Students' perception of team-based learning: Evidence in Economics

Gemma Abío[1], Manuela Alcañiz[2], Marta Gómez-Puig[1]*, Luís Ortiz-Gracia[2], Vicente Royuela[2], Glòria Rubert[1], Mònica Serrano[1], Alexandrina Stoyanova[1]

[1]Department of Economics, University of Barcelona, Barcelona, Spain
[2]Department of Econometrics, Statistics and Applied Economics, University of Barcelona, Barcelona, Spain
*Corresponding Author: marta.gomezpuig@ub.edu

ABSTRACT

Today's new teaching and learning methodologies in higher education have moved the center from teacher to student and from teaching to learning. Since Team-Based Learning (TBL) is one of the most frequently used active learning methodologies that have emerged, the objective of this paper is to analyze and evaluate students' perception of this methodology. To that end, first, we study the positive and negative aspects of TBL considered by students. Then, we define a synthetic indicator to assess students' degree of satisfaction with the methodology and analyze it with respect to some relevant sociodemographic variables. Finally, we study the correlation between individuals' satisfaction with TBL and their academic performance measured by students' final grades. Data comes from a unique database created by merging information collected through an online questionnaire answered by students, and academic and sociodemographic information extracted from administrative records. The main results show that TBL is perceived as a positive methodology, with respect to improving teamwork abilities. Significant differences in several competences were found by age groups, between students with or without a paid job, depending on gender, and depending on the educational attainment of their parents. Analyzing students' perception of active learning methodologies in higher education can help to determine who benefits most from the introduction of these strategies and tailor them accordingly.

INTRODUCTION

Today, higher education faces great challenges. The new habits of communication and interpersonal relationships in society and the explosion and rapid growth of information to which we are exposed every day are, among others, some of the most important aspects of the environment that surrounds the students we find in classrooms. This context requires a transformation of the traditional teaching process towards the adoption of innovative methodologies that promote students' more active engagement in their learning.

The new methodologies benefit those students with poor knowledge that impedes their learning process and students who do not have the necessary learning skills and abilities to be successful not only in the educational environment but also in the new social reality (Kruger and Dunning, 1999; Pennebaker et al., 2013). A society that is constantly changing increasingly demands people with creative thinking able to find

solutions to new problems, cross-disciplinary knowledge, and commitment and motivation. It is assumed that if we train students to achieve these requirements in their learning process, they will be a constant throughout their lifetime. Adapting the higher education system to this reality is needed to guarantee the quality of university education as well as to bring it closer to the real world.

Several studies show significant improvements in student learning when using interactive classroom formats, rather than more traditional classroom systems. For example, Deslauriers et al. (2011) found that even when lectures are taught by highly regarded teachers, the benefits of learning for students are less than those achieved in a more interactive context —even when the interactive classes were taught by a post-doctoral student with less teaching experience. Baepler (2014) shows that class time can be reduced by introducing active learning sessions without worsening student outcomes. In addition, Park and Choi's (2014) experiment showed the existence of "light" and "shadow" areas in the classroom that discriminate against the students' learning experience based on where they are sitting in the classroom. They found that, unlike traditional methods, active learning methodologies did not produce this positional discrimination. In fact, students felt that active classroom participation creates a more inspirational atmosphere. For students with better academic achievement, more interactive teaching and learning methods significantly encourage new ideas and the exchange of information among participants. Although the idea of substituting masterclass time with active learning activities was originally designed for small groups, Jackson, and Prosser (1989) already advocated the implementation of this kind of learning technique in large groups. Indeed, Knight and Wood (2005) found that the introduction of student participation and cooperative problem-solving during class time in large biology groups improved academic performance.

In this context, one of the active learning methodologies that has emerged in higher education is Team-Based Learning (TBL) in its various forms. TBL is an innovative and collaborative work-based teaching strategy. In some of its versions, TBL combines individual work outside the classroom and the benefits of small-group task development within large groups of students and has been one of the most frequently used active teaching-learning methods in higher education (Millis and Cottell, 1998; Johnson et al., 2007; Queiruga-Dios et al., 2019), because of its alignment with the new changes and social reality, in which education plays a relevant and key role.

The academic literature draws on numerous experiences that show positive results in terms of academic achievement and study motivation among students following this new active methodology. Concretely, several studies show that TBL not only strengthens students' knowledge and learning processes (Nordberg, 2008; Shah, 2013; Opdecam et al., 2014) but also helps them develop interpersonal communication skills (Michaelsen et al., 2004). This cooperative learning strategy enhances students' interconnectedness and academic performance through participation in a common project (Yamarik, 2007). At the same time, their self-esteem and motivation are increased, and a teamwork spirit is encouraged (Millis and Cottell, 1998). These improvements in engagement and productive learning behaviors occur in both low- and high-performing students (Hong and Pham, 2013). Abío et al. (2019), on the other hand, focus their analysis on the benefits of introducing the most interactive class format into large groups exclusively for underperforming students who repeat a course.

TBL is based on four fundamental principles (Michaelsen et al., 2004, 2008 and Michaelsen and Sweet, 2011): (1) permanent work teams strategically formed to ensure the equitable distribution of intellectual talent, cross-disciplinary skills, and competences among groups; (2) an early learning assurance process based on individual responsibility in relation to autonomous learning and collaborative work; (3) activities that apply concepts that aim to promote both active learning —the so-called learning by doing process— and team development; and (4) an evaluation that emphasizes the importance of frequent feedback, the role of self-assessment as an instrument to reflect the achievement of individual goals, and the importance of co-evaluation in determining the degree of involvement of team members in collaborative tasks.

An important complement of students' work in TBL is based on two different teaching and learning methodologies: flipped classroom and frequent tests. The flipped classroom is a pedagogical strategy that focuses on the importance of using class time for knowledge building rather than information transmission. To do so, the traditional teaching system is reversed: students prepare the contents and concepts before the class, converting the classroom into a dynamic area where the teacher is a kind of instructor or guide for the students who build their knowledge in an interactive learning environment. The beginnings of the flipped classroom can be traced back to the 1990s (Johnson et al., 2007; Mazur, 1997; Crouch and Mazur, 2001) and it became popular during the 2000s (Bergmann and Sams, 2012). Many studies support its success (McLaughlin, 2013; Missildine et al., 2013; Wilson, 2013), highlighting improvements in student participation and attitudes toward learning and teaching, and greater satisfaction of the faculty involved (Lage et al., 2000; Berrett, 2012; Strayer, 2012; Chung, 2014; Prieto et al., 2014). Regarding frequent testing, Roediger et al. (2011) find that the benefits of testing go beyond mere evaluation. Questionnaires allow students to identify gaps in their knowledge, provide feedback to teachers on each student's progress and, most importantly, improve learning. Pennebaker et al. (2013) found that the benefits of frequent testing are immediate feedback and its ability to improve students' learning habits.

However, despite the growing literature on TBL, so far little attention has been devoted to the research and study of the role played by students in this methodology. Knowing the students' degree of satisfaction with and assessment of this methodology makes it possible to identify the positive and negative aspects related to their motivation and commitment to TBL. Notwithstanding its importance, empirical evidence in this regard is still scarce and case-centered (see, for instance, Masters, 2012; Frame et al., 2015; Remington, 2017; or Espey, 2018). This paper aims to contribute to the existing literature in this field by analyzing and evaluating students' perception of this methodology.

Concretely, an analysis using statistical methodology will be performed. The analysis will be carried out considering various sociodemographic variables, such as gender, age, whether students work, and their parents' educational attainment. The results obtained regarding the motivation, performance, and commitment to the learning process that the students perceive from TBL can offer some additional information about the sociodemographic characteristics of the students who will show greater acceptance and appreciation of the introduction of TBL.

METHODS

Database

The analysis of students' perception of TBL methodology has been performed based on a database created by merging two datasets: an online questionnaire answered by students, and academic and sociodemographic information extracted from administrative records.

The questionnaire is based on the database used by Abío et al. (2019). This study analyzes the benefits of applying TBL with students retaking a subject in special groups called Groups of Intensive Study (GIS) at the University of Barcelona, Spain. The database includes information from five subjects (Introduction to Economics and Microeconomics from the bachelor's degree in Business Administration; and Introduction to Economics, Microeconomics I, and Microeconomics II of the bachelor's degree in Economics) over five academic years (from 2013/2014 to 2017/2018). At the end of the course, each student who had followed the continuous assessment, and thus the TBL, answered the online questionnaire —through Google Drive— to assess their experience, opinion, and perception about the TBL methodology implemented in the course.

Regarding academic information, the continuous assessment qualifications, and final grades of all the students in the subject are available —both those who opted for continuous assessment and, therefore, the new methodology and those who opted for a single assessment—.

Additionally, the Academic and Teaching Planning Office of the Academic and Teaching Support Area of the University of Barcelona provided further academic and socio-demographic information on the students who completed the online questionnaire. Finally, after merging both datasets, the study has been carried out based on a final database that includes information for 657 students.

The students' sociodemographic variables finally considered in the analysis were gender, age, whether they had a paid job and the educational attainment of their parents.

According to recent literature, diverse teaching and learning methodologies and assessment methods have a different impact on students' grades and perceptions depending on gender. For instance, multiple-choice tests and the time limitation of exams result in worse performance for women. Conde-Ruiz et al. (2020) relate that empirical literature has found evidence that women skip more questions in tests and that this has a negative impact on their performance. They analyze the data of the Spanish Physicians' National Exam of 2019 and find that women can reduce this negative impact by training intensively for test assessment. However, despite this preparation, some differences in exam performance remain, this gender gap being greater for the best candidates. Another reason to include this variable is that, as women have more collaborative skills, we expect them to have a better perception as well as an increase in their final grades. In collaborative learning, women tend to favor relationship building more than men, who tend to assert and confront when communicating (Carr et al., 2004). Similarly, Curşeu et al. (2018) find that the proportion of women in groups positively predicts discussion quality and that this has a benefit for the group's academic performance.

Age is a variable usually included in this kind of studies. Although age among the group of students in our analysis is very similar as they are all studying for the bachelor's degree, we expected to find a better perception and performance with TBL in older students, as they are more mature and closer to their entry into the labor market.

We also decided to consider whether there is any difference depending on whether students have a paid job. The reason is that we expect that those who work and study at the same time might have a higher level of maturity and thus better accept the introduction of TBL and take greater advantage of it in their final grades. Another reason for this might be that they probably work in groups, and therefore they are likely to understand the utility of this methodology better than those students who do not work.

The educational attainment of the student's parents' socioeconomic variable has been included in the analysis because it can approximate not only the economic situation of the student's home but also their cultural background. Traditionally, in the literature, both variables have been shown to have a clear positive impact on students' results and attitudes in their studies. In this study, we expect to find a similar result. We also consider the mother's educational level to try to ascertain whether it has a different impact, as they are the ones who have probably spent more time taking care of the children and supervising and helping them with their studies in the past.

Methodology

Students' perception of TBL methodology cannot be directly observed; therefore, we try to estimate it from the answers to a questionnaire which is presented in Table 1. As Table 1 shows, the questionnaire includes several statements to be valued on a Likert scale of 1 (the methodology has not helped me at all) to 6 (the methodology has helped me a lot). Frequencies, means, and standard deviations were used to identify the aspects of TBL considered as positive and those perceived as negative by students.

We summarize the answers to the questions by each student, defining a perception indicator consisting of an average score. To evaluate its internal consistency, we use Cronbach's alpha (Cronbach, 1970), which makes it possible to quantify the level of reliability of a measurement scale for an unobservable magnitude (students' perception of TBL) constructed from several observed variables (the answers to each question). Additionally, the assumption of normality of the resulting indicator needs to be checked, as the

validity of parametric tests depends on it. Normality tests were performed using visual tools and the Shapiro-Wilk test (Shapiro and Wilk, 1965). Due to the non-normality of rating and perception variables, the correlations were assessed using Spearman's non-parametric correlation coefficient. Non-parametric statistics were also used to evaluate perceptual demographic differences. Specifically, the Mann-Whitney test was used to determine whether the differences in the mean indicator observed for binary characteristics (for instance gender) had statistical significance. Likewise, we used the Kruskal-Wallis and Dunn's tests for characteristics with more than two categories (for example, mother's studies). A brief account of the modern topics in non-parametric inference can be found in Wasserman (2006). Sidak's method was used to adjust the p-value for multiple comparisons, as recommended by Midway et al. (2020).

Table 1. Questionnaire

1. Capacity for analysis
2. Capacity for synthesis
3. Ability to use mathematical instruments in an economic context
4. Ability to reason logically in the context of the economy
5. Ability to identify and raise problems
6. Ability to solve problems in abstraction
7. Learning ability
8. Critical ability
9. Ability to work autonomously
10. Ability to apply knowledge in practice
11. Teamwork
12. Time planning and prioritization of tasks
13. Concern for quality and work well done
14. Self-criticism and motivation for success
15. Oral expression
16. Reading comprehension
17. Acquire notions and practice in oral communication
18. Ability to adapt to new situations
19. Maturity to be aware of what it means to study at the university
20. Ability to generate new ideas
21. The new methodology used has helped to learn and will pass the course
22. You like the new methodology more than the traditional methodology with theoretical and practical classes
23. The new methodology helps to work the subject during the course more than the traditional methodology with theoretical-practical classes

RESULTS AND DISCUSSION

Positive and negative aspects of TBL according to students' perception

As a first step to studying the degree of satisfaction, motivation, and commitment to the learning process, we assess students' perception with respect to TBL methodology. This objective has been addressed by means of statistics describing the students' perception. To this end, the answers to the 23 questions of the questionnaire have been considered.

We have calculated the frequencies, means, and standard deviations for the answers to each question. Almost all answers obtained a mean score between 3.50 and 5.00 (on a 1 to 6 scale, 6 being the maximum positive mark). Question 11 about "TBL helped me to improve teamwork" obtained the maximum mean score (5.13) and question 17 about "TBL helped me to improve my oral communication" the minimum (3.33). We have summarized this information for questions 11 and 17 in Table 2.

Table 2. Maximum and minimum mean score of the questionnaire.

Question number	Mean	Std. deviation	Frequencies (%)					
			1	2	3	4	5	6
11	5.13	1.04	1.37	2.13	2.74	13.85	35.77	44.14
17	3.33	1.51	17.66	13.70	17.35	27.40	17.50	6.39

Regarding sociodemographic variables, Pearson's chi-squared tests were performed to detect possible associations between each variable and the Likert scores for every perception item, ranging from 1 (worst perception) to 6 (best). Question 11 regarding "Teamwork" shows significant differences by gender, with women being the group that shows higher scores (p-value=0.046). Differences between age groups are also significant, the youngest being the most satisfied (p-value=0.001). When considering whether the student combines work and studies, there are significant differences for both question 8 assessing "Critical capacity" (p-value=0.003) and question 22 "I like the new methodology more than the traditional methodology with theoretical and practical classes" (p-value=0.027). For both items, those students who work report higher ratings compared to their counterparts that only study. Considering the variable finished studies of the parents, with categories grouped in low, medium, and high education, there are significant differences in scores for question 18 "Ability to adapt to new situations" both for mother (p-value=0.025) and father (p-value=0.049), being the students with parents with less than higher education those who give more relevance to this skill. The students with less educated mothers also value significantly higher (p-value=0.005) item 19 "Maturity to be aware of what it means to study at university" (p-value=0.000). In the case of the father, we find significant differences for questions 15 "Oral expression" (p-value=0.030) and 16 "Reading comprehension" (p-value=0.019), with lower scores for students with highly educated fathers.

Defining an indicator to analyze students' perception of TBL.

Once we had identified the aspects of TBL with a higher degree of satisfaction, all the previous answers were considered to define a synthetic indicator to analyze students' perception of TBL.
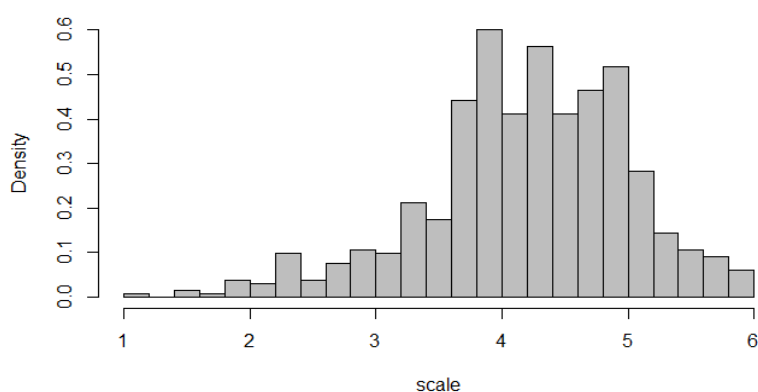
Figure 1. Histogram of perception indicator.

According to Cronbach's alpha indicator, the 23 perception questions of Likert type have a very high internal consistency (alpha = 0.923). This value supports the creation of an indicator by calculating the average for the 23 Likert questions. On average TBL was perceived as a positive methodology that helps students to improve their abilities. The average score of the 23 questions is 4.2, and the standard deviation is 0.8, showing a considerable degree of satisfaction by students.

On analyzing the normality of the synthetic indicator of students' perception of TBL, we can see that the distribution of the perception variable has a significant negative asymmetry, as shown in the histogram (see Figure 1). Additionally, the normality Shapiro-Wilk test was performed with a value of 0.978, resulting in the rejection of the null hypothesis of normality with a p-value of less than 0.001.

In summary, given the non-normality of the synthetic indicator, we will use non-parametric statistics to perform the following bivariate analyses.

Analyzing the synthetic indicator of students' perception of TBL according to sociodemographic variables

The aim of this section is to analyze to what extent the value of the synthetic indicator of students' perception of TBL is significantly different considering different sociodemographic characteristics. The sociodemographic variables considered in this analysis were gender, age, whether the student has a paid job, finished studies of the father, and finished studies of the mother.

Table 3. Statistics for perception by sociodemographic variables

	Sample size	Mean	Std. deviation	95% confidence interval	
Gender					
Women	217	4.28	0.05	4.17	4.38
Men	439	4.16	0.04	4.08	4.24
Age					
18	362	4.24	0.04	4.16	4.32
19	142	4.14	0.07	4.00	4.28
20+	153	4.16	0.07	4.01	4.30
Job					
>=15 hours/week	186	4.31	0.06	4.19	4.43
<15 hours/week	39	4.23	0.11	4.01	4.45
Not working	430	4.15	0.04	4.08	4.23
Studies of the father					
No studies	12	4.55	0.25	4.06	5.05
Primary school	63	4.26	0.11	4.05	4.47
Lower secondary	107	4.26	0.07	4.13	4.40
Upper secondary	175	4.25	0.05	4.14	4.35
Undergraduate	69	4.20	0.10	3.99	4.40
Master	163	4.07	0.07	3.93	4.21
Others	67	4.18	0.11	3.96	4.40
Studies of the mother					
No studies	15	4.59	0.23	4.14	5.03
Primary school	45	4.22	0.12	3.99	4.45
Lower secondary	132	4.26	0.07	4.13	4.39
Upper secondary	170	4.27	0.06	4.16	4.38
Undergraduate	93	4.07	0.11	3.86	4.28
Master	149	4.10	0.06	3.98	4.23
Others	52	4.20	0.12	3.96	4.44
Marks					
N	62	4.37	0.07	4.23	4.52
A	406	4.22	0.04	4.14	4.30
S	158	4.07	0.07	3.94	4.20
P	26	4.03	0.15	3.74	4.32

Regarding gender, the Mann-Whitney non-parametric test is used to determine whether there are significant differences between women and men in the perception of TBL. The mean and standard deviation by gender is presented in Table 3, along with a confidence interval, showing that there are marginal differences between women and men. Based on their means, women reported a higher level of satisfaction

than men (4.28 versus 4.16). The p-value of the test is 0.085. It is worth remarking that the total number of observations is 656 since the variable gender contains wrong information in one observation.

With respect to the variable age, we carry out a Kruskal-Wallis test, by considering three groups: 18 years, 19 years, and 20 or more years. We summarize the results in Table 3. Based on the test, no significant differences in perception were found among the groups (the p-value is 0.550).

To analyze whether the perception of TBL is different depending on whether the student has a paid job, three different categories have been defined: the first one contains students who work 15 or more hours per week, the second one is composed of students who work less than 15 hours per week and, finally, the third group consists of students without a paid job. Descriptive statistics are shown in Table 3, with a total of 655 observations due to two missing values of the variable.

The Kruskal-Wallis equality-of-populations rank test shows significant differences in perception depending on paid job (the p-value is 0.034). Since the results of this test are statistically significant, we carry out a Dunn's pairwise comparison test to determine exactly which groups are different. Dunn's test (Table 4) shows the differences between those who work 15 hours or more and those who do not work (4.31 versus 4.15 with a p-value of 0.005).

Table 4. Results of Dunn's test for students with a paid job

Mean (p-value)	>=15 hours/week	<15 hours/week
<15 hours/week	0.89 (0.188)	
Not working	2.60 (0.005)	0.43 (0.334)

Finally, we analyze the effect of the variables finished studies of the father and the mother. No differences in perception were found according to studies of the father (the p-value is 0.326). However, in the case of the variable finished studies of the mother, the Kruskal-Wallis results suggest that statistically significant differences could be found between some categories (the p-value is 0.087). Descriptive statistics are also shown in Table 3, with a total of 656 observations due to a missing value of the variable.

For the variable finished studies of the mother, we report pair comparisons of categories using Sidak's method. We report the p-values of the test in Table 5. They show that students with mothers without studies score higher in perception compared to students of mothers with a diploma (4.59 versus 4.07 with a p-value of 0.048) and students with mothers with a degree or higher (4.59 versus 4.10 with a p-value of 0.047).

Table 5. p-values of Sidak's method for the finished studies of the mother

	No studies	Primary school	Lower secondary	Upper secondary	Under-Graduate	Master
Level of studies						
Primary school	0.095					
Lower secondary	0.076	0.519				
Upper secondary	0.090	0.544	0.497			
Undergraduate	0.048	0.352	0.241	0.266		
Master	0.047	0.259	0.124	0.111	0.453	
Others	0.080	0.421	0.386	0.401	0.432	0.425

Analyzing the correlation between individual final grades and the synthetic indicator of students' perception of TBL

Spearman's non-parametric correlation test is used to establish whether there is a statistically significant relationship between students' final grades and their perception of TBL. The result shows a statistically

significant relationship, although the correlation is very weak (Spearman's correlation is 0.097 and the p-value is 0.014). Since the distribution of the final grade shows a high concentration of marks at 5 and a gap just below 5 (due to rounding at 5), we will use the ordinal rating and compare the perception between the different groups of marks. The ordinal scores are not presented (P), fail (S), pass (A), and notable (N). Descriptive statistics are summarized in Table 2 (with 652 observations).

Dunn's test shows that, when we look at the differences between pairs of categories, we can see that there are the following significant differences:

(1) Those with notable (N) report higher perceptions than those not presented (P) (the p-value is 0.038) or those who failed (S) (the p-value is 0.010).

(2) Those who passed the exam (A) also have a higher perception than those who failed (S) (with a p-value of 0.023).

Analyzing the correlation between individual final grades and the synthetic indicator of students' perception of TBL according to sociodemographic variables

The next step is to analyze whether there is a statistically significant relationship between students' final grades and their perception of TBL considering the differences in sociodemographic characteristics. We consider the same sociodemographic variables as in the previous analysis, that is gender, age, whether the student has a paid job, finished studies of the father, and finished studies of the mother.

Regarding gender, it is interesting to note that among women there is a statistically significant positive correlation between perception and final grade (Spearman's correlation is 0.183 and the p-value is 0.007), whereas among men this correlation does not exist (Spearman's correlation is 0.051 and the p-value is 0.286).

As for age, for younger groups no statistically significant correlation was found between perception and final grade, either for 18-year-old students (with Spearman's correlation equal to 0.051 and p-value of 0.332) or for students aged 19 (with Spearman's correlation of 0.069 and p-value 0.414). In contrast, we found a significant correlation for students in the 20 and older age group (Spearman's correlation is 0.256, and the p-value is 0.002). If we consider the fact of having a paid job, the only group that has a significant, although negligible, correlation is the non-working group, whereas in groups corresponding to a paid job of more than 15 hours/week or less than 15 hours/week, there is no significant correlation. Finally, if we consider the finished studies of the father and the mother, there is a significant correlation only for students with mothers with secondary or lower education (Spearman's correlation is 0.178 and the p-value is 0.014).

In summary, the sociodemographic variables of gender, age, paid job, and mother's education are potential moderators of the relationship between perception of TBL and final qualification.

The variations in students' perceptions of TBL's impact on teamwork abilities across age groups suggest that different cohorts may respond differently to this pedagogical approach. Older students, aged 20 and above, exhibited more positive perceptions of TBL's effectiveness in developing teamwork abilities, while younger students (18-year-olds and 19-year-olds) showed mixed perceptions. This discrepancy could be attributed to the varying levels of maturity, prior exposure to collaborative learning experiences, and readiness to engage in team-based activities among different age groups. Tailoring TBL activities to suit the preferences and learning styles of each age group may promote more consistent and positive perceptions of its impact on teamwork abilities (Dyrbye et al., 2007).

The influence of employment status on students' perceptions of TBL's impact on teamwork abilities is noteworthy. Students without paid jobs tended to perceive TBL more favorably, whereas those with paid jobs showed a less pronounced positive perception. Fatmi et al. (2013) suggest that employed students may face additional time constraints and responsibilities, which could affect their ability to fully engage with TBL activities and benefit from collaborative learning experiences. To address this, educators can consider

flexible scheduling and accommodations for employed students to maximize their involvement in TBL-based teamwork activities.

The presence of gender-related differences in students' perceptions of TBL's efficacy in enhancing teamwork abilities has implications for promoting equitable learning experiences. Parmelee et al. (2012) found that male students tended to express higher satisfaction with TBL's team-based activities compared to female students. Stephenson & Sadler-Mcknight (2016) highlighted that these differences might be linked to gender-specific learning preferences and communication styles. To mitigate gender-related disparities, educators should adopt gender-sensitive approaches, foster an inclusive learning environment, and provide opportunities for students of all genders to actively participate in team-based activities.

Students' perceptions of TBL's impact on teamwork abilities were found to vary depending on the educational attainment of their parents. Students with parents who had lower educational attainment tended to perceive TBL more positively in terms of teamwork skill development (Bikanga Ada & Foster, 2023; Craig et al, 2020). These findings underscore the importance of considering the sociocultural context in which students are raised, as it may influence their attitudes toward collaborative learning experiences. By understanding the educational backgrounds of their students' parents, educators can design targeted interventions that resonate with the diverse sociodemographic backgrounds of their learners.

The findings of this study highlight the significance of analyzing students' perceptions of active learning methodologies, such as TBL, to identify which subgroups benefit most from their introduction. By recognizing and addressing the diverse needs and preferences of different sociodemographic groups, educators can tailor the implementation of TBL to optimize its impact on teamwork abilities and learning outcomes for all students. This approach aligns with the work of Michaelsen & Sweet (2008), who emphasized the importance of customizing TBL to fit the specific needs and contexts of learners.

CONCLUSION

University education has started a major transformation in recent decades, an important feature of which has been to give students a more leading role in their learning. With this objective in mind, active learning methodologies, including TBL, have emerged as an alternative to traditional lectures. There is considerable evidence of the effectiveness of these strategies in the improvement of student learning and academic performance. However, students' perception of these active learning strategies has often been overlooked.

We analyzed students' perception of TBL methodology using parametric and non-parametric statistical methods. We considered different sociodemographic variables —gender, age, whether the student has a paid job, finished studies of the father, and finished studies of the mother— and studied whether there is any association between them and the degree of satisfaction with TBL.

The main results show that TBL is perceived as a positive methodology by all students, particularly to improve teamwork skills. Female students report higher satisfaction than male students. Women tend to be more patient and perseverant, qualities necessary to excel in time- and individual and team effort-demanding methodologies as the TBL. Students working more than 15 hours per week reported higher satisfaction with the methodology than those who did not work. No significant differences in perceptions were found across age groups and by parents' education.

When digging into specific abilities, significant differences between age groups were found, in the perception of teamwork skills, the youngest being the most satisfied.

Regarding the students' study-work situation, significant differences were found in their perceptions of whether TBL gives them a critical capacity and whether the methodology has helped them to learn and pass the course. The students with paid jobs reported higher satisfaction. This may be explained by the fact that

the students who combine their job and studies have better time management skills and take advantage of the positive aspects of the TBL methodology.

Traditionally, in the literature, the education of the parents has been shown to have a clear positive impact on students' academic results and attitudes towards learning. However, our results suggest that the lower the mother's education, the higher the degree of satisfaction students show with the TBL methodology and their perception that it benefits their learning process. Possibly, this type of student has less access to extra help outside the classroom or at home and, therefore, values more the active learning strategy.

Analyzing students' perceptions of active learning methodologies in higher education can help to determine who benefits most from the introduction of these strategies and tailor them accordingly. From our analysis, we can infer that females and youngest students, those that combine work and studies, and those with less educated mothers are the ones that show the highest satisfaction with the TBL methodology. Therefore, it seems that this teaching strategy is better valued by students belonging to more disadvantaged groups. Thus, the use of active learning methods can contribute to reduce the possible gaps in terms of motivation, study effort and academic performance among students with different characteristics and backgrounds.

Finally, given that satisfaction positively affects academic performance, and the present study does not consider the reasons why a certain type of student seems to show less satisfaction with the TBL methodology, this is certainly a needed future line of research.

ACKNOWLEDGMENTS

REFERENCES

Abío, G., Alcañiz, M., Gómez-Puig, M., Rubert, G., Serrano, M., Stoyanova, A., & Vilalta-Bufí, M. (2019). Retaking a course in economics: Innovative teaching strategies to improve academic performance in groups of low-performing students. *Innovations in Education and Teaching International*, 56, 2, 206–216.

Baepler, P. (2014). It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. *Computers and Education*, 78, 227-236.

Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day*. Washington, D.C.: International Society for Technology in Education.

Berrett, D. (2012). *How 'flipping' the classroom can improve the traditional lecture*. The Chronicle of Higher Education. http://chronicle.com/article/How-Flipping-the- Classroom/130857/

Bikanga Ada, M., & Foster, M. E. (2023). Enhancing postgraduate students' technical skills: perceptions of modified team-based learning in a six-week multi-subject Bootcamp-style CS course. *Computer Science Education*, *33*(2), 186-210.

Carr, T., Cox, G., Eden, A., & Hanslo, M. (2004). From peripheral to full participation in a blended trade bargaining simulation. British Journal of Educational Technology, 35(2), 197–211. https://doi.org/10.1111/j.0007-1013.2004.00381.x.

Chung, K. (2014). *Professors 'flip' classrooms, enhance learning*. Daily Tar Heel. http://www.dailytarheel.com/article/2014/01/flipped-classrooms-0108.

Conde-Ruiz, J.I. & Ganuza, J.J. & García, M. (2020). Gender gap and multiple choice exams in public selection processes. *Hacienda Pública Española / Review of Public Economics*, 235(4), 11-28.

Craig, J. M., Nodeland, B., Long, R., & Spivey, E. (2020). Student Perceptions of Team-Based Learning in the Criminal Justice Classroom. *Journal of Criminal Justice Education*, *31*(3), 372-389.

Cronbach, L.J. (1970). *Essentials of psychological testing* (3rd ed.). New York: Harper & Row.

Crouch, C., & Mazur, E. (2001). Peer Instruction: Ten Years of Experience and Results, *American Journal of Physics*, 69, 970-977.

Curşeu, P.L., Chappin, M.M.H. & Jansen, R.J.G. Gender diversity and motivation in collaborative learning groups: the mediating role of group discussion quality. Soc Psychol Educ 21, 289–302 (2018). https://doi.org/10.1007/s11218-017-9419-5

Deslauriers, L., Schelew, E., & Wieman, C. (2011). Improved Learning in a Large-Enrollment Physics Class. *Science*, 332, 862-864.

Dyrbye, L. N., Thomas, M. R., Eacker, A., Harper, W., Massie, F. S., Power, D. V., ... & Shanafelt, T. D. (2007). Race, ethnicity, and medical student well-being in the United States. *Archives of internal medicine*, *167*(19), 2103-2109.

Espey, M. (2018). Diversity, Effort, and Cooperation in Team-Based Learning. *Journal of Economic Education*, 49, 1, 8-21.

Fatmi, M., Hartling, L., Hillier, T., Campbell, S., & Oswald, A. E. (2013). The effectiveness of team-based learning on learning outcomes in health professions education: BEME Guide No. 30. *Medical teacher*, *35*(12), e1608-e1624.

Frame, T.R., Cailor, S.M., Gryka, R.J., Chen, A.M., Kiersma, M.E., & Sheppard, L. (2015). Student perceptions of team-based learning vs traditional lecture-based learning. *American Journal of Pharmaceutical Education*, 79(4), 51.

Hong, T., & Pham, T. (2013). Using group projects as a strategy to increase cooperation among low- and high-achieving students. *Higher Education Research and Development*, 32, 993-1006.

Jackson, M.W., & Prosser, M.T. (1989). Less lecturing, more learning. *Studies in Higher Education*, 14, 55-68.

Johnson, D.W., Johnson, R.T., & Smith, K. (2007). The State of Cooperative Learning in Postsecondary and Professional Settings. *Educational Psychology Review*, 19, 1, 15–29.

King, A. (1993). From sage on the stage to guide on the side. *College Teaching*, 41, 30-35.

Knight, J. K., & Wood, W. B. (2005). Teaching More by Lecturing Less. *Cell Biology Education*, 4, 298-310.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality & Social Psychology*, 77, 1121–1134.

Lage, M.J., Platt, G.J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, 31, 30-43.

Masters, K. (2012). *Student response to team-based learning and mixed gender games in an undergraduate medical informatics course*. Sultan Qaboos University Medical Journal, 12, 3, 344-351.

Mazur, E. (1997). *Peer Instruction: A User's Manual Series in Educational Innovation*. Prentice Hall, Upper Saddle River, NJ.

McLaughlin, J.C. (2013). Pharmacy student engagement, performance, and perception in a flipped satellite classroom. *American Journal of Pharmaceutical Education*, 77, 1-8.

Michaelsen, L.K., & Sweet, M. (2011). Team-based learning. *New Directions for Teaching and Learning*, 128, 41-51. doi:10.1002/t1.467.

Michaelsen, L.K., Knight, A.B., & Fink, L.D. (2004). *Team-Based Learning: A Transformative Use of Small Groups in College Teaching*. Sterling, Va.: Stylus.

Michaelsen, L.K., Parmelee, D.X., McMahon, K.K., & Levine, R.E. (eds.) (2008). *Team-Based Learning for Health Professions Education: A Guide to Using Small Groups for Improving Learning*. Sterling, Va.: Stylus.

Michaelsen, L. K., & Sweet, M. (2008). The essential elements of team-based learning. *New directions for teaching and learning*, *2008*(116), 7-27.

Midway, S., Robertson, M., Flinn, S., & Kaller, M. (2020). Comparing multiple comparisons: practical guidance for choosing the best multiple comparisons test. *PeerJ*, 8:e10387. doi: 10.7717/peerj.10387.

Millis, B.J., & Cottell, P.B. (1998). *Cooperative Learning for Higher Education Faculty*. Phoenix, Arizona: Oryx Press.

Missildine, K., Fountain, R., Summers, L., & Gosselin, K. (2013). Flipping the classroom to improve student performance and satisfaction. *Journal of Nursing Education,* 52, 597- 599.

Nordberg, D. (2008). Group projects: More learning? Less fair? A conundrum in assessing postgraduate business education. *Assessment & Evaluation in Higher Education*, 33, 481– 492.

Opdecam, E., Everaert, P., & Van Keer, H. (2014). Preferences for Team Learning and Lecture-Based Learning among First-Year Undergraduate Accounting Students. *Research in Higher Education*, 55, 400-432.

Park, E.L., & Choi, B.K. (2014). Transformation of classroom spaces: traditional versus active learning classroom in colleges. *Higher Education*, 68, 749-771.

Pennebaker, J.W., Gosling, S.D., Ferrell, J.D. (2013). Daily Online Testing in Large Classes: Boosting College Performance while Reducing Achievement Gaps. *PloS ONE* 8, 11, e79774.

Prieto, A., Díaz, D., Montserrat, J., Reyes, E. (2014). *Experiencias de aplicación de estrategias de gamificación a entornos de aprendizaje universitario*. ReVisión, 7.

Queiruga-Dios, M.A.; Sáiz-Manzanares, M.C., & Montero-García, E. (2019). Problemas-Proyectos Adaptativos y Creativos en la enseñanza de las ciencias. Descripción de la metodología y apreciación de los estudiantes involucrados. *Research in Education and Learning Innovation Archives*, 23,1-23. 10.7203/realia.23.15567

Remington, T.L., Bleske, B.E., Bartholomew, T., Dorsch, M.P., Guthrie, S.K., Klein, K.C., Tingen, J.M., & Wells, T.D. (2017). Qualitative Analysis of Student Perceptions Comparing Team-based Learning and Traditional Lecture in a Pharmacotherapeutics Course. *American Journal of Pharmaceutical Education*, 81, 3, 55.

Roediger, H.L. III, Putnam, A.L., & Smith, M.A. (2011). *Ten benefits of testing and their applications to educational practice*. Edited by: Mestre, J.P., Ross, B.H. Psychology of Learning and Motivation: Cognition in Education Book Series: Psychology of Learning and Motivation, 55, 1-36.

Shah, S.Z.A. (2013). The use of group activities in developing personal transferable skills. *Innovations in Education and Teaching International*, 50, 297-307.

Shapiro, S.S., & Wilk, M.B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, 52 (3-4), 591-611.

Stephenson, N. S., & Sadler-Mcknight, N. P. (2016). Developing Critical Thinking Skills Using the Science Writing Heuristic in the Chemistry Laboratory. *Chemistry Education Research and Practice*, 17(1), 72–79. https://doi.org/10.1039/c5rp00102a

Strayer, J. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments*, 15, 171-193.

Wasserman, L. (2006). *All of nonparametric statistics*. Springer Texts in Statistics, New York: Springer.

Wilson, S.G. (2013). The flipped classroom: A method to address the challenges of an undergraduate statistics course. *Teaching of Psychology*, 40, 193-199.

Yamarik, S. (2007). Does cooperative learning improve student learning outcomes? *Journal of Economic Education*, 38, 259-277.