Peer-reviewed version available at Sustainability 2018, 10, 1334; doi:10.3390/su10051334

Article

Incidence of the Flipped Classroom in the Physical Education Students' Academic Performance in University Contexts

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Abstract: This research analyzes the Physical Education students' degree of academic performance with the incorporation of active methodologies, specifically the flipped classroom mixed learning, restricted to evaluation periods in the months of June and September. The study focuses on whether there are significant differences in this variable through the scores obtained. Through a simple random sampling, 131 students participated in this empiric-analytic research, using an ex-post-facto study with a retrospective design with quasi control group. A robust test of averages comparison, multiple linear regressions and an evaluation of the relative importance of predictors is conducted. The results show how flipped classroom methodology linearly and positively influences academic performance and correlationally motivation and support. As main conclusion, in a hybrid and digitalized learning context, the value of the consideration of active methodologies (flipped classroom) based on emerging pedagogies, allows improving students' achievement and competence development, providing critical, significant, ubiquitous, transformational and especially motivating experiences.

Keywords: Flipped classroom; methodological change; ICT.

1. Introduction

The gap between practice in classrooms and training education in Higher Education requires a transformation of the academic model. This new paradigm includes a shift to hybrid learning with the integration of new tools and methodologies that challenges the educational position of the traditional teaching that has existed for decades at universities for the improvement of the teaching-learning process, providing dynamic and innovative opportunities from an active students' participation. In this sense, the new Higher Education framework (2010) encourages teachers to integrate technology in the classroom, as it becomes clear in Horizon Report (2016), achieving a significant impact on education in the next three years (Johnson, Adams Becker, Cummins, Estrada, Freeman & Hall, 2016). To this end, teachers must not only use technological tools, rather they should familiarize themselves with the Technological Pedagogical Content Knowledge model (Technological Pedagogical Content Knowledge: TPACK) to integrate technology with disciplinary, pedagogical and technological knowledge, offering more interaction between teachers and students (Harris, Mishra & Koehler, 2009; Sen-Eshaluce, Fidalgo-Blanco, Alves, 2017).

Students are not mere spectators in the course of their learning through the listening processes sitting in class, performing tasks and waiting for the teacher's answers. Students must actively

participate on what they are learning, interact and transfer the contents as well as apply them to contextual situations. One of the teaching-learning processes that is gaining ground in the different educational levels is the B-Learning or mixed learning, defined as the combination of class work and on line work with some control parameter over the path, time and rhythm to be followed, under the teacher's guidance, turning itself into a liable and pro-active shared commitment integrating learning experiences. Within this rotation model we find the "flipped classroom" hybrid sub-model developed in our research.

Most recent research works reveal the flipped classroom model has been widely used in several disciplines with positive results in university education (Gilboy, Heinerichs & Pazzaglia, 2015; Guy & Marquis, 2016; He, Holton, Farkas & Warschauer, 2016; Heyborne & Perrett, 2016; Liebert, Lin, Mazer, Bereknyei & Lau, 2016), trying to establish an alternative to traditional teaching through a learning that takes place when students acquire knowledge through experiences, being able to increase it with the use of tasks where students are active learners, participating in the analysis, synthesis and evaluation of contents, and in turn, being passive learners by taking up information from the vision, hearing and reading of contents (Sams, 2013), to remember, describe and apply, which would lead students to develop lower thinking skills, deepening knowledge and finally being able to develop superior thinking skills. Thus, the teacher needs to use his experience and his deep knowledge on the subject to be able to project and raise good tasks. These circumstances imply a transformation of the teaching function, due to the fact in the traditional class, the teacher can be described as an "expert" who presents information in various formats waiting for the students to pay attention and understand the information, meanwhile, in the flipped classroom, the teacher has the role of a "counselor" who works with students to guide them through their individual and collective learning experiences (Bergmann, Overmyer & Wilie, 2012).

The teacher designs intentional learning experiences and the student is responsible for exploring the materials, in their various formats, asynchronously provided to obtain basic knowledge before the teaching (Educause Learning Initiative, 2012), while the time in the classroom is dedicated to develop, with a greater deepening of the contents, by means of designing tasks for the integration of competences not just of knowledge, but helping them to be able to know to do and know to be through practical experiences. To develop this model, two phases are designed:

- Previous Learning phase: students acquire basic knowledge of subjects by viewing the training materials provided by the instructor in various formats, such as online videos, podcasts, or text, audio, or visual diversified materials before the teaching.
- Classroom learning phase: students have active student-centered learning activities in the classroom, such as interactive lectures, problem solving, case studies, lab experiments, role plays, collaborative design and creation ...

In short, it is necessary to introduce educational strategies that place the teacher as an activator role, maintaining an adequate teacher-student relationship, creating proposals for reciprocal teaching, establishing a frequent feedback, offering spaces for reflection and meta-cognition, and providing a clear message to be understood (Fullan, 2014).

The literature review shows us the scarce studies with regards to the flipped classroom model in students of Educational Sciences, and more particularly in Physical Education, not being such in Higher Education in other areas of knowledge, as it shows Zainuddin and Hajar's work (2016), that sets out the different research areas in recent years, on the flipped classroom model, in which quantitative studies are slowly emerging, highlighting the works in Science, Technology, Engineering and Mathematics (STEM), Sociology, Humanities, Health, Business and English, without referencing studies on the field that concerns us, Physical Education, what shows the need and importance of carrying out this type of work that so good results is reaching in other environments. However, more recently, two works have been found in Educational Sciences, González-Gómez, Su, Airado and Cañada-Cañada (2016), and Mingorance, Trujillo, Cáceres and Torres (2017), being the second one developed with future Physical Education teachers.

Research focused on the flipped classroom effectiveness in Higher Education is extremely limited, however, some works found in the literature review show a better academic performance,

which results in students showing they can better understand the content, get higher scores on the exams and improve their performance (Alvarez-Bell, 2014; Heyborne & Perrett, 2016; González-Gómez et al., 2016; Guy & Marquis, 2016; He, Holton, Farkas & Warschauer, 2016; Koo, Demps, Farris, Bowman, Panahi & Boyle, 2016; Mingorance et al., 2017; Sahin, Cavlazoglu & Zeytuncu, 2015), although a limited improvement has also been found in other studies evaluating the results, the flipped classroom group had higher scores in the exam compared to the traditional class group (Betihavas, Brigman, Kornhaber & Cross, 2016; Geist, Larimore, Rawiszer & Al Sager, 2015; Yacout & Shosa, 2016; Presti, 2016).

Focusing on the effectiveness and impact of the flipped classroom model on scores, we highlight some of the most recent works. Thus, Albert and Beatty (2014) carried out a study comparing the performance among first year undergraduate students, in a module of introduction to the management, evaluating the impact of a flipped classroom (2013) opposed to a master class (2012) on the scores obtained. To do this, they compare the traditional classroom taught by the same instructor using the same text and the same tests with the flipped classroom, the results indicate that the scores in exam 1, the students of the traditional classroom obtained significantly lower results (M = 7.66, SD = 1.16) to students of the flipped classroom (M = 7.92, SD = 1.51). In exam 2, the students of the traditional classroom (M = 7.37, SD = 1.3) obtained lower scores than students of the flipped classroom (M = 7.53, SD = 1.36), but the significance did not reach 0.5, and in exam 3 the students of the master class (M = 7.52, SD = 1.25) obtained significantly lower scores than students of the flipped classroom (M = 7.7, SD = 1.42), there were no statistically significant differences between the two groups compared, but on average the scores increased by two points.

In the same way, Sahin, Cavlazoglu and Zeytuncu (2015), in several mathematic sections, carried out a work with the aim of understand the opinions of the university students in the flipped classroom courses with regards to the traditional classroom and to investigate how the flip affects their performance. The students achieved average scores in the test significantly higher in the flipped sections (M = 8.32, SD = 1.36) than in the traditional classroom (M = 7.54, SD = 1.69). In general, most students (83%) stated that flipped learning prepared them better.

González-Gómez et al. (2016) also evaluated the effects of the flipped classroom on the students' perception and performance in a scientific subject of the Degree of Primary Education in 2014/2015. The class was divided into two groups, the first followed a traditional methodology and the second one used the flipped classroom methodology. The results showed statistically significant differences in all evaluations with the flipped classroom students group, who obtained an average of 6.23 ± 1.81 in their scores and their highest score reached 9.8, while in the traditional classroom the average was at 3.52 ± 2.22 and their highest score was 6.59 points. The percentage of students who successfully completed the course was 56.7% in the traditional classrooms, while the percentage of students who did it with the flipped methodology was 67.3%. In general, students agreed that the flipped method provided them with the possibility of working autonomously and at home, making it possible to see the material again to catch up, hazard a great help.

Also Mingorance, et al. (2017) carried out a research work with students of second year of Primary Education, in the field of Organization of educational centers (Physical Education), where the hypothesis was to know whether with the flipped methodology ratings are best as regards the traditional methodology, to be confirmed and there are significant differences, highlighting among other issues the reduction of abandonment of the subject and as a result attendance, participation and interaction and the improvement of the final grades.

Finally, Borchardt and Bozer (2017) carried out a work comparing the differences between a traditional course based on lectures and a micro-flipped classroom course to see if there were differences in three exams and in the general course scores, resulting increases in performance with the flipped method and that require at least one semester of execution to be significant.

However, not all research compared to traditional vs. flipped classroom in Higher Education turns out to be effective. In this sense, Blair, Maharaj and Primus (2016), Li and Dan (2015), McLaughlin, Griffin, Esserman, Dabidson, Glatt, Roth, Gharkhlonarehe and Mumper (2013), Muzyk, Fuller, Jiroutek, O'Connor, Butler and Byron (2015), Ryan and Reid (2016) works, provide that the

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results do not show significant differences in students' performance through the exam scores in both formats, not improving the students' performance at the end of the course.

There are also different reports of improving classroom attendance and satisfaction (Maarek & Kay, 2015; Mingorance et al., 2017; Clark, 2015; Koo et al., 2016; Lin, Zhu, Chen, Li, Li, Liu, Lian, Lu, Zou y Liu, 2017) participation and interaction among equals, students and teachers through a more significant shared communicative approach (Gilboy, Heinerichs y Pazzaglia, 2015; Guy y Marquis, 2016; Jungić, Kaur, Mulholland y Xin, 2015). In turn, it is emphasized that the students' attendance, participation, interaction and feedback are manifested as important elements in the evaluation of the students' learning (Mingorance et al., 2017).

2. Materials and Methods

2.1. Objectives

The objectives of this study focused on analyzing whether there are significant differences in the academic performance and if it improves the attendance, depending on the methodology used in the global teaching-learning process, with the change of intervention paradigm, which main axis is student-centered.

2.2. Research design

This research is empirical-analytical, of non-equivalent cuasi-experimental groups (León and Montero, 2003). The data collection process has been developed with a transversal design.

2.3. Participants

For the students' selection we have worked with the students enrolled in the subjects of Organization of Educational Centers (Degree) of 2nd year Primary Education with honor in Physical Education, in the University of Granada. A simple random sampling was carried out among the entire students' population, with 131accepting and producing data sample.

2.4. Data collection instruments and Procedure

For the development of this research, the scores obtained at the end of the semester have been considered, understanding this moment as the end of the intervention in both methodologies, avoiding strange variables in the work assumed along the semester. In the same way, throughout this period, the intervention has been carried out by the same teacher, so that the teaching style and the classroom environment did not become strange variables. The experience took place in the subject of Organization, as part of the basic training of undergraduate students, developed in the second semester, in morning hours, for 15 weeks, with a weekly duration of three hours for the students, two hours of large group and few hours of small group, with two equated subgroups. The 2015-16 control group students developed the teaching-learning process through a traditional methodology, in which the teacher presents the information during the classes in multimedia format, carrying out various practical activities related to the topics, waiting for students to pay attention and understand it.

The development of traditional teaching lessons occurred through exhibition classes of interactive contents between teachers and students, and retroactively, in which the teacher takes advantage of the students' questions to redirect the subject toward the goals of the lecture in class. The development of traditional classes were structured in the following way: to) Phase of introduction, in which the contents exposed in previous days were briefly reviewed, recalling the point left, hence to be able to build new knowledge. In turn, it arises what will be carry out in the new class with the aim of engaging students through the exposure to a problem or asking questions based on the content. (b) Phase of development, through the exhibition by the teacher in multimedia format (PowerPoint: text, video and images) with the inclusion of anecdotes and illustrative examples, trying to maintain a high level of attention. During the lecture students listen, take notes,

ask and make some brief comments on the process of interaction with the teacher, practical activities, through case studies, exhibitions of the students' works carried out and debates. (c) Phase of closing of the session using a synthesis of discussions, in which we put the emphasis in highlighting exposure through questions to students.

Students of the experimental group received their classes through a flipped classroom methodology during 2016 / 2017, in which students perform a previous work of development of the topics through videos, presentations, power point, readings and reflection on questions of control over the pre-class, while during the class, the teacher works with them to guide them through their individual and collective learning experiences.

The structure and development of the flipped classroom consisted of preparing and properly design the intervention sessions, before the classroom, through online platform, and during the session, distributing the process in the following way: to) Phase of creating the contents to be taught in a multimedia format, using text, videos-audios and images of own development and search of contents and open network resources. To create the videos Windows Movie was used, the presentations were made with PowerPoint that subsequently went to format video with E M PowerPoint video converter, interactive questionnaires were carried out with the Moodle platform, the individual and collaborative activities were developed through Moodle, Hot Potatoes and Office. (b) Phase of development of the learning environment through the Moodle platform, which can be accessed anytime, anywhere, out of the academic schedule. For each of the subjects a glossary of terms and an interactive lesson were developed, in which the student progressed by the same reading, viewing videos, images and answering the questions that were occurring as the lesson progressed by the lesson, to receive timely feedback form so students can understand and analyze the presented contents. Once the lesson is finished, students complement it by the reading of recommended articles and the viewing of videos related to those articles, later settling the forums to discuss ideas and begin to clear doubts, the appropriate activities and the self-assessment questionnaires to record the students' activity and to know the difficulties encountered by students before reaching the face to face classroom. (c) Phase during the teaching, at the beginning, resolve the doubts students may have, hence, we analyze the registry's answers made by them in the lesson and in the questionnaires, turning occasionally to the videos proposed, by setting the time to participate, ask and understand what has been previously discussed. In this way, we begin the deepening of knowledge through the design of situations introduced through anecdotes, illustrative examples and problems that allow to enter us the case, simulations in conflict organizational resolution, discussion groups, peer discussions and instruction and collaborative learning in small groups of 4-6 students to reflect on and evaluate the deepening of the content in the classroom. (d) Phase at the end of the session, will be held a synthesis of discussions, in which we place emphasis on outstanding issues developed in the classroom through questions to students for their level of understanding. (e) Completion phase of the topic in its two parts, virtual and face-to-face, in which the students will develop a final test of the lesson on the same platform with the timely feedback, to be ready to attend the subsequent exam.

3. Analysis of results

The following variables were used in this study:

- Dependent variables (DV): performance in June and September.
- Independent Variables (IV):
  - Factor 1: Course (2 levels, 1:2).
  - Factor 2: Culture (3 levels, 1:3).
  - Factor 3: Sex (2 levels, 1:2).
  - Factor 4: Method (2 levels, 1:2).
  - Metric Variable 1: Initial attendance.
  - Metric Variable 2: Final attendance.

3.1. Descriptive results related to the method and the performance

Before proceeding to make contrast hypothesis on each of the population parameters, we proceeded to graphically analyze the average performance scores for the months of June and September using the R "Ggplot2" package.

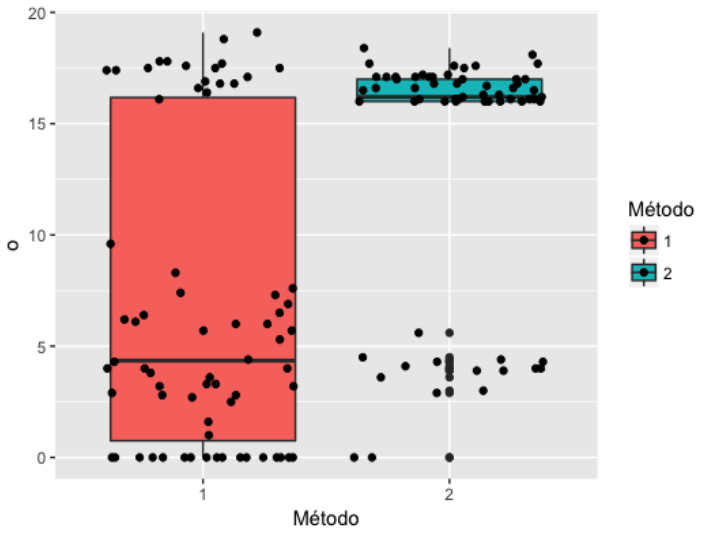

Figure 1. Average performance scores. **Method (Methodology): 1 (traditional methodology) 2(flipped methodology)*

Figure 1 is a combination of a boxplot and a scatterplot, using Cartesian coordinates to show the values obtained in relation to each research methodology. It has been used to compare visually the average scores of each one of the methodologies and analyze trend data.

We see that the average scores obtained with the "Method2" (flipped methodology) (M = 13.55, SD = 5.74) are superior with respect to the "Method1" (M = 6.92, SD = 6.78), i.e. the students' average performance who followed the "Method2" was better with respect to Method1. Also, there are points that could potentially be outliers. They will be evaluated more closely in the following sections.

3.2. Evaluation of the model assumptions

In this section we evaluated the linearity assumption, presence/non-presence of atypical values, and the correlation degree between the study variables, in order to determine the most appropriate statistical test (parametric/non-parametric/robust) to test the hypothesis.

3.3. Evaluation of the linearity, atypical values and correlation between metric variables

To evaluate the classic linearity assumption, presence of atypical values or outliers and the correlation between the different quantitative variables the R "GGally" package was used, and more specifically with the function "ggpairs". It contains templates for different plots to be combined into a plot matrix.

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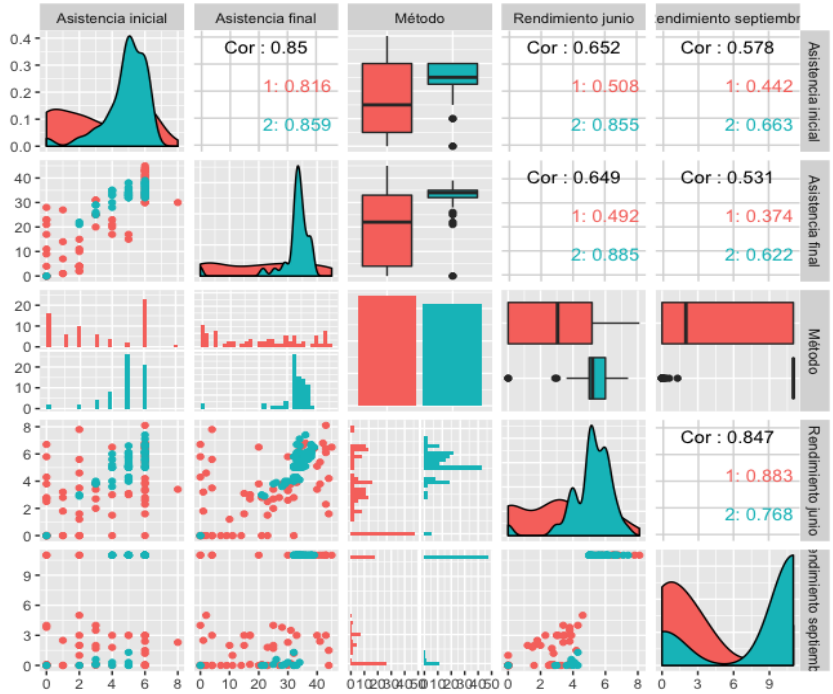

Figure 2. Linearity, outliers and correlations. * *Asistencia inicial* (Initial attendance), *Asistencia final* (Final attendance), *Método* (Method), *Rendimiento junio* (June performance), *Rendimiento septiembre* (September performance)

Figure 2 was used to analyze possible problems of linearity between the predictor variables of the study (scatter plots), to analyze the presence of outliers (boxplots) and the correlation between them (Pearson's correlation).

According to the above figure, we can conclude that: (a) no linearity problems are observed between the different variables; (b) a strong correlation between "Method2" and the performance in June and September exists, not being the same for "Method1"; (c) a greater linear correlation between attendance in June and September exists with "Method2" than with respect to "Method1", that is, this method could have improved the students' motivation.

Finally, it was also assessed the univariate normality assumption for the students' attendance to the different sessions and for the academic performance of the months of June and September.

The results showed that neither the attendance data (W =. 85, p <. 05) nor those of performance (W =. 81, p <. 05) followed a normal distribution.

All previous results confirm that, because the univariate normality assumption and the presence of outliers were not fulfilled, it was considered necessary to carry out robust tests to increase the capacity to detect real effects in the treatment.

The parametric tests require the fulfillment of certain cases (usually normality and homoscedasticity), which do not comply with the data of the study. For this reason, we did not use them. In the same way, another possible alternative was the use of non-parametric tests since they are not based on any assumptions on data distribution. However, not all these previous tests are resistant in the presence of outliers, being the most appropriate robust evidence to carry out the analyses outlined then.

3.4. Robust test of mean comparison

To carry out the robust test of mean comparison in the students' academic performance in the months of June and September the YuenTTest function (Wilcox, 2005 & Yuen, 1974) of the R DescTools package was used. This test is used with one or two samples, specifying this data in the function code, for trimmed means. The results showed there were significant differences in the academic performance, both in the month of June (t(-5.2) = 50.38, p = 3.514e-06), and in September (t(-5.8)=78.6, p=1.435e-07) in terms of the method used.

3.5. Multiple linear regression

The multiple linear regression allows modeling the value of a variable according to one or more variables, through a monotonic linear function. That is, it assumes a change in the independent variable (IV) will result in a change in the dependent variable (DV), and the amount of the change in DV is constant for the entire range of the IV.

In this study we adjusted the linear model that included X multiple predictor variables, using the multiple linear regression analysis: $yi = \beta 0 + \beta 1 * xi1 + ... + \beta j * xij + ... + \beta p * xip + \varepsilon i$, where we have p predictor variables (j = 2... p), and n observations (i = 1... n). Yi value is the i observation of the Y response variable when the X1 predictor variable equals x i1, the X2 variable is worth xi2, Xj is worth xij, etc. The β parameters are the regression coefficients. The β0 intercept is the true mean value of Y when all X variables are worth zero.

The β1 parameter is the (partial) slope or the change in Y per unit of change in X1, maintaining X2, Xj... constant. Finally, εi is the random or unexplained error associated with i observation.

In our case, it was interesting to build the multiple linear regression model only for the month of June to avoid strange variables that could have appeared in the month of September as a result of the vacation period. The coefficients of the model are shown below.

Table 1. Multiple linear regression model.

	Estimate	Std.Error	t value	Pr(>|t|)[1]
(Intercept)	.94934	.32870	2.888	.00456 **
Initial attendance	.36331	.12222	2.973	.00354 **
Final attendance	.04376	.02067	2.117	.03621 *
Sex2	.34325	.30715	1.118	.26589
Method2	.78950	.33619	2.348	.02041 *

[1]Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.602 on 126 degrees of freedom

Multiple R-squared: .4983, Adjusted R-squared: 0.4823

F-statistic: 31.28 on 4 and 126 DF, p-value: < 2.2e-16

The resulting model is significant ($F(4,126) = 31.28$, $p < 0.01$) and the goodness of adjustment is moderate (R2aj = 0.4823), ie 48.23% of the variability of the scores of the academic performance in June is explained by the variables shown. In order to increase the R2aj it would be advisable to incorporate future variables to improve the adjustment of the model.

The coefficients for the "initial attendance" and "final attendance" variables are significant, but the same is not true for the "sex" and "method" variables. The interpretation of the coefficients is then detailed.

The equation of the model is: June performance = β0.9434+ Initial attendance*.36331 + Final Attendance*.04376+Sex2*.3433*Method2*.7895, where "β0" is the intercept (or constant) and "β1... β4" represent the coefficient for the "Initial attendance", "Final attendance", "sex" and "method" variables. "β0" value indicates the change in response (Y) due to a unit of change in predictors (X).

Remembering the reference or basal category is "Method1", the "Method2" coefficient can be interpreted as the predicted difference between "Method1" and "Method2", that is to say, for each increase in one point of the scores of "Method1" and "Method2", the scores of "Method2" further increase in .079 points.

The "Method2" coefficient can also be interpreted as the amount that is added to the predicted value when it is passed from one method to the other, that is, so that the performance scores of the month of June with "Method1" are equal to those of "Method2", these have to increase by .079 points for each point.

Then, it was evaluated with the "vif" function of the R "car" package possible co-linearity problems in the predictor variables. None of these variables (initial attendance, final attendance, sex and method) presented a VIF (Variance Inflation Factor) greater than 10, which indicates that co-linearity is not a problem in our data. The model was then reset by eliminating only those

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variables that are not significant (and in order according to the p-value if they were more than one variable). Our model was therefore defined as follows: June performance = β0.9434+ Initial attendance*.36331+Final attendance*.04376+ *Method2*.7895.

3.6. The relative importance of predictors

In order to evaluate the relative importance of predictors, i.e. the "initial attendance", "final attendance" and "Method2" independent variables, the R "relaimpo" package was used.

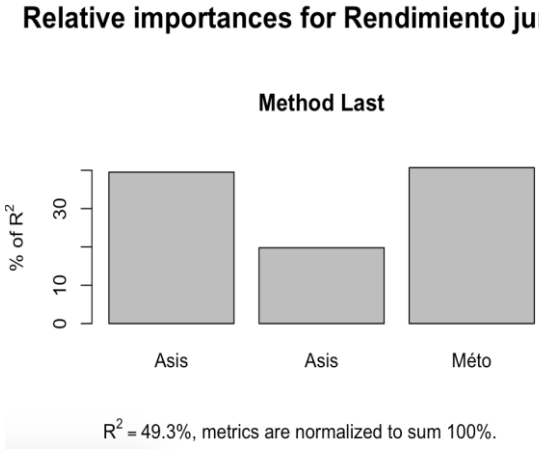

Figure 3. Relative importance of predictors.* *Rendimiento junio* (June performance)
* *Asis* (Initial and final attendance respectively); *Méto* (Methodology)

In the first column the "Initial attendance" variable appears, in the second “Final attendance” and in the third “Method2”. According to the Last Method, “Method2” variable is the one that has the greatest importance in the linear regression configured model, i.e, is the one that most contributes to the improvement of the students’ academic performance in the month of June.

4. Discussion

The present moment urges the effective development of an educational model focused on learning assuming a great methodological and consequently cultural change, conforming a strategic plan with innovation proposals based on the emerging pedagogies, the consideration of good educational practices, the necessary teacher training, the social value, the development of the emotional competence and the ultimate consideration of shaping learning communities (Cortina, Gallardo, Jiménez & Trujillo, 2014; Trujillo, Cáceres & Aznar, 2015).

The use of the flipped classroom method stages a teaching-learning context where the average scores obtained have been better, in a linear way, than from a traditional methodological approach (Guy & Marquis, 2016; He, Holton, Farkas & Warschauer, 2016; Heyborne & Perrett, 2016) enabling critical meaningful training experiences, inserted in its environment and with social projection commitment, generating perspectives and possibilities on an ubiquitous, social, distributed and critical learning. All this must be developed from the dialogic value, promoting active participation, exercise of transformational and resilient leadership and picking collective intelligence.

According to the results obtained (especially innovative and significant in the field of Social Sciences and specifically in Education-Physical Education) in this study we have detected, in the same way, the strong correlation between the flipped classroom methodology and the performances in variable, sequenced and continuous periods, observing how motivational issues and consequently related to classroom attendance are binding and thus we have shown some of them (Muir & Geiger, 2015; Porcaro et al., 2016). The obsolescence of knowledge, increasingly accelerated, necessarily configures arguments in favor of the inclusion of new models and pedagogical structures, where the evaluation processes are eminently competency-based, meaning new forms of organization and appearing new definitions of the tasks, giving a particular value to the learning to learn. Thus, the students’’ active participation becomes a requirement, fully complying from his

commitment and generating training spaces based on more meaningful learning and therefore transfer facilitators and practical application in diverse contexts.

We have found that the performance (June) is significantly determined by the initial assistance, the final attendance and by the method of flipped classroom, as regards to the multiple linear regression model. These results could be so due to the fact this methodology empowers the ubiquity, autonomy, self-regulation, the empowerment of the strengthening of social cooperation, the resolution of cognitive problems, the ethical commitment and values and the functional learning are reflected in the use of this model (Chaves, Trujillo & López, 2015).

It is interesting to note that month scores do not depended on the students' sex, in other words, this variable had no significant influence on them. The conclusions of this study are parallel with Willians & Takaku (2011) and Olajide (2013) research works, as no significant cash of the variable sex in the students' performance measured at the end of the academic year has been found.

Similarly, it was found that the predictor which had a greater weight on the scores obtained in the month of June was the flipped methodology, i.e. the students' performance in this month is explained more by the methodology to be followed than by other independent variables as the final and initial assistance.

In short, we can conclude that the improvement of academic performances, using the flipped classroom methodology are better compared to other groups that use traditional methodology, valuing relevant motivational issues and attendance and commitment related to those scores.

Therefore, the teaching-learning processes that use emergent and active pedagogies, such as the flipped classroom, offer openness and collaboration, democracy and commitment, being necessary its impulse by the enhancement of cognitive processes involved and especially the valuation of the improvement in the implicit performances. All this in spite of the possible difficulties that may limit their use, among which, we highlight the involvement degree, the necessary commitment and the demand level that especially determines in teacher and student planning alike.

Possible future research works focus on the consideration and study of MOOC resources, for example, as they facilitate the integration of the flipped classroom methodology, self-regulation perceptions and the improvement in the use of the flipped classroom, analysis of the conformation of effective personal learning environments, exploration of new techniques and strategies that encourage the students' interactive participation to increase their motivation degree, achievement of the classroom humanization and effective development of emotions, among others. Also, and from a statistical point of view, it is suggested the conducting of multivariate classification techniques, which enable the identification those students that more and less scores obtained to provide them quality feedback in line with the competencies or skills deployed in relation to each one of the methodologies followed.

We will know if the flipped classroom methodology, as a reality, generates a more participatory, flexible, adaptive, effective and competency learning that definitively will engage in a global project of methodological change that facilitates and certainly empowers people, groups and social movements. The precise combination of mobile technology, contents and the students' willingness to learn are key aspects to create learning ecologies that go beyond the traditional formal and face to face context, integrating multiple virtual and interactive spaces (Rubia & Guitert, 2014) where the teacher becomes fundamental to form structures for critical and shared meaning.

This study has been financed by PIBD 17-12 project entitled Flipped peer classroom, as an innovative teaching methodology for The training of future professionals in Education through semi-presence and collaborative learning environments in University. This project has been endorsed by the National Agency for Quality Assessement and Accreditation (ANECA) and the Vice-Rectorate for Quality Assurance of the University of Granada (Spain).

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