Article

Flipped Classroom to Improve University Student Centered Learning and Academic Performance

Ángel Custodio Mingorance Estrada [1,*] , **Juan Granda Vera** [2], **Gloria Rojas Ruiz** [1] and **Inmaculada Alemany Arrebola** [3]

[1] Department of Didactics and School Organization, Faculty of Education and Sports Sciences, University of Granada, 52005 Melilla, Spain; glrojas@ugr.es

[2] Department of Didactics of Corporal Expression, Faculty of Education and Sports Sciences, University of Granada, 52005 Melilla, Spain; jgranda@ugr.es

[3] Department of Developmental and Educational Psychology, Faculty of Education and Sports Sciences, University of Granada, 52005 Melilla, Spain; alemany@ugr.es

*   Correspondence: amingoe@ugr.es

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Abstract: In recent years, educational research has focused on analyzing significant differences in the academic performance of university students according to the intervention model of the traditional methodology vs. the flipped classroom. This empirical-analytical research is based on a quasi-experimental design with non-equivalent groups. The results reveal significant differences on the average grades of university students; those participating in the flipped classroom obtained higher scores than students following a traditional methodology, regardless of the specialization. Moreover, this research concludes that the flipped classroom approach offers an opportunity to transform the traditional system by improving the classroom environment, the teaching-learning process and the student's assessment.

Keywords: student evaluations of teaching; flipped classroom; academic performance; feedback

1. Introduction

Technology is rapidly changing our lifestyle and interactions with others in the world. Smartphones, tablets and laptops are examples of the range of technological devices that have changed our daily routines, as well as our personal, academic and professional habits because of the advent of the Internet, apps and social media. Nowadays, some educational research focuses on demonstrating the benefits of technology to improve the academic performance of university students. Technological advances have influenced a new intervention paradigm in Higher Education, introducing new methodologies and innovation tools that shift from traditional methodology towards a learner-centered approach in order to focus attention on the student learning process.

This new scenario and the challenges of the European Higher Education Framework (2010) encourage teachers to integrate technology into the classroom. According to the Horizon Report (2016), measuring this integration would help to achieve a significant impact on education in the next three years (Johnson et al. 2016).

With the objective of achieving that impact, teachers must use technological tools in addition to familiarize themselves with the Technological Pedagogical Content Knowledge (TPACK) model that integrates technology with disciplinary, pedagogical and technological knowledge (Sen-Eshaluce et al. 2017). Likewise, this model promotes a greater interaction between teachers and students (Sen-Eshaluce et al. 2017) through more significant synchronous and asynchronous communication approaches.

The pedagogical practices are established according to the teaching-learning modality: face-to-face learning blended learning (B-Learning), distance learning (E-Learning), attending classes by means of handheld devices (M-Learning) or any other electronic device, such as TV, radio ... (U-Learning) (Martín García et al. 2014; Salinas et al. 2018).

In any of these learning styles students are considered passive subjects, merely limited to listening while sitting in class, performing tasks or waiting for the teacher's answers. These facts are in line with Tapscott (2010), who concludes that the use of technological resources encourages a more interactive, collaborative, personalized and discovery learning.

B-Learning refers to the combination of face-to-face and virtual modalities, combining didactic or curricular elements with technological devices and control parameters along the path, time, and pace of the student learning process guided by the teacher (Owen and Dunham 2015). These characteristics require students to assume a more responsible and proactive role during their learning experience in order to improve their academic performance. Most of the Faculties of Education, specifically in the field of future teachers' training, do not analyze the results of this method at the final stage, though (Zainuddin and Hajar 2016; Lundin et al. 2018; Cabi 2018). Horn and Staker (2014) refer to the rotation model, and within it the flipped classroom sub-model, which consists of a new approach in which the class is inverted in order to change the traditional working time perspective in the classroom.

In Flipped Learning, the teacher designs intentional learning experiences in which the student is responsible for exploring the materials provided in an asynchronous way to acquire basic knowledge before attending class (Educause Learning Initiative 2012). Therefore, the FL approach allows using classroom time for explaining contents in greater depth through activities oriented to the acquaintance of skills for real-life situations. The explained process requires the teacher to have an extensive knowledge and expertise on the subject to be able to explain the concepts in depth and propose convenient tasks. Constructivist learning through personal experiences increases the number of situations in which students are active learners.

The flipped classroom approach helps students to develop cognitive strategies, such as understanding, retention, elaboration and the restructuring of information (Fooladvand et al. 2017; Ganbari-Taleb et al. 2013). The flipped classroom also promotes autonomous and independent learning in such a way that the control of the learning process passes from the teacher to the students. In this sense, students are given the opportunity to plan, develop and evaluate their own learning process, training their meta-cognitive strategies. Therefore, the functions and responsibilities of both teacher and students become proactive, and the acquisitions of new or improved skills are often required to optimize the quality and efficiency of the teaching and learning processes (Educause Learning Initiative 2012).

More recent studies reveal that the flipped classroom sub-model has been widely applied in various disciplines in university education, such as IT, Chemistry, Algebra, Economy, Engineering, Sociology and Humanities, Physiology, Statistics, Health Sciences, Calculus, Science, Technology, Mathematics, Business and English (Zainuddin and Hajar 2016), and has displayed positive results (Gilboy et al. 2015; Meyers 2016). The design according to this new approach provides the students with a more active than in a more traditional model by allowing them to analyze, synthetize and evaluate activities while participating in them, resulting in a deeper acquisition of knowledge, as stated in Bloom's taxonomy (Bloom 1956).

The activities proposed following the flipped approach, including watching images, videos, explanations, presentations and real experiences, participating in debates, and carrying out simulations, encourage students to "do". These tasks enable them to retain, understand and transfer more information in comparison with activities in which they just "read", "listen" or "observe" (Dale 1969). Therefore, Dale (1969) concludes that the Flipped Classroom approach produces a more active learning. At the same time, they are passive learners as they absorb information by listening, reading and seeing, in order to remember, describe and apply. These activities develop students' lower thinking skills, which are required to acquire in-depth knowledge, and eventually develop higher thinking skills.

Consequently, the teacher's experience and deep knowledge of the subject is crucial to restructure the methodology according to the syllabus of the subject. This new learning paradigm encourages students' pre-class preparation through adequate tasks involving technological resources that aid this learning model with a wide diversity of tools.

These tools include: Platforms that contribute to develop both collaborative and individual activities, such as (Moodle or Google Drive); presentation programs, such as (PowerPoint or Prezi); video editing programs, such as (Movenote or Blubbr); platforms to design interactive questionnaires, such as (Quizlet, Socrative, or Kahoot . . .); collaborative learning programs, such as (Google Drive or Google for Education . . .); platforms, such as (Blogger or Twitter . . .); and finally platforms to evaluate students with (rubrics, such as Teacher Planet, Rubric Maker or teAchnology).

An initial assessment is required before starting pre-class work to follow the Flipped Classroom approach adequately. During class time, active learning strategies, such as watching videos, (Brewer and Movahedazarhoulijgh 2018; Uzunboylu and Karagozlu 2015) are incorporated, and eventually, students do formative tests at the end of each teaching unit to monitor their progress.

The existing literature shows that this flipped classroom offers several benefits to students' learning, such as a higher class attendance (Maarek and Kay 2015; McLaughlin et al. 2014; Sahin et al. 2015). Attendance requires a more active role in the learning process prior to class, as it has proven to be crucial for success (Mingorance 2019; Mingorance et al. 2017). Moreover, flipped classroom also requires the students to increase their participation during class time (Gilboy et al. 2015; Guy and Marquis 2016; McLaughlin et al. 2014; Mok 2014; Porcaro et al. 2016) as well as during individual, peer-to-peer and small group learning activities, enhancing interaction between the students and the teacher through communication　(Mok 2014; Sen-Eshaluce et al. 2017; McLean and Attardi 2018; Velegol et al. 2015). This approach provides the opportunity to detect mistakes in the material comprehension (O'Flaherty and Phillips 2015; Lai and Hwang 2016), as this permits the teacher to give immediate feedback (Mingorance 2019).

Several researches reveal that students' motivation increases (He et al. 2016; Muir and Geiger 2015) together with their responsibility, interest and engagement (Lasry et al. 2014; Meyers 2016; McLaughlin et al. 2014).

In turn, flipped classroom increases student satisfaction (Galway et al. 2014; Koo et al. 2016; Muir and Geiger 2015; Porcaro et al. 2016; Sahin et al. 2015; Troehling et al. 2017), although conflicting results were also obtained as other research reveals that students express dissatisfaction with the application of the model, since students prefer to attend lectures and adopt a passive position associated with the traditional classroom methodology. In addition, the workload for students attending flipped classroom is higher, and not all students can easily adapt to the interactive approach of a flipped learning environment and they may struggle with the learning how to learn competence, independently of all the basic and advanced materials through video conferences (Betihavas et al. 2016; Presti 2016).

Given the contradictory results obtained with this method, the main objective of this research is learning if the change of methodology has any consequence in students' academic performance. Therefore, this study aims to analyze the results of the implementation of the flipped classroom approach in comparison with a traditional methodology at university education level, in order to improve students' performance. Studies focused on other fields conclude that students participating in the flipped classroom show better academic performance, since they show a better understanding of the concepts and obtain higher grades in exams; (Bishop and Verleger 2013; Galway et al. 2014; Guy and Marquis 2016; Hinojo et al. 2018; Koo et al. 2016; Maarek and Kay 2015; McLaughlin et al. 2014; Mingorance et al. 2017; Porcaro et al. 2016; Sahin et al. 2015).

Other studies find limited improvements, such as an increase in study time and the lack of immediate feedback after watching the videos, although for now the investigations conducted on this model and its impact are more anecdotal than rigorous, and they are based on the potential effects in the learning performance.

The students working with a flipped classroom approach still obtained higher scores in exams in comparison with the traditional methodology group (Betihavas et al. 2016; Love et al. 2014; Yacout and Shosha 2016; Presti 2016). However, these authors point out that some additional studies on the results of flipped classroom are required to guide the future implementation of this approach.

However, not all the comparative research papers on flipped classroom vs. traditional classroom in higher education agree with the effectiveness of this new approach. In this sense, the results of studies conducted by Blair et al. (2016); Braun et al. (2014); Gross et al. (2015); Li and Dan (2015); Ryan and Reid (2016) and Troehling et al. (2017) show no significant differences in the students' performance between both approaches at the end of the course.

The studies conducted by Bishop and Verleger (2013); Karabulut-Ilgu et al. (2018); O'Flaherty and Phillips (2015); Stöhr and Adawi (2018), and Yong and Wang (2016) on this new model indicate that there are very few controlled studies that objectively examine the learning outcomes in the student's performance over a semester. These authors claim that there is a scarcity of experimental or quasi-experimental designs and cross-sectional and longitudinal studies with a solid base to provide a deeper understanding, although they point out that there is a lot of indirect, anecdotal or testimonial evidence of the improvement of the academic performance and the satisfaction of students with this model.

There are a striking limited number of studies that have examined the efficiency of the flipped classroom as a didactic model in the Education Science classes which focus on the training of future teachers. Few research papers compare the flipped approach with traditional structures during the learning process. Therefore, this research is crucial to the contribution of scientific literature on the subject, filling the information gap to obtain more evidence in the evaluation of learning outcomes and academic performance.

The new European Higher Education Framework proposes a shift from a teaching-centered paradigm toward a learner-centered paradigm (Schreurs and Dumbraveanu 2014). In the European Framework context, the objective of this study is analyzing whether the methodology used in the teaching-learning process influences both academic performance and class attendance of university students in the Education Science field, specifically in the future teachers training.

2. Methodology

2.1. Research Design

This study uses an empirical-analytical methodology of non-equivalent, quasi-experimental groups. Moreover, a transversal design was used in the data collection process (Atos et al. 2013).

2.2. Participants

The participants of this study are students of the new Bachelor's Degrees in Early Childhood Education and Primary School Education, of the University of Granada (Spain). The students are enrolled in the courses "Organization of the Center and Children Classroom" and "Organization of the Educational Center", both delivered in the second year.

Therefore, the study has been carried out with 555 students enrolled in the subjects related to the organization mentioned above, where 189 of them (34.1% of the sample: 180 females and 9 males) study the BA's degree in Early Childhood Education, while 366 (65.9% of the sample: 226 females and 140 males) study Primary School Education. 149 (26.85%) are male students and 406 (73.2%) are female students, numbers that show how feminized these Degrees in Education are. In this sample, 328 (57.3%) study the subject in lectures following a traditional methodology (from now on, TC), whereas 237 (42.7%) study it following a Flipped Classroom approach (from now on, FC.)

2.3. Variables and Instrument

The independent variable of the study is the methodology applied during the course: traditional vs. flipped classroom.

The dependent variable is academic performance, since it measures student learning process (Edel Navarro 2003) and is a quality indicator in Higher Education. For this reason, the average grades obtained at the end of the course were collected, ranging from 0 to 10 (Felman et al. 2008), including the grades of those who did not attend the assessments, as this point is considered to be the end of the intervention in both methodologies.

The evaluation is continuous and similar in both groups to eliminate variables that may contaminate the results. Class attendance in both methodologies is also considered.

In addition, throughout the period of intervention in both TC and FC groups, during the second semester of each course, the teaching process has been conducted by the same teacher, who taught the classes following the traditional methodology in some groups and the flipped classroom in others. The variables that could contaminate the measurement have been controlled; hence the teaching style and the classroom environment are similar in all the groups.

Finally, this research has been conducted on the "Organization of Educational Centers", which lasts 14 weeks, and concerns the basic training of Bachelor students. They attend this course three hours a week in the mornings.

2.4. Procedure

Traditional classes were carried out through interactive-retroactive lectures between teachers and students, in which the teacher used the students' questions to redirect the subject towards the objectives of the theoretical and practical concepts exposed in class. For this reason, traditional classes have been structured in three phases: Firstly, in the introductory phase the teacher goes over the contents explained in previous sessions in order to continue constructing new knowledge through presentations; secondly, in the phase of development, the teacher exposes the contents through presentations on multimedia platforms (PowerPoint: text, video-audio and images) and finally, the closing phase concludes with a synthesis, based on a summary made by the teacher and students' questions.

Regarding the Flipped Classroom (FC) method, the classes were divided into two phases: In the first one, the students work with videos, presentations, readings and reflections on control questions before attending the class, in order to prepare the contents. Therefore, depending on the contents, the material is presented in multimedia format. Likewise, the learning platform for the pre-class preparation is Moodle, which is accessible at any place and time, even during no academic hours. Activities, self-assessment questionnaires and a forum to discuss ideas and clear up doubts are also available within the platform.

In the second phase during class time, the teacher starts clearing doubts by answering the students' questions related to the previously given academic material and then aims to deepen the knowledge through a design of situations introduced through anecdotes, illustrative examples, problems and simulations. This method is carried out through peer group activities where small groups of four to six students work collaboratively. The class ends with a synthesis of the work done in class, and students are given the opportunity to ask questions. Finally, students take a final test on the platform at the end of the session and are given immediate feedback on their answers.

3. Results

The mean, standard deviation, asymmetry, kurtosis and the percentage of the global scores obtained after the analysis are detailed in the table in relation to the methodology (Table 1).

Table 1. Descriptive values of the performance in the regular call according to methodology in each academic year (June exam period).

	TC 2011–12	TC 2012–13	TC 2013–14	FC 2014–15	FC 2015–16	FC 2016–17
Mean	2.12	1.59	2.30	5.15	5.04	4.48
SD	2.622	1.831	2.396	2.618	1.393	2.140
Asymmetry	0.906	1.115	0.753	−0.320	−1.445	−1.115
Kurtosis	−0.390	0.715	−0.368	−0.510	2.940	0.224
Absent	47 (49%)	16 (37.2%)	63 (35.2%)	6 (7.3%)	2 (2%)	7 (12.3%)
F (<4.99)	25 (26%)	22 (51.2%)	71 (39.7%)	30 (36.6%)	25 (25.5%)	14 (23.78%)
E + D (5–6.99)	18 (18.8%)	4 (9.3%)	37 (20.7%)	24 (18.3%)	68 (69.4%)	33 (57.9%)
B + C (7–8.99)	4 (4.1%)	1 (2.3%)	6 (3.3%)	15 (18.3%)	3 (3.1%)	3 (5.3%)
A (9–10)	2 (2.1%)	-	2 (1.1%)	7 (8.5%)	-	-
Total	96 (100%)	43 (100%)	179 (100%)	82 (100%)	98 (100%)	57 (100%)

SD = standard deviation; TC (Traditional Classroom); FC (Flipped Classroom); F < 4.99; E + D = 5–6.99; C + B = 7–8.99; A = 9–10.

After comparing the final data in both groups, the data indicates that students participating in the flipped classroom obtained the best learning results in the June exam period. Thus, 18.6% of students in the traditional methodology group passed the exam during the stated exam period. 52.7% of students who worked with the flipped classroom passed the exam, with an increase in A and B + C grades, in comparison with the traditional class (11.9% in the flipped classroom versus 4.8% in the traditional classroom). In the same manner, there is a significant decrease of students who did not show up, or dropped the subject, being 39.6% for the traditional methodology compared to 6.3% for the flipped classroom.

In the September resit period, students who worked with the flipped classroom approach obtained better learning outcomes, i.e., 5.3% of students studying with the traditional methodology passed the exam in the resit period, compared to 24.1% who worked with the flipped classroom. Similarly, there is a decrease in the number of people who did not sit the exam or dropped out of the subject, being 47.5% for the traditional methodology and 30.4% for the flipped classroom. There is also a decrease in the percentage of failed exams compared to the number of students who failed in the resit period, being 75.9% in the flipped approach, compared to 93.2% in the traditional classroom.

A more detailed analysis of performance in the June exam period, considering the obtained scores ranging from 1 to 10, reveals that the average score achieved by the students participating in the flipped classroom is 4.95 out of 10 points. To the contrary, students who have worked with traditional methodology obtained an average score of 2 points out of 10, this tendency repeated throughout the different academic courses.

Therefore, the results reveal significant differences in academic performance depending on the methodology, obtaining a large effect size (M_{TC} = 3.56; SD_{TC} = 2.12; M_{FC} = 5.28; SD_{FC} = 1.68; t = 364.28; p < 0.001; Cohen's d = −0.899, $r_{effect\ size}$ = 0.41). If we analyze performance according to the specialization during the June exam period, the data shows the same trend in both specialties. Thus, in Early Childhood Education (M_{TC} = 3.45; SD_{TC} = 1.84; M_{FC} = 4.9; SD_F = 1.49; t = 5.15; p =< 0.001; Cohen's d = 0.866, $r_{effect\ size}$ = 0.397) and in Primary School Education (M_{TC} = 3.65, SD_{TC} = 2.25, M_{FC} = 5.45, SD_{FC} = 1.73, t = 6.98, p < 0.001, Cohen's d = 0.896, $r_{effect\ size}$ = 0.409) the best grades are obtained by students participating in the flipped classroom or inverted classroom, obtaining a large effect size.

Similarly, students who follow the inverted approach obtained better grades in the September exam period, although they did not manage to pass the exam, obtaining a medium effect size (M_{TC} = 2.65, SD_{TC} = 1.45, M_{FC} = 3.66, SD_{FC} = 1.74; t = 3.71; p < 0.001; Cohen's d = 0.630; $r_{effect\ size}$ = 0.300). In relation to the specializaton, there are significant differences in the Degree in Primary School Education, obtaining a large effect size (M_{TC} = 2.63, SD_{TC} = 1.45, M_{FC} = 4.16, SD_{FC} = 1.72, t = 4.45, p < 0.001, Cohen's d = 961; $r_{effect\ size}$ = 0.433), in which the students belonging to the flipped group obtained better grades.

At the same time, it can be appreciated that in both exam periods, the number of students who did not show up or dropped out in June is higher in the traditional methodology than in the flipped classroom, both in Early Childhood Education and Primary School Education (33.1% and 43.3% in traditional methodology, 1.5% and 8.1% in flipped classroom, respectively). The same tendency is evidenced in the September resits, although the dropout rate is higher in the traditional methodology (59.1% in Early Childhood Education and 62.3% in Primary School Education), compared to 14.8% of Early Childhood Education students and 35.7%% of Primary School Education students with a flipped approach. These results should be analyzed in greater depth in future research.

In addition, we analyzed the relationship between academic performance with the teaching methodology and the course schedule. The data indicates that there is a correlation between both variables, being $R_{METHODOLOGY//PERFORMANCE} = 0.489$; $p < 0.001$ and $R_{SCHEDULE//PERFORMANCE} = 0.087$; $p < 0.05$.

Subsequently, the influence of the schedule in theoretical-practical classes of the two methodologies on academic performance was analyzed. The data indicates that there are no significant differences in academic performance and class schedule, although performance of the traditional class students improves during the first class ($M_{SCHEDULE\ 9:00-11.00S} = 1.11$; $M_{SCHEDULE\ 11:00-13.00} = 1.26$). The opposite was found in the flipped-approached classes ($M_{SCHEDULE\ 9:00-11.00S} = 2.83$; $M_{SCHEDULE\ 11:00-13.00} = 2.81$).

Class attendance was also analyzed according to the methodologies. The data indicates that in the traditional approach, 12.8% of the students never attended classes, against 6.3% in the inverted methodology. Similarly, 77.7% of students who followed the traditional methodology attended under 50% of the classes, compared to 52.4% of students who worked with the flipped approach; moreover, only 23.3% of students working with the traditional methodology attended lectures nearly always or always, against 41.7% participating in the flipped classroom.

From this data, it was analyzed whether there were any differences in students' attendance to classes, according to the methodology; the data shows that a methodology shift affects the attendance, obtaining a medium effect size (Table 2).

Table 2. Class attendance depending on educational methodology.

Methodology	N (Mid-Range)	MAN-WHITHNEY U	*p*	Cohen's d	r~Effect-size~
Traditional **Flipped**	N = 275 (222.77) N = 237 (295.64)	23,312.50	<0.001	0.427	0.209

N = participants; U = Man-Whitney; $p < 0.001$.

Subsequently, the impact of the methodology on academic performance was analyzed (Table 3); the results indicate that there are significant differences, obtaining a large effect size.

Table 3. Academic performance depending on educational methodology.

Methodology	Mean	MAN-WHITHNEY U	*p*	Cohen's d	r~Effect-size~
Traditional **Flipped**	M = 2.31 M = 4.95	17,517.00	<0.001	1.175	0.506

M = mean; U = Man-Whitney; $p < 0.001$.

Additionally, it was tested whether there were differences in academic performance depending on the methodology and specialization studied. The results demonstrate that there are no significant differences in performance, although the students that worked with the traditional methodology displayed a poorer performance, regardless of the specialization. On the contrary, the students who have participated in the flipped classroom improved their performance in both specializations.

Finally, a regression analysis was carried out in order to look at the influence of the methodology and the attendance in relation to academic performance showed in the grades attained during the June

exam period. The results (R^2) indicate that 65.6% of the grade variance depends on the methodology, obtaining a high correlation (R = 0.810). Regarding the analysis of the methodology and attendance variables, the data shows that both the percentage of the explained variance and the correlation increase (R^2 = 72.4% and R = 0.851). In addition, Analysis of Variance (ANOVA) indicate significant differences ($F_{methodology/performance}$ = 975.50, $p < 0.001$; $F_{methodology\ and\ attendance/performance}$ = 667.14, $p < 0.001$).

Eventually, the regression analysis was carried out to find out the influence of the above-named variables and their relationship with the grades obtained in the resit exams in September. The results (R^2) are lower than those in the June period; 26.6% of the grade variance being dependent on the methodology, thus obtaining a significant correlation (R = 0.511).

Regarding the analysis of the methodology and attendance variables, the data indicates that both the percentage of the explained variance and the correlation are lower in the June examinations (R^2 = 32.6% and R = 0.571). The results of the ANOVA test reveal significant differences ($F_{methodology/performance}$ = 103.23, $p < 0.001$; $F_{methodology/attendance/performance}$ = 70.43, $p < 0.001$).

4. Discussion

This study focuses on students enrolled in the course "Organization of Educational Centers", being a basic subject that students must undertake in order to complete their studies. According to the statistical data over the last few years, students have experienced difficulties in successfully completing this course. This difficulty has led to the abandonment of the course; the average of students who dropped the course is 40.46% over the last three years in traditional classes. Such a phenomenon invited us to reflect upon this, in order to modify the intervention model with a new approach, namely flipped classroom. Resultantly, after three years working with this model, a considerable decrease in subject abandonment has been noticed.

Moreover, the intervention improves performance, decreasing the number of students who failed (38.96% and 28.62% in traditional classrooms and flipped classrooms, respectively) and increasing the number of students who passed, with 19.5% in the traditional setting and 60.33% through the flipped setting, as the results conclude.

These references regarding academic improvements allow the positive changes required in higher education through the emerging educational models centered on student learning, which improve the students' learning and performance.

There is little research where quasi-experimental and longitudinal studies point out the positive results from a change in the educational paradigm. This study provides some scientific support towards the shift in the intervention approach, necessary to establish a strategic plan to re-design the learning strategies and environment through innovative proposals by way of techno-pedagogical designs.

As a result, the research focuses on analyzing whether there are differences in the learner's average grade, in respect to academic performance and their potential consequences, based on the intervention methodology. Karabulut-Ilgu et al. (2018), O'Flaherty and Phillips (2015), and Stöhr and Adawi (2018) indicate that information on university studies still proves inadequate due to the limited research that objectively presents learning results through experimental, controlled quasi-experimental, transversal and longitudinal designs. Similarly, there are no studies showing great temporary synchronic and diachronic outreach in Education that establish statistically significant results of this new model deigned to improve academic performance of university students.

The use of the flipped approach establishes an improvement in the grades attained in relation to the traditional approach. In this way, the studies conducted by Mingorance (2019); Guy and Marquis (2016); Koo et al. (2016); Maarek and Kay (2015) and Porcaro et al. (2016) prove that there is not only an improvement in the grades, but also a better perception of the used approach. These results were not found at the beginning of our intervention in the academic courses with the new methodological approach, although the perception improves and shifts throughout the semester, reaching positive reviews, ranging between 89% and 95% in all three courses.

Furthermore, this study analyzes the academic performance with the flipped classroom approach, in both the June exam period, as well as in the September resits, achieving improvements in the results. However, the grades obtained in the September resits were lower than those in June. This shift in performance can be explained due to the fact that the students turned into active subjects of their own learning, establishing the basis for the acquisition of in-depth theoretical and practical knowledge in the subject area, as Mingorance (2019) indicates. Therefore, the new approach enables new formative experiences for the construction of in-depth and significant knowledge from a critical perspective, enabling a ubiquitous, open, distributed and social learning, focused on the action and transfer to new situations.

Taking into account the obtained results of this innovative approach, the data seems relevant to the Higher Education field. This is due to the scarce availability of studies that support its impact on academic performance; whereby the number of student passing the course with the flipped approach are superior to those following the traditional methodology. These results are in line with the studies carried out by Muir and Geiger (2015), who concluded that there is a significant correlation between the flipped classroom approach and the academic performance. The studies found that the students were more motivated towards the subject in a hybrid environment, which influences class attendance.

Consequently, following Mingorance et al. (2017) and Meyers (2016), the increase in participation redounds in greater responsibility, interest and compromise by the students, who are given more autonomy and flexibility in their learning process. Students are able to build their knowledge at their own pace, at any time and place, through fixed or mobile technology, enabling them to access material as many times as necessary to establish a solid basis to know, understand and apply the concepts. This technology encourages students to work actively and individually before going to class; but also helps to deepen the knowledge during the lessons to analyze, evaluate or solve in a creative manner the proposed scenarios, thus improving the development of superior cognitive skills.

Methodological shifts may lead to resistance, particularly by students, as it must be considered that not everyone attended classes adequately, as they had not done the proposed activities before the beginning of the class. This has been demonstrated by analyzing platform entries whereby the online material could be found (52–57%), a situation which corrected itself as the semester went by. The data indicates that students start recognizing the importance and necessity of committing to the subject through active and participative work.

Furthermore, the results indicate that the number of students who dropped out significantly decreases with the flipped classroom approach. This can be explained due to the previous work students must carry out before class, with a flipped, flexible approach (Guy and Marquis 2016; Nguyen et al. 2016), through interactive lessons with different materials (Mingorance 2019; Mingorance et al. 2017) and at their own pace (Hernández-Nanclares and Pérez-Rodríguez 2016). Another possible explanation could be the fact that the working method is more attractive and allows more participation than the traditional methodology, as it is more flexible, including interactive lessons and different materials, that adapt to students' pace of learning. This is beneficial for all the learning styles and improves the students' feeling of control of their own learning process. In this way, students do not feel lost in the subject due to the previous preparation of contents, having a solid knowledge basis before its development during the lessons and throughout the semester, which enables a greater interaction in class with their peers and the teacher. The result obtained is in line with the work by Lai and Hwang (2016) and O'Flaherty and Phillips (2015), which concluded that the active participation in the students' learning process makes them experience greater comprehension and depth of the contents, due to the detection of thinking errors. Moreover, as a result of the previous work done at home and during the lessons, as well as immediate feedback (Mingorance 2019), students state a significant learning and rapid development of in-depth knowledge of the contents.

On the other hand, regarding the June exam period results, it is important to highlight the role of technology as pointed in the work conducted by Della Ratta (2015) and Johnson et al. (2016). The results of this study indicate that academic performance is better towards the end of the semester,

rather than during the September exam period, although both cases show improvements with the new approach in comparison with the traditional one. It must be highlighted that technology plays a greater role for students who take exams in September, as technology works as a supply resource to classes, as the established linear regression model demonstrates. It is likely that the student establishes their own learning pace through the range of materials presented in a linear manner, which they can consult at any time and place in a similar way as during the semester, thus, serving as a tool to clear doubts and deepen knowledge in the subject.

These considerations refer especially to the September call, in which students can exchange information and collaborate to solve doubts and problems through the interactive platform (chat), as they have been doing during the development of the subject in the June period exam.

Regarding class attendance, the data suggests that students who followed the traditional methodology show a lower attendance percentage and higher subject drop outs. On the contrary, this percentage reduces on the flipped focus, leading to an increase in class attendance and greater engagement, with a significant decrease in subject drop outs. These results are in line with the investigations by Guy and Marquis (2016); Koo et al. (2016); Maarek and Kay (2015) and Sahin et al. (2015). This methodological change is encouraging in terms of drop outs and subject engagement by students throughout the semester, in regard to previous courses. A possible explanation for these results is a shift on the intervention approach which leads to didactic strategies and the inclusion of technological resources used by the teacher and available to students. This, in turn, helps to improve the intervention process centered on students, exerting their influence on student performance.

Moreover, the increase in class attendance and student participation, during classes leads to a greater learning motivation: higher levels of voluntary assistance, commitment to the course, and interaction between peers and between the professor and the students. This shows similar results to the findings by Gilboy et al. (2015); Guy and Marquis (2016); Porcaro et al. (2016), where it was concluded that the organization established for learning, either individually, in pairs or in small groups, impacts on the predisposition towards the subject. Furthermore, this entails more significant interaction amongst students and with the teacher, as manifested by Mok (2014); Sen-Eshaluce et al. (2017); Velegol et al. (2015) through a shared synchronic or asynchronous approach.

5. Conclusions

The results obtained reveal that the methodological shift produces an improvement in the grades in comparison to the traditional methodology. Additionally, there is an increase in learning motivation, observed in class attendance and participation, as well as greater interaction among the students and greater commitment. The feedback given by the teachers and the student-teacher interaction stimulates the motivation to learn, being indicators the number of questions stated during lessons and a greater participation on student's behalf. This greater participation was concluded due to a larger number of students interacting with their classmates in FC than in TC; collaboration among classmates when answering the given problems; and comments made by students to the teacher.

In addition, the flipped classroom enables autonomous learning, as the material can be studied and revisited as many times as necessary. Students may also catch up, in case of being unable to attend the class, being a very useful tool to follow the contents developed throughout the course, without getting lost or feeling isolated. As Sahin et al. (2015) stated, it seems that flipped classroom better prepare students.

Among the difficulties throughout this experience, the students' initial resistance to methodological change must be highlighted. Observed negative comments made by a small part of the students indicated this resistance and the analysis of student entries to the platform. Although, as time goes by, students started adopting a more positive view. These results coincide with those found by Galway et al. (2014). This new focus requires the adaptation to the endeavor culture before and during classes, in order to be able to follow the subject. For the teachers, this implicates spending more time redesigning the syllabus of the subject and the existing material and establishing the most

adequate resources. This greater workload can be relieved through collaborative projects among teachers in charge of the same subjects, developing contents in different formats, tasks and evaluations. This requires an institutional culture and economic investment to improve the innovation processes centered in learning and incorporating technologies that facilitate students' performance.

It is remarkable that the students' monitoring and evaluation through this approach must not simply consist on finding out what the students know, but rather acknowledge what they are capable of doing with their knowledge.

In conclusion, two claims are proposed which might be important for future investigations, given the possible consequences of a shift in methodology and its impact on the teaching-learning of university students. On the one hand, it is important to study in depth the variables that influence students' performance, as well as personal, social and institutional conditions. On the other hand, future research must explore how teachers may apply this approach in a more beneficial way. This new approach would help to improve the learning process centered on the students, inquiring into the elements that influence the teaching processes, underlining the teaching style, the content design to guide the task development towards knowledge building in higher thinking skills and the incorporation of technologies.

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