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Active Participation and Interaction, Key Performance Factors of Face-to-Face Learning

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Abstract: During the last decade and, particularly, from the restrictions on mobility brought by the COVID-19 pandemic, online and digital teaching is positioning itself as an alternative to face-to-face teaching. As of today, however, the soundness of this alternative teaching in terms of learning outcomes and students' success is not yet clear, even though it is particularly important, since it may determine future teaching plans, strategies and methodology. This article presents the results of a teaching research project analyzing the impact of active participation and face-to-face interaction of students on their performance from a quantitative approach. Through an empirical study carried out with several groups of university students in financial accounting over a four-year period, we analyze the effect of including face-to-face techniques of participation and teaching innovation on students' success and performance. The quantitative results indicate a significant improvement in all the indicators of the "experimental" groups, compared to face-to-face standard teaching groups and streaming teaching groups. By enhancing active participation, better marks and performance are achieved, especially in the continuous evaluation system. The qualitative results, based on the opinion of the students, also indicate their preference for models of active participation and interaction, as well as their positive perception of the success of the initiative. The advantages derived from innovative face-to-face teaching are evidenced since it favors group interaction and active participation of the students, which are crucial elements for performance and academic success.

Keywords: participatory learning; face-to-face; teaching innovation; interaction

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1. Introduction

The recent pandemic caused by COVID-19 has revealed abundant contradictions in the transition from the educational model to a distance or online system, in which the interaction between students and teachers ceases to be face-to-face and is subject to different virtual communication tools. Despite the many technological advances available today, there seems to be consensus among teachers and specialists regarding the greater effectiveness and convenience of the traditional face-to-face model to achieve the proposed learning objectives. The degree of interaction and participation of students when they are in the classroom, as well as the willingness to develop transversal competences, is fundamental to maximize academic performance and the success of the learning process.

Over the last few years, in fact, the process of European convergence has promoted a methodological renewal in higher education aimed at enhancing these issues. In the conclusions on the renewed EU agenda for higher education, the Council of the European Union (2017) encourages higher education institutions to rethink the way they think about learning and teaching. In particular, this is to encourage a student-centered approach and learning based on collaboration and experimentation. There are three basic reasons to promote this change in methodology: the need for lifelong learning, to develop the capacity for self-learning, as well as for the student to acquire the generic and specific skills to develop professionally, personally and socially, [1] (2005).

Already in 1995, Barr and Tagg spoke of a paradigm shift "from teaching to learning", shifting the focus from the teacher to the student. Studies such as Cano et al. [2] or Martínez-Clares and Gonzalez-Morga [3], however, indicate that the focus remains on teaching over learning. Cano et al. [2] analyzed the teaching methodology and evaluation systems in European universities from the perception of the 'Erasmus'. The results obtained confirm that the teaching methodology is not only focused on learning and practice, but also on teaching and relegating the autonomous work of the student.

More recently, Gargallo et al. [4] derived a positive influence from learning-focused methods on the student's various abilities and on their perception of the teacher's designed learning environment. In a meta-analysis with data from 225 studies, Freeman et al. [5] achieved empirical evidence of improvement in student performance in classes with active learning methods compared to traditional expository classes in science, technology, engineering and mathematics (STEM) courses.

Over the last few years, multiple experiences focused on learning have been studied [6–11], applying innovative methodological proposals implemented by university professors within a participatory approach focused on the student. Trying to change the methodologies without altering the rest of the components of the system, however, is a vain purpose [12]. According to this author, "learning and the way in which it occurs overflows the teacher-student relationship and is open to influences from other context elements such as curricular organization, work climate, institutional culture, expectations and conditions of the professional future". Of all the curricular components of the degrees, the methodologies are those that have a greater impact capacity on training, being the curricular component that is most clearly in our hands, as opposed to planning, content selection, evaluation, etc. [12].

According to Prince [13], there is sufficient evidence to assume the effectiveness of active learning in improving student recall of information, and the effectiveness of student participation in improving their academic outcomes. Indeed, back in 1999, in his theory of participation, Astin showed that the greater the students' participation in the university, the more and better their learning and personal development. Hence, in order to achieve the effectiveness of any educational policy or practice, the basic requirement is that student participation increases. Following Trowler [14], recent papers correlate engagement and greater academic success [15–18].

Looking at the use of teaching techniques of active participation to improve the teaching-learning process, a number of papers are significant for every topic (Table 1). Other authors, such as Birgili et al. [19]) or Uzunboylu et al. [20], analyse the different trends and approaches of studies applying this methodology.

Table 1. Significant research in active participation techniques.

Topic	Papers
Cooperative learning and learning by projects	Cottel and Millis [21], Delgado and Castrillo [22], Herrada y Baños [11] Carrasco et al. [23], Palazuelos et al. [24]
Problem-based learning	Adler and Milne [25], Stanley and Marsden [26], Wilkin [27], Delgado y de Justo [28], Hincapié et al. [29], Gil-Galvan et al. [30]
Case Method	Hassall and Milne [31], Azofra et al. [32], Alsalman [33], Ktoridou et al. [34], Jhala and Mathur [35]
Peer learning	Adler and Milne [25], Zhang et al. [36]
Serious Games	Bakan and Bakan [37], Calabor et al. [38], Zainuddin [39]
Others: teamwork, tutorials, active seminars, one minute paper, etc.	Camacho et al. [40], Flórez y Albelda [41], Li and Guo, 2015 [42], Perera y Hervás [43]

On the other hand, the use of information technologies and digital platforms as tools to support the entire process has significantly enhanced the impact and possibilities of these methodologies [44,45]. In recent years, a technique that has been widely used is the flipped classroom, popularized by Bergmann and Sams [46], which focuses face-to-face classes on the discussion and resolution of doubts about syllabuses previously studied at home by the student. According to its proponents, this technique puts the focus on the student and encourages autonomous and self-regulated learning [46].

In the field of accounting teaching, although the influence of Bologna has been significant, several professional bodies advocate a methodological renewal and competency development for the profession in the field of education (AAA [47], AICPA [48], IFAC, [49–51]). In particular, the insufficient development of general competencies and the lack of capacity of graduates to transfer their knowledge to the workplace have been described [52–56]. The development of judgment, analysis, oral and written communication, and interpersonal relationship skills shall be prioritized, to the detriment of the memorization of rules and standards, whose usefulness and validity is relative, especially if compared to a sound command of new technologies [57].

In a longitudinal study, Marriot and Marriot [58] analyzed the attitude of students towards accounting as a profession after studying the subject, raising the need to use methodologies of active participation. Empirical teaching work in accounting shows inconclusive results. In general, in all cases improvements in student learning are inferred without obtaining statistically significant differences [59–61] by measuring student satisfaction or opinion through surveys or focus groups [24,26,38,62] and/or the impact on academic outcomes [27,44]. Most of these works evaluate the acquired competences or the development of skills and promotion of attitudes such as critical thinking, analytical capacity, problem-solving capacity and self-learning.

The diversity of strategies used in class is essential to improve the students' performance [63]. According to Bonner [64], an accounting teacher needs to carefully employ multiple teaching methods to achieve all the learning objectives of a given accounting course, as these goals likely encompass the full range of accounting learning needs. Learning objectives involving complex skills require teaching methods that promote active learning by students. Essential competencies in accounting learning are written and oral communication skills, the ability to judge and have critical thinking (including the need to learn for oneself) and the ability to work in groups.

Garcia-Benau and Zorio-Grima [58] carried out a teaching experience in which they used a set of techniques (concept map, puzzle, crossword puzzle, online test) to create a cooperative learning environment in order to make the master class very participatory. Although they obtained positive results on the academic performance of students and on their degree of satisfaction, these are purely qualitative, based on surveys conducted by students, so it cannot be clearly determined whether the use of such techniques has led to an improvement in performance and/or academic success, and to which extent.

In short, many authors advocate for a more participatory and interactive educational approach, which seems to necessitate a face-to-face teaching context, while online systems are gaining acceptance in the university arena. Both trends find their arguments in qualitative studies that lead to this apparent contradiction with no conclusive results based on quantitative data.

The research presented below in this paper focuses precisely on the objective of quantitatively assessing the extent to which the incorporation of participatory and active teaching within the framework of a face-to-face relationship can have a measurable positive impact on the preparation of the student for the accounting field.

Therefore, and in order to obtain quantitative results, the research compares a face-to-face teaching system based on active participation to the traditional prevailing system and to the new online initiatives. To that end, the main research question is phrased as follows:

Research Question (RQ). *The face-to-face teaching system based on active participation prompts better learning outcomes than the traditional and/or the online-based systems.*

The contribution of this research is two-fold. On the one hand, the research results can help teachers and education practitioners determine which approach could be more efficient and interesting to achieve the learning goals and boost the students' capitalization of their learning journey. On the other hand, our results contribute to the literature by measuring with concrete and reliable data the supposed success of innovative teaching models, in order to determine their validity and applicability, as well as to provide results that allow the assessment of their suitability in terms of efficiency and cost-benefit of face-to-face teaching.

2. Materials and Methods

2.1. Research Objectives

The main objective of the research is assessing if the inclusion of face-to-face innovative teaching initiatives in class leads to better results in terms of commitment, success and performance, and measuring its impact in relation to other models in place. To that goal, a longitudinal experimental project has been designed, allowing for the quantitative comparison of the results obtained through different teaching approaches: (a) the historical 'standard' model used until now, (b) the 'innovative' model proposed in the experiment, and (c) the 'streaming' model which is increasingly gaining interest in universities, characterized for combining face-to-face classes with online classes in streaming.

While the 'standard' and 'streaming' models are based on theoretical lectures followed by practical classes with exercises, the experimental model designed for the research involves a series of actions aimed at enhancing general and particular learning in the accounting field. These measures are of a transversal nature, applied throughout the subject, or of specific nature, applied depending on the specific subject to be taught. The set of proposed measures, based on the work and studies referred to in the previous section, are presented in Table 2.

Table 2. Teaching innovation practice.

Measure	Character	Objective	Application
Students' involvement in the project	General and transversal	Empower the student, their participation and a good predisposition to the proposed measures.	The project is openly transmitted, emphasizing its participatory and proactive character and its objectives.
Previous survey	General and transversal	Collect previous data, establish the framework of action and involve the student.	Students' opinion about the prevalent model, and his/her interest in more participatory models and initiatives.
Inverted class	General and concrete	Enhance the autonomous work of the student, and the use of time in the classroom.	When subjects allow for it, students receive written and audiovisual materials prior to the class lectures.
Teaching of practice before or at the same time of theory	Particular and transversal	Maximize learning, from the specific to the abstract. Complex concepts are best understood from the known.	In abstract and complex topics, practical exercises and mechanics are taught firstly, and only then the related theory.
Self-assessment questionnaires	General and transversal	Enhance autonomous learning, reflection and student confidence.	Students count on self-assessment questionnaires to test their knowledge and reinforce what they have learned in class.
Non-evaluable partial tests (exam)	General and transversal	Enhance student confidence and effectiveness in the learning process.	Partial non-evaluable tests are carried out so that the student becomes familiar with the exam situation.
Audiovisual materials (MOOCs)	General and transversal	Maximize learning options from available tools and materials.	Complementary materials are shared in different formats (videos, articles, etc.).

Table 2. *Cont.*

Measure	Character	Objective	Application
Case analysis	Particular and concrete	Promote learning from participatory teaching techniques.	Case studies are presented to be openly solved and discussed in class.
ABP	Particular and concrete	Promote learning from participatory teaching techniques.	Where possible, students in groups are confronted with complex cases so that they seek optimal solutions on the subject.
Aronson puzzle	Particular and concrete	Promote learning from participatory teaching techniques.	Shared and distributive learning sessions are carried out, enhancing attention and the use of effort.
Voluntary delivery of exercises	General and transversal	Enhance student confidence and effectiveness in the learning process.	Students can voluntarily submit the exercises, which are corrected and returned with the corresponding comments.

Source: The Authors.

2.2. Sample

The subject selected for the empirical study is Financial Accounting, taught during the first year of the degrees of Finance and Accounting (FICO), Business Administration and Management (ADE) and Marketing and Market Research (MIM), of the University of Zaragoza (Spain). This subject has been selected due to the results obtained through previous course evaluation processes, which recurrently presented difficulties in understanding, problems with learning and low rates of use, attendance and success.

The sample of students corresponds to different groups with equivalent prior studies, studying the same subject and degree, in the same faculty and counting with the same resources, so that comparing their results was consistent with the research goal. Indeed, the results obtained by these different groups over previous courses are totally equivalent to each other.

However, to better isolate the potential little differences between groups throughout the years, the groups for the year 2018/2019 were divided into two categories: the sub-groups where the experimental system would be applied, and the sub-groups that would stay under the conventional system and would, therefore, be considered as Control sub-groups. Again, aiming at limiting the effect of different teaching styles as much as possible, all teachers for the course assigned to the experimental and control sub-groups classes were also involved in the initiative, trying to homogenize styles, pace and all other aspects beyond the experimental actions designed.

The total sample includes groups of students for every academic year from the course 16/17 to the course 20/21, disregarding the course 19/20, which teaching system and results were strongly affected by COVID-19 pandemic restrictions. The different courses and systems included in the research, as well as the number of students per course, are presented in Table 3.

Table 3. Courses and models included in the research.

Course	Students	Model	Characteristics
Courses 16/17 and 17/18 (Historical)—GH	225 + 231	Standard	F2F theory lectures and practical cases
Course 18/19 (control)—GC	233	Standard	F2F theory lectures and practical cases
Course 18/19 (experim.)—GE	206	Experimental	F2F innovative techniques (Table 2)
Course 20/21 (streaming)—GS	215	50% Streaming	Theory lectures in streaming and F2F practical cases

Source: The Authors.

The total sample of four academic years, ten groups and 1.110 students belonging to the same degree and faculty, and studying the same course, allows for significant, useful and representative results.

2.3. Data Collection and Analysis

The empirical nature of this study is based on the need to obtain results that show, in a quantitative way, the impact that the proposed system has on the performance and success of students.

From a quantitative standpoint, the outcomes can only be measured through the number of students attending the exams, the number of students passing them, and the number of enrolled students who successfully pass the course. Therefore, the variables to evaluate this impact are directly related to the results obtained by the students, with the analysis indicators seen in Table 4.

Table 4. Quantitative indicators of the study.

Indic.	Variable	Ratio	Meaning
Indic.1	Commitment (C)	Taking exam/Enrolled	Percentage of enrolled students who take the exams in continuous evaluation and in global evaluation. Attendance and follow-up.
Indic.2	Success (E)	Pass/ Taking exam	Percentage of students taking and passing the exams, reflecting the success in tests. Degree of preparation of the students before the evaluation.
Indic.3	Performance (P)	Pass/ Enrolled	Percentage of enrolled students passing the exams, reflecting the students' performance. Aggregate impact of the proposed initiatives on the students' passing of the subject.

Source: The Authors.

The three indicators proposed in the study are obtained for the results of each of the evaluation tests carried out during the subject, the two that make up the continuous evaluation system (first and second test; RC1 and RC2), and the two offered as an overall assessment (June and September; RF1 and RF2).

The impact of the experiment is measured by comparing the results obtained by the experimental sub-groups with those of the control sub-groups and those of the historical and streaming groups.

In order to complement the quantitative results with qualitative indicators related to the students' perception of the success and suitability of the initiatives introduced, two specific actions are carried out, of a subjective nature and aimed directly at the student. On the one hand, students are asked to carry out a new survey, derived from the one they already completed at the beginning of the subject, in which they evaluate the success of the initiative, its relevance, how it has affected their commitment, performance and success, and what improvements could be incorporated. On the other hand, focus groups are held in which the experience is openly discussed with small groups of students, relying on an established script, in order to know their impressions in a semi-structured way.

Figure 1 shows the outline of the empirical study relating the results obtained by the four main groups of students according to the teaching system.

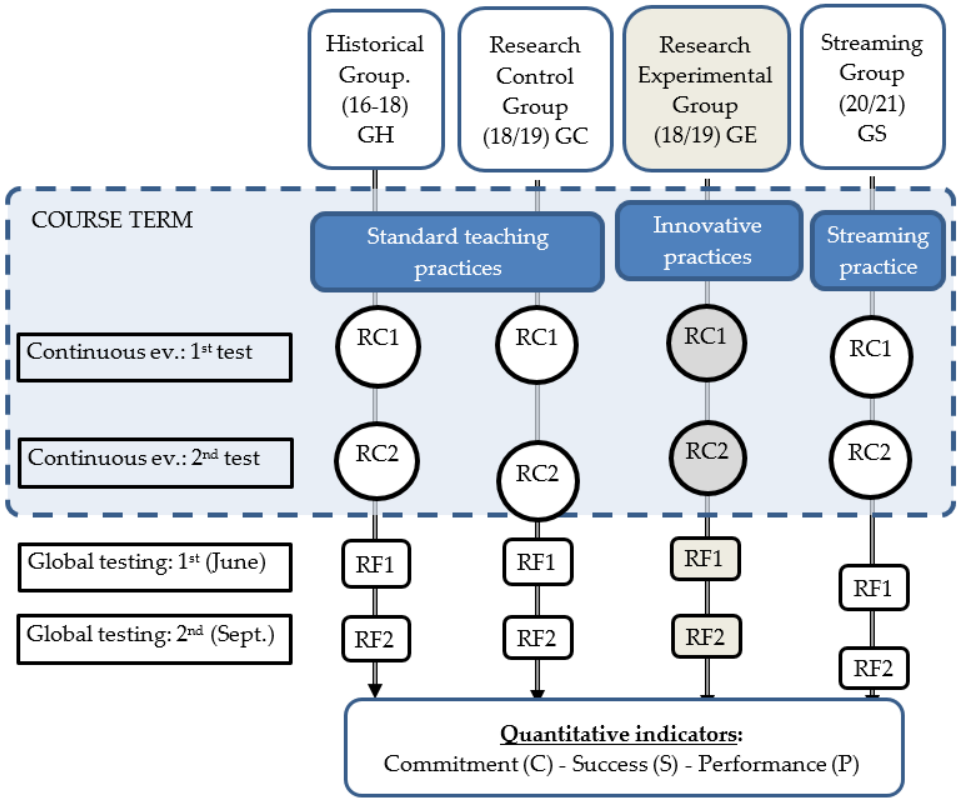

Figure 1. Outline of empirical study. Source: The Authors.

3. Results

In the first place, the indicator called 'Commitment' shows the percentage of students who take the exam in each of the four evaluation tests of the course, over the total number of students enrolled. In the first two exam tests, under the continuous assessment model, this indicator shows the degree of class attendance of the students, especially in the second test, which can only be accessed after passing the first one.

The results obtained throughout the course in the four evaluation tests are shown below in Table 5 for the sub-groups of the experiment (GE), the control sub-groups (GC), the groups of previous courses (GH) and those of streaming teaching (GS).

Table 5. Results in Commitment.

Commitment	Ratio Attending Exam/Enrolled				
	Continuous Evaluation			Global Tests	
	1st Test	2nd Test	Continuous	1st Test	2nd Test
GE	64.91%	39.04%	39.04%	37.72%	25.88%
GC	54.98%	30.33%	30.33%	35.55%	26.07%
GH	60.70%	31.86%	31.86%	33.95%	30.93%
GS	76.38%	32.02%	32.02%	32.28%	26.77%
Difference GE and GC	9.94%	8.70%	8.70%	2.17%	−0.19%
Difference GE and GH	4.21%	7.17%	7.17%	3.77%	−5.05%
Difference GE and GS	−11.47%	7.01%	7.01%	5.44%	−0.89%

Source: The Authors.

The differences observed in the ratios of the different groups are remarkable, giving a significantly higher percentage of students presented over enrolled in the experimental sub-groups, especially when compared with the control sub-groups. In the second continuous assessment test, in fact, the difference is considerable in both cases, reflecting the lower dropout from class attendance after the examination of the first part. Regarding the final

exams, the control sub-groups (GC) indicate almost 5% more students presented to the first test, and practically the same percentage to the second.

This negative difference in relation to the experimental sub-groups (GE) can be explained as a result of a greater number of those presented in continuous evaluation who pass the subject, and do not need to attend the global call. As for the historical groups (GH), it seems clear there is a greater tendency to derive the subject for the second global test (September), to the detriment of the continuous evaluation and the first global test (June), which could indicate a greater degree of distance from or abandonment of the subject, if possible. A special case seems to be that of the streaming groups, with a large percentage of students attending the first continuous exam followed by a drastic drop in the second exam. The fact that the exams in this model were taken online and at home may have encouraged students to take the exam even if they were not really prepared for it, as suggested by the low marks obtained (Table 6).

Table 6. Results in Success.

Success	Ratio Passed/Attending Exam				
	Continuous Evaluation			Global Tests	
	1st Test	2nd Test	Continuous	1st Test	2nd Test
GE	62.84%	73.03%	73.03%	15.12%	32.20%
GC	59.48%	68.75%	68.75%	10.67%	30.91%
GH	54.02%	70.80%	63.50%	33.56%	27.82%
GS	45.02%	61.48%	55.74%	21.95%	36.27%
Difference GE and GC	3.36%	4.28%	4.28%	4.45%	1.29%
Difference GE and GH	8.81%	2.23%	9.53%	−18.45%	4.38%
Difference GE and GS	17.82%	11.56%	17.30%	−6.83%	−4.07%

Source: The Authors.

The second indicator proposed is that of 'Success', which shows the percentage of students who pass the subject among those who attended it, indicating their preparation for and aptitude in the exam and, therefore, the success of their learning effort. Table 6 shows the results obtained for each test and group.

Again, the differences of the experimental groups with those of control, history and streaming are very notable. In the continuous assessment tests, the percentage of 'pass' is significantly higher in the experimental sub-groups, even taking into account the higher percentage of students attending them. The higher success in all tests compared to the control sub-groups, almost 5% more success in the Continuous and first global test, seems to suggest that students in the experimental sub-groups are better prepared than those in the control sub-groups.

In historical groups, the lower success achieved in continuous evaluation together with the high negative difference in the first global test indicates a tendency to focus directly on the global test to the detriment of continuous evaluation. Again, the streaming model shows a different trend, marked by the much lower success in Continuous, which is partially compensated in global tests.

However, as these are success rates on students attending the exam, it is necessary to combine 'Success' with 'Commitment' to obtain a clear indication of what impact the experiment has had on the whole subject, both at the level of attendance and of successfully passing it (Table 7). The following indicator includes this idea under the name of 'Performance', showing the percentage of 'pass' in each test over the total number of students enrolled in every system course.

Table 7. Results in Performance.

Performance	Ratio Passed/Enrolled				
	Continuous Evaluation			Global Tests	
	1st Test	2nd Test	Continuous	1st Test	2nd Test
GE	40.79%	28.51%	28.51%	5.70%	8.33%
GC	32.70%	20.85%	20.85%	3.79%	8.06%
GH	32.79%	22.56%	20.23%	11.40%	8.60%
GS	34.38%	19.69%	17.85%	7.09%	9.71%
Difference GE and GC	8.09%	7.66%	7.66%	1.91%	0.28%
Difference GE and GH	8.00%	5.95%	8.28%	−5.69%	−0.27%
Difference GE and GS	6.41%	8.82%	10.66%	−1.38%	−1.38%

Source: The Authors.

The results for 'Performance' confirm the previous results, with significant differences in both continuous assessment tests with the control, historical and streaming groups. As an aggregate indicator that synthesizes the degree of success of the experiment, the percentage of students who pass the subject in continuous evaluation is from 7.5% to 10% higher in the experimental sub-groups than in the remaining groups.

From the set of previous results, it is clear that class attendance and the continuous evaluation model have been significantly higher in the experimental sub-groups than in the control sub-groups or the previous year ones. In this sense, the most relevant period is the one that corresponds to the first part of continuous evaluation, since many of the students who fail this first test abandon the attendance to class during the second part.

Although the differences in group results appear to be evident, a test for independent samples has been conducted so that the statistical significance of results between the experimental sub-group and the control sub-group can be checked. As shown in Table 8, the tests deliver different means and variances for both samples in continuous tests and not for global tests, thus confirming the previous results.

Table 8. Independent Samples Test.

		Levene's Test for Variances		*t*-Test for Equality of Means		
		F	Sig.	*t*	df	Sig. (2-t)
Pass1C	Equal variances assumed	10.07	0.001	1.663	437	0.097
	Equal variances not assumed			1.666	436.522	0.096
Pass2C	Equal variances assumed	12.291	0.001	1.737	437	0.083
	Equal variances not assumed			1.743	436.836	0.082
PassCont	Equal variances assumed	6.792	0.009	1.294	437	0.196
	Equal variances not assumed			1.298	436.982	0.195
PassJune	Equal variances assumed	2.146	0.145	0.904	153	0.368
	Equal variances not assumed			1049	88.588	0.297
PassSept	Equal variances assumed	0.223	0.637	0.026	112	0.980
	Equal variances not assumed			0.026	110.482	0.980

Source: The Authors.

4. Discussion and Conclusions

At a time when online and digital teaching are presented as alternatives to the traditional system of face-to-face teaching, this work analyzes the advantages of the latter, studying the mechanisms of direct interaction that this system makes possible. Numerous works have measured the effect of techniques or methods of active participation in the learning process of their students. In this paper we evaluated the aggregate impact of a set of measures that enhance active student learning by applying it in a combined way to achieve an overall goal.

Unlike most similar studies, the methodology applied in this case focuses on a quantitative analysis that allows measuring the concrete impact of the measures incorporated in the achievement, success and performance of students. To do this, the set of measures is applied to a group of "experimental" students and another set to a group of "control" students. Besides, we compare the results with those of the previous years, "historical groups" and those of the following year based on streaming teaching.

The results show significant differences in the commitment, success and performance of the experimental sub-group compared to the control sub-groups and all other groups. In particular, it is highlighted that the implementation of active participation and interaction techniques significantly favors the monitoring and use of the continuous evaluation model, significantly increasing the number of students attending (around 10% more) and passing the exams (close to 5% more). Still, the most relevant result in terms of outcomes is likely to be the 'performance' ratio, namely the number of students enrolled who pass the exam. Indeed, the students in the experimental teaching reached an 8% higher degree of passing/enrolled than the control and historical groups, and more than 10% higher than the streaming groups.

Results show that face-to-face interaction and participation have a greater incentivizing effect on the students than the conventional teaching process and the online teaching approach. While the conventional teaching system seems to discourage students from attending the continuous evaluation exams, the online teaching approach appears to fail in providing the students with the necessary knowledge to pass the exams. The experimental system tested in this research, on the contrary, appears to balance attendance and success, thus delivering the best aggregated results, especially for continuous assessment.

In order to obtain qualitative indicators related to the students' perception of the success and suitability of the initiatives introduced, they carried out two surveys, at the beginning and end of the subject, in which they evaluated the initiative, its relevance, how it affected its commitment, performance and success, and what improvements could be incorporated. Besides, focus groups were held, in which the experience with small groups of students was openly discussed, relying on an established script in order to know their impressions in a semi-structured way. In both cases, the results clearly indicate the good perception that students had of the initiative, and their support for it.

The results of our work are relevant at different levels. From the educational and teaching arena, the outcomes of our research point out the relevance and validity of a face-to-face approach. While the technology and online approach is undeniably interesting as a tool to enforce and maximize learning, our results prove that it shall remain subject to the direct and in-person relationship between teacher and learners, as complementary and not substitute. Active participation is key to improve the students' performance, and face-to-face teaching appears to be the most efficient system to boost participation. Both teachers and educational planners could take into account our conclusions when preparing the teaching methodology and approach.

From the academic perspective, our research contributes to the literature by providing quantitative and empirical information for decision-making related to the teaching methodologies. Given there is an open debate about the validity and efficiency of new teaching approaches, combined with a lack of actual data comparing the different co-existing systems, our results help clarify the outcomes and expectable results of the different options available.

As happens when researching with different groups of people through the years, our research is subject to limitations, mostly in the form of potential subjectivity or heterogeneity in the students' behavior. We have tried to reduce this limitation by creating a control group and by working with a large sample, but there is always room for little intrinsic differences among groups. Continuing the research through the years, including more groups, degrees and experimental variables would not only enrich the research but also help reduce the potential limitations.

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