the instructors' supervision and guidance. The above mentioned quizzes can also enhance learning because if students are “tested” prior to class, we have the additional opportunity to use feedback from these tests to tailor the content addressed in class.

With this research, we intend to examine whether the introduction of this flipped model improved the learning experience according to the final exam performance and students' perception.

4. Methodology

Two types of data were collected: course performance and student perception data. The performance data shows the results of the FMC in relation to the percentage of students who passed the courses in both the traditional and flipped classroom model. So, the results from both groups were examined in relation to each other and in relation to their standing within a particular year. We also analysed if there was any relationship between the results obtained in the final exam and the classifications obtained in the online quizzes carried out by the students in MatActiva Project. Performance data was also studied through an analysis of the spread of grades, achieved by each group in their final exam.

Through the online Registrar's Office, each course taught at ISCAP and each lecturer is evaluated at the end of the semester. The course evaluation involves a quantitative evaluation using 17 Likert-type questions followed by one open-ended question that allow for qualitative feedback. The lecturer evaluation involves a quantitative evaluation using 7 Likert-type questions, also followed by one open-ended question. Students rate statements about the course 1–4: where 1 is “Strongly disagree” and 4 is “Strongly agree”. They also rate the lecturer's overall performance 1–4: where 1 is “Poor” and 4 is “Excellent”. Therefore, the perception data was drawn from the student course and lecturer evaluation results. This kind of evaluation, made by students from flipped group, is seen as a mean to improve future practice by reviewing what have been done before. The completion of the survey by flipped students was voluntary. In 2016/2017, 43 of the 80 students completed the survey, 35 of the 72 in 2015/2016 and in 2014/2015, 31 of the 58 students completed it. The survey closes with one open question that allowed students to give suggestions about measures they think appropriate to improve the course and the lecturer's performance.

We have also developed a short survey in an attempt to find out how the flipped classroom model affected ISCAP Financial Mathematics students' training, understanding and their performance. The survey was given at the end of the semester to analyze participants' global thoughts about the use of the flipped model in their classes. In particular, this survey was designed to try to discover in which way the flipped classroom (including short video lectures and interactive online exercises) helped these students. Flipped instruction offers the opportunity to efficiently collect data on improved subject learning (Arnold-Garza, 2014). While some studies reveal a smaller improvement in Mathematics than in other subjects (Barbier, Cevenini, & Crawford, 2012) we feel that video-lectures available in MatActiva Project have an important role in the work of prerequisites items, in which we feel (and know) the students have missed in their previous “educational life”. The video materials available have been very successful and with a wide and strong utilization from our students. We also have used the Learning Analytics tools provided by Moodle platform for monitoring students' progress in real time. This platform offers to the teacher/administrator different analytical instruments with a wide range of information reports on the numerous activities carried out by their students in a particular subject, which can be an important tool to improve, adapt and modify the subject in question (Lopes & Soares, 2016a).

5. Results and discussion

There were 552 648 log records and 43 954 sessions made by the 803 students of the FMC, with 55 sessions per student, and 11 actions per session for each student in average.

One of the significant measures as to the success, or otherwise, of the flipped classroom is the final exam results, so we have used the results of the final exam to try to measure the success of the flipped classroom model. If there were substantial changes in the course results from previous years or the average course results are very different in relation to existing traditional classes, then there might be evidence of impact. Table 1 shows the relationship of results of the 2014/15, 2015/16 and the 2016/17 in the traditional classroom group against flipped classroom group.

We can observe, from Table 1, that the success rate for the flipped classroom version increased by 19,8% from the starting point set in 2014/15. We can also notice that the success rate for the flipped classroom is bigger than the success rate for the traditional classroom in FMC. All iterations of flipped classroom clearly outperform the average success rate across of traditional classroom, the

Table 1

Measuring the success of Flipped Classroom against the Traditional Classroom.

Source: Own elaboration.

	2014/2015	2015/2016	2016/2017
Flipped Classroom success rate	71,4%	90,5%	91,2%
Traditional Classroom success rate	49,2%	62,3%	62,7%

average success rate for the traditional classroom improved by 13,1% in 2015/16 and 0,4% in 2016/17, while the average success rate for the flipped classroom improved by 19,1% in 2015/16 and 0,7% in 2016/17. From this we can see that there was a slight increase in overall performance in the flipped classroom version in relation to successful students. We are very pleased about the flipped classroom model results, and we plan to use it again next year 2017/18. The student success rate in the flipped class supplanted, in a perfectly visible way, those obtained by students in the traditional class. But also, the average grade achieved among the successful flipped students, was higher than the average grade achieved among the successful students of traditional class. For flipped classroom students, in 2014/15 the average grade for Financial Mathematics was 13.3, 14.5 in 2015/16 and in 2016/17 it was 14.9 (out of 20), while the average grade for the students from traditional class was during this time: 11.2 in 2014/15, 12.1 in 2015/16 and 12.3 in 2016/17.

We applied a chi-squared test to the average grade achieved by the two groups of students (see Table 2). These results show that there was no significant difference, although there was a small increase in the percentage grade achieved. This suggests that the increase in the flipped group average grade was higher than the other group.

In Figs. 1–3 we can visualize a “strong” linear connection of MatActiva online quizzes average grades with the final exam grades obtained by flipped students, during the study period. The data shows individual results as well as a line of best fit (R^2). The higher the R^2 result, the stronger the relationship between MatActiva quizzes grade and final exam grade.

As well as examining course performance data, data was also drawn from student perception results. Results revealed the diverse types of training students did before coming to face to face sessions that were exploited in the overall flipped classroom individualised moments. Table 3 summarizes the frequency of students' preparation preferences.

Analysing these data, it is clear that most of the students preferred video lectures and doing online exercises, for training, more often than all available written resources. The high number of students that used online exercises can, possibly, be explained by the fact that a Question Pool was created from the ground up, grouped into categories and subcategories, on Financial Mathematics Course content. The combination of questions in each category is randomized and it generates a huge number of different tests that students can solve online, wherever they are and at a time that suits them. The tests allow multiple attempts, providing automatically quantitative results and each attempt is corrected immediately. For each wrong answer the feedback is presented with a suggested step by step solution, in order to help students to understand what went “wrong” with their answer, providing and promoting self-assessment and skill development.

A large number of participating students (86,9%) stated that video lectures helped them understand the concepts studied in Financial Mathematics (see Table 4). No students indicated any negative thoughts about flipped classroom video lectures.

It is amazing that in answering the question “Online exercises helped me gain solid knowledge and skills in Financial Mathematics”, the majority of students (97,7%) indicated that online exercises with the detailed solution proposed helped them perform better. Only 2,3% of the participants were neutral about the benefits of the online exercises in the flipped classroom, in terms of providing them better performance (see Table 5).

Before finishing this section, we present (Table 6) the global feedback results about flipped classroom preferences. In this same survey, to the question about the student's preferences in relation to the flipped classroom, 66% prefer a flipped classroom. 23,8% of the participants were neutral about the preferences related with the flipped classroom and 10% of the participants prefer the traditional classroom.

Through the examination of the online Registrar's Office responses of 2014/15, 2015/16 and 2016/17, data were also extracted from the students' perceptions about the course and the lecturer. Students' overall rating of the course was “Excellent” in 2014/15 and “Very good” in 2015/16 and 2016/17, while the lecturer's overall performance was rated as being “Excellent” in 2014/15, “Very good” in 2015/16 and “Excellent” in 2016/17.

Over the past recent years, the implementation of flipped classrooms has been increasingly discussed. Some studies have revealed the advantages of flipped classrooms (Davies et al., 2013; Missildine et al., 2013), and demonstrated that this learning approach can help students' learning. In this study, a flipped classroom approach was used, and a set of materials was developed to aid students'

Table 2

Average grade for FMC Flipped Classroom versus Traditional Class.

	2014/2015	2015/2016	2016/2017	Row totals
Flipped Classroom average grade	13,3	14,5	14,9	210
Traditional Classroom average grade	11,2	12,1	12,3	593
Column totals	258	262	283	803

Chi-square statistic is 0.0372. P value is 0.652374. Result not sig. at $p < .05$.

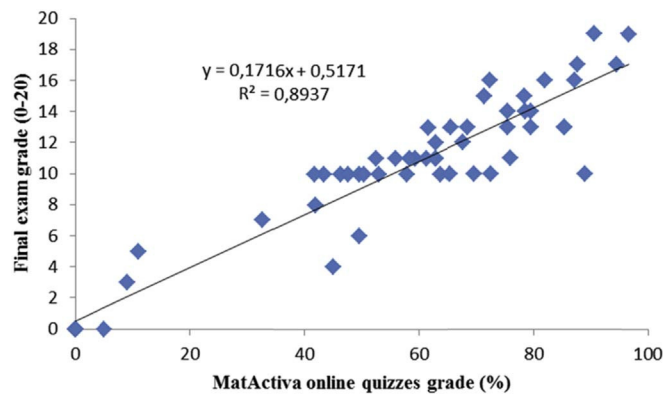


Fig. 1. Final exam grade vs. MatActiva online quizzes average grade in 2014/15.

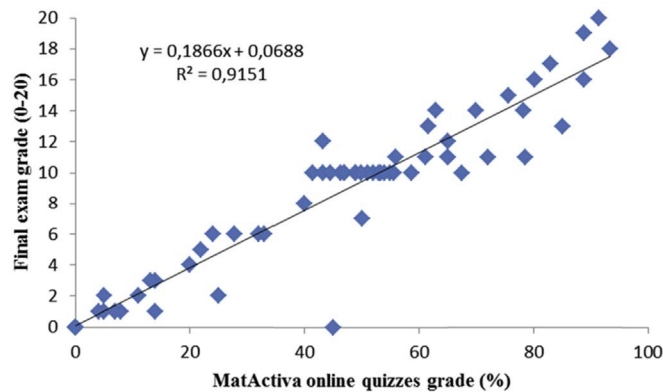


Fig. 2. Final exam grade vs. MatActiva online quizzes average grade in 2015/16.

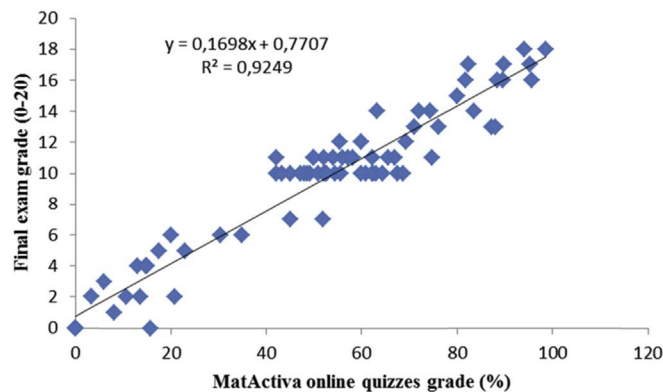


Fig. 3. Final exam grade vs. MatActiva online quizzes average grade in 2016/17.

out-of-class learning and improving the quality of the in-class interaction with students and professor. A research was conducted in an undergraduate Financial Mathematics Course to evaluate the flipped learning approach. The flipped group learned with the flipped classroom approach, while the traditional group learned with the conventional classroom approach. The results showed that the flipped approach significantly benefited the flipped students' learning achievement. These findings provide evidence that the flipped classroom model makes students more responsible for their own individual learning process while giving them bigger motivation to experiment and experience new challenges.

6. Conclusion

The flipped classroom seems a promising teaching-learning procedure that can take advantage of all the recent and available technological developments which shouldn't be underestimated, an innovative pedagogical approach that focuses on learner-centered

Table 3

Students' preparation types in flipped classroom.

Source: Own elaboration.

	Watching flipped video	%	Watching other videos	%	Reading the textbook	%	Doing online exercises	%
2016 2017	65	81,3	42	52,5	31	38,8	78	97,5
2015 2016	63	87,5	34	47,2	25	34,7	70	97,2
2014 2015	49	84,5	28	48,3	39	67,2	50	86,2

Table 4

Video lectures and students' preparation.

Source: Own elaboration.

The video lectures helped me understand the concepts studied in Financial Mathematics	Number	Percentage
Strongly agree	62	47,7%
Agree	51	39,2%
Neither agree nor disagree	17	13,1%
Disagree	0	0%
Strongly disagree	0	0%

Table 5

Online exercises and students' performance.

Source: Own elaboration.

Online exercises helped me gain solid knowledge and skills in FMC	Number	Percentage
Strongly agree	98	75,4%
Agree	29	22,3%
Neither agree nor disagree	3	2,3%
Disagree	0	0%
Strongly disagree	0	0%

Table 6

– Students' preferences.

Source: Own elaboration.

I'd prefer a flipped classroom course over a traditional classroom course	Number	Percentage
Strongly agree	49	37,6%
Agree	37	28,4%
Neither agree nor disagree	31	23,8%
Disagree	13	10%
Strongly disagree	0	0%

instruction. The main purpose of this paper was to investigate how the incorporation of the flipped classroom model into a Financial Mathematics class, in Institute of Accounting and Administration of Porto (ISCAP), affected students' class training, learning, and achievement. In agreement with other studies on flipped classrooms (Arnold-Garza, 2014; Bishop & Verleger, 2013; Gilboy et al., 2015), we set up that students in the flipped classroom preferred watching video lectures than reading textbooks about the issue they are studying. We also found that for student is very important the opportunity of doing online exercises and have access to their solutions (explained in detail). This study also shown that flipped classroom model caused an increase in student achievement in Financial Mathematics Course.

The integration of the flipped classroom into the educational process led to an increase of students' motivation and interest for studying Financial Mathematics. Furthermore, it has a positive impact on students' determination and autonomy due to the fact that students take on responsibility for their own learning.

We asked students their opinion on their experiences in the flipped classroom and they wrote, “The video tutorials allowed for class time to be much more efficiently used, and the quizzes due before class provided a good incentive to stay on program”; “I liked the way that we watch video lectures at home and do the online exercises and then got to work on problems in class so that we had a chance to practice the material with professor there”. Such positive evaluations, encourages us to continue with this project.

Finally, the flipped classroom increases students' responsibility for their own learning. They become more self-directed and

motivated than in a traditional classroom environment. Students have to learn how to manage their time working with the online course, developing self-study and autonomous learning skills, their role in the learning process is changed, making them active participants of the educational process.

From the professor point of view, it was a rewarding but quite exhausting task. The huge amount of work to put up this venture was a little bit reduced by the existing materials from the MatActiva Project. However, these were all revised and complemented with “fresh” ones as well as the question pool was continuously enlarged. It must be mentioned that, in order to have a “productive” class time, a global scheme must be planned and all students must be “synchronized” (effective pre-study) and this is one of the most difficult tasks we daily faced in a flipped model. However, when students realize the actual results and feel as being the “vital gear” in this gigantic learning/teaching “motor”, they began to be more responsible and less complacent with others’ failure to comply with the flipped model rules. Successful students and good feedback based on positive learning outcomes is the reason we embrace such projects and experiences.

In our opinion, further research is needed in other subjects and instructional contexts so that they can contribute to the instructional decision making being undertaken in Higher Education Institutions, related to the use of flipped classroom environments.

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