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Analyzing the Influence of Belbin's Roles on the Quality of Collaborative Learning for the Study of Business Fundamentals

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Abstract: This work uses Belbin's balanced group theory to analyze whether the formation of teams improved the performance of 21 groups formed by the 149 students of an Introduction to Business class in a collaborative learning environment in Higher Education. The analysis is based on a comparison of two types of groups: balanced groups (according to Belbin's role theory) and those that are not so balanced. The analysis techniques used to determine any significant differences in student grade scores were the student average comparison and the Chi homogeneity tests. The relevance of the different roles that students can acquire when forming work groups was derived from multiple regression in the exams and practices punctuations, and the relevance of each student role was determined by discriminant analysis. The results indicate that balanced groups facilitate greater homogeneity in group grades, improving the performance of the group overall.

Keywords: Belbin roles; team building; performance; collaborative learning; higher education

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1. Introduction

A university is subject to changes in its educational model in order to face the challenges that society demands. The acquisition of skills by students is considered the basis of the current educational model to improve knowledge, performance, and adaptation to the labor market.

A labor market demands professionals with a great capacity for teamwork. The "teamwork" competency is one of the most mentioned in teaching guides for different degrees, because according to Alberola et al. [1], it facilitates more effective learning and guarantees student adaptation to work environments more oriented to teamwork than to the individual.

To implement this competency, it is necessary to work with active methods that allow students to integrate into groups to achieve common objectives [2] such as collaborative work. In this endeavor, not only is work done so that the group achieves optimal results, but it generates knowledge and a strong relationship between members, so its objective concerns all of them. According to Johnson et al. [3], in the field of education, this is understood as the didactic use of small groups, in which students work together to maximize their own learning and that of others.

It is important to analyze the characteristics of students for the formation of teams, because the placement of students in a group does not guarantee their development [4]. There are many studies of the performance or quality of teamwork with team composition [5–9]. Also, in the field of collaborative learning, they investigate to detect conflicts that may affect team performance [10,11]. Still, Rajabzadeh et al. [12] conclude the most common drawback when collaborating with peers in scholarly environments was the conflict between group members due to different personalities, ideas, or work methods.

One of the approaches to design that composition is the definition of different roles that people can assume within the team, the so-called team roles, with the model proposed by Belbin [13] being the most widely used [5,14,15].

Given the above, the main objective of the present work was to analyze whether student performance improves with team building in a collaborative learning environment, based on the balance of roles defined by Belbin.

The implication of our work in the literature is important for three reasons: First, it helps determine whether there is a relationship between student performance and team formation according to Belbin's balance of roles; second, whereas in most of the analyzed studies [1,16–18], the definition of the students' roles and their grouping is done prior to activities, in our experience, this study is done later, facilitating at the time of self-evaluation of various student roles a deep knowledge of the person evaluated [1]; third, it is one of the few studies in the field of business economics.

The work is structured as follows. In Section 2, we review what is understood as collaborative work, the design of work teams, and a hypothesis statement. In Section 3, we address the experience and various methodologies used and the rationale for them. In Section 4, we provide the results, and in Section 5, we present a discussion of the study and the main conclusions.

2. Literature Review

2.1. Collaborative Work

The currently established university educational model seeks to improve knowledge and academic results through the attainment of competencies by the student. This is compared to competencies obtained in a model based on teaching, in which students have shown a strong apathy during their training, continuous lack of attention, and little interest in learning the knowledge that was imparted [19]. One of the transversal competencies that repeatedly appears in various teaching guides is that of "teamwork" [20]. Teamwork implies the mobilization of one's own and external resources of certain knowledge, skills, and aptitudes. These allow an individual to adapt to and achieve a task, together with others, in a situation and a given context [21]. According to Alberola et al. [1], the importance of this competency is because it allows more effective learning and guarantees that students adapt to work environments that are more oriented to teamwork than individual work.

A team is "a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable" [22]. In a generic sense, we can define teamwork as the ability to join work groups to achieve common goals [2]. This produces a systematic division of labor but results in only partial knowledge of the subject because each person works in a specific area of knowledge and appears to be defined formally as a figure of authority that leads and coordinates his or her work. However, in collaborative work, the figure of the leader emerges spontaneously, and the objective is not so much to achieve optimal results as to generate knowledge. This is because the work is based on a strong relationship of interdependence between members, so its objective concerns everyone. There is a clear individual responsibility of each member of the group toward the achievement of the final objective. The formation of its members is heterogeneous in characteristics and abilities. The attainment of objectives is pursued through the (individual and joint) accomplishment of tasks. There is a positive interdependence between subjects. In addition, collaborative work requires from the participants communication skills, symmetric and reciprocal relationships, and a desire to share the resolution of tasks [23–25].

Thus, collaborative work is a key concept that can be understood as a process in which an individual learns more than they would on their own. This stems from the interaction of team members who know how to differentiate and contrast their points of view in such a way that they generate a process of knowledge construction [26]. Collaborative work in education is understood as the didactic use of small groups in which students work together to maximize their learning and that of others [3], in which each group member is responsible for both their learning and that of other members. It assumes a teaching method in which the teacher actively involves his or her students in the learning process.

The advantages of collaborative work for learning also have an impact on the improvement of transversal teamwork competencies [27,28]. This learning strategy aims to provide students within small groups with tools to increase their cognitive and behavioral profiles [29]. And in some cases, this methodology is also used to detect conflicts that may affect the performance of teams [11].

It seems clear that to achieve teamwork competency, it is necessary to work on it. However, not all students are the same. It is important to analyze student characteristics to build more productive work teams. The theory of team roles makes it possible to obtain favorable results from work teams by considering individual skills. The heterogeneous composition of such teams has been analyzed by numerous authors who assert that diversity has a strong relationship with team effectiveness in creative and intellectual tasks, suggesting that high-performance teams have a complementary personality type [13,30–32].

One thing is the amount of time dedicated to teamwork, but quite another is the quality of this teamwork. Therefore, at the second level of analysis, we must also look at that quality [33]. For work teams to be efficient, we must consider their formation.

2.2. Design of Collaborative Teams

The formation of working groups is key to improving their performance because the placement of students in a group does not guarantee the development of teamwork [4]. Many studies have analyzed team performance with their formation [5–9,33–35].

One of the approaches to designing the composition of teams focuses on defining the different roles that people can assume within the team, which are called team roles. Several authors have developed typologies for such roles [13,30–32,36,37]. The role model proposed by Mumma [31] is based on the development of a guide for facilitators, according to which eight behavioral roles that may arise in work teams are identified, whereas the McCann-Margerison [30] model is a psychometric tool composed of 60 questions intended to organize efficient teams based on the personalities of its members. The authors proposed eight different roles that serve as a basis for their combining them and thereby integrating and coordinating work within the team.

Among the above studies, the design of group role preferences described by Belbin and his team has become the most popular, as it has been used in many private and public organizations and has been translated into 16 languages [13–15,38,39].

The team role specified by Belbin is based on the work of Bales [36] and is defined as a pattern of behavior characteristic of the way in which a team member interacts with another to facilitate the progress of the team as a whole [5,13]. It is not related to operational knowledge of the job, which is called technical skills or functional role, but rather to personality and behavioral factors [5,13].

As seen in Table 1, the Belbin model [13,40] defined nine roles grouped into three major categories: mental, social, and action.

Each role must be performed by one person, although an individual can have more than one role, marked according to Belbin [38] by the level of preference that each person has in performing that function. These levels are divided into low, average, high, and very high. When the preference level is high or very high, a person can play the role naturally. Balanced groups or the so-called "balance of roles", that is, those containing the greatest number of natural roles, have the best performance [5,7,38,40]. Aritzeta and Ayestarán [38] indicated that a larger number of roles guarantees greater knowledge and skills that are complementary to executing a task. This facilitates greater homogeneity in the group and better performance. On the contrary, if there are roles in a team that are not understood as natural or if several of its members duplicate roles, it is understood that this team is unbalanced [13,40].

Table 1. Team roles.

Team Role	Positive Qualities	Allowable Weaknesses
Team worker	An ability to respond to people and to situations, and to promote team spirit	Indecisiveness at moments of crisis
Implementer	Organizing ability, practical common sense, hard-working, self-discipline	Lack of flexibility, unresponsiveness to unproven ideas
Resource investigator	A capacity for contacting people and exploring anything new, an ability to respond to challenge	Liable to lose interest once the initial fascination has passed
Monitor–Evaluator	Judgment, discretion, hard-headedness	Lacks inspiration or the ability to motivate others
Shaper	Drive and a readiness to challenge inertia, ineffectiveness, compliance, or self-deception	Proneness to provocation, irritation, and impatience
Coordinator	A capacity for treating and welcoming all potential contributors on their merits and without prejudice	No more than ordinary in terms of intellect or creative ability
Complementer-Finisher	A capacity for follow-through; perfectionism	A tendency to worry about small things; a reluctance to "let go"
Plant	Genius, imagination, intellect, knowledge	Up in the clouds, inclined to disregard practical details or protocol
Specialist	Single-minded, self-starting, dedicated	Contributes on a narrow front only

Source: Adapted from Belbin (1981).

In an educational context, many authors have analyzed the relationship between team formation based on the model proposed by Belbin and its impact on the level of learning and performance [1,7,14,18,25,41,42]. There is no consensus on the results. Some authors established a positive relationship between the balance of roles and performance [1,7,38,41]. Others did not find a conclusive relationship [14,43,44].

Aritzeta and Ayestarán [38] analyzed the effectiveness of 40 teams by relating the academic grade attained at both group and individual levels of each member to their participation (or not) in balanced or unbalanced teams. They concluded that the scores obtained by the balanced groups were higher than those that were not. However, Meslec and Curseu [14] stated that the relationship between the quality of teamwork and team composition can be observed in the preliminary stages when it is evident that balanced groups have better performance. However, this could not be confirmed in later stages. Blekinsop and Maddison [43] completely denied the existence of such a relationship, asserting that a model based on team learning itself predicts team success.

2.3. Hypothesis

In the present work, once the value of team design using the team roles defined by Belbin was analyzed and its importance to performance in the educational context was substantiated [1,14,18,25,38,41,42], the following hypothesis was checked:

H0: Student performance is not affected by its balanced configuration.

Because there is no clear consensus, we aimed to provide arguments for or against the relationship between student performance and team formation according to Belbin's balance of roles. The main contributions of the work are based on the following: In the field of study, it is one of the few works that implements the methodology in a business course and, at the time of role definition, the various student roles are identified once the activities to be performed during the course are completed. In this way, as Alberola et al. [1] commented, a deep knowledge of the individual being evaluated is achieved.

3. Definition of Experiment and Methodology

3.1. Definition of Experiment

The sample consisted of 149 students enrolled in the course Introduction to Business II within the Business Administration degree of King Juan Carlos University, groups A and B. At the beginning of the course, the students were encouraged to carry out a collaborative project during the course, consisting of the development of digital academic posters with subject matter content. To do this, they were asked to form teams of 4–6 members with selected classmates, resulting in 21 groups. Therefore, participants self-identify with their partners instead of random assignment. This leads to a quasi-experimental design, that may be improved in other experiments using different experimental designs.

The work was developed throughout the first semester and had to be supervised by the teacher.

Once the (collaborative) teamwork was finished, each team member had to assess themselves and their colleagues, using for this assessment an adaptation of the version of the self-assessment instrument developed by Belbin [13]. According to Alberola et al. [1] for the evaluation of group members, a deep knowledge of the person evaluated is necessary. This knowledge was obtained in the course of our work. This is because the group was formed voluntarily, with grouping in most cases by affinity and because the students had already worked together for a few months.

The adaptation of the version of the instrument was divided into seven sections, where it was valued among the statements indicated that best represented it. For this, each section was divided into 10 points, which could be distributed equally or assigned to a single statement. The scores for each section were calculated using the following steps:

1. First, the mean scores of the self-assessment and that of the rest of the group members were calculated.
2. Second, all average scores for the section were added and divided by 70 points.
3. Third, the total valuation was transformed into percentages.

Table 2 shows the role assignment of one of the groups.

Table 2. Role assignment.

Member	Implementer	Coordinator	Shaper	Plant	Finisher	Monitor-Evaluator	Team Worker	Resource Investigator
1	14.00	10.00	7.00	12.00	11.00	2.00	7.00	7.00
2	11.90	9.10	9.80	7.70	4.20	7.00	13.30	7.00
3	14.00	10.00	13.00	2.00	2.00	14.00	5.00	10.00
4	8.00	10.00	10.00	8.00	7.00	8.00	9.00	10.00
5	7.00	8.00	5.00	11.00	9.00	6.00	18.00	6.00

Source: authors.

As seen in Table 2, at the time of role identification, the role of Specialist was not used because we believe that in educational environments, there is no student that can assume that profile. In addition, we used the scale of the original version of the self-assessment instrument followed by Belbin [13], in which the definition of team roles is valued in an interval from 0 to 100. Here, values from 0 to 30 are considered “rejected roles,” between 31 and 70 team roles that can be assumed, and between 71 and 100 “natural roles”. We converted these ranges into a scale from 0 to 10, using the same criteria for their identification: 0–3 rejected roles; 4–7 assumed roles; 8–10 natural roles.

Having identified the role of each student, we were able to verify how 14 groups were considered balanced because they naturally contained different roles within the group. The remaining groups were considered unbalanced because the roles within them were repeated. To conduct the analysis, we called the balanced groups the control group and the remainder formed part of the experimental group. The students who were part of the control group numbered 69, and those in the experimental group numbered 80.

Once the teams were identified, student performance was measured through the following tests: the work carried out by the team (collaborative learning methodology), whose grade was common to all team members; a final exam measured in two parts, theoretical and practical, whose contents had been treated in the work developed by the students during the semester.

3.2. Methodology

The following hypothesis tests were used to validate the hypotheses of the models used for the various proposed analyses in order to determine any significant differences in student qualification scores according to the different methods used:

- Student's *t*-test mean comparison to determine whether there are significant differences between the averages of the two groups
- Chi-square homogeneity test to determine if two distributions come from the same population
- Kolmogorov test to determine whether a random variable is distributed according to a known random variable. In our case, the comparison variable was the normal distribution.
- Levene's test to determine if the variance of k random variables is homogeneous
- Bartlett's sphericity test to determine the existence or absence of collinearity in the random variables under study

To study the relevance of the different roles that students can acquire when forming work groups, we performed multiple regression. This type of analysis allows the explanation or prediction of the values of a variable (which we call dependent or explained) through one or more variables (independent or explanatory). This is very useful when the dependent variable is difficult to measure directly but it is easy to measure other variables related to it. A linear equation is sought that permits relation of the explanatory variables with the dependent variable. Equation (1) shows the multiple regression model in the case of k explanatory variables $x_1, \ldots, x_k$, where y is the dependent variable and error term associated with the model.

$$y = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + \varepsilon \quad (1)$$

The parameters $\{\beta_0, \beta_1, \ldots, \beta_k\}$ are optimized so that the error between the observed variables and those estimated by the model are as small as possible. The term represents the intercept of the regression line with the abscissa.

To determine the relevance of each student role in the two groups, we propose a discriminant analysis. Within the predictive models (to predict future values of dependent variables), segmentation and classification techniques extract behavioral profiles or classes, with the objective of building a model that permits the classification of any new data. If we have two or more groups of individuals or cases, we know all the values they take in the different variables, and we can meet the following objectives using a discriminant analysis:

- We want to explain belonging to one or another group based on the variables, quantifying the relative importance of each
- Predicting to which group an individual belongs that is not part of the analyzed data and of which we know the value it takes in the variables, but we do not know to which group it belongs

One of the variables must be discrete to define the groups, acting as an endogenous or dependent variable. Discriminant analysis is an ad hoc classification and segmentation technique. Because this analysis has as its fundamental objective the creation of a rule or classification scheme that allows a researcher to predict the population to which it most likely belongs, the result will be a function of the explanatory variables that allows determination of the group to which it belongs for each observation. The discriminant analysis yields factors or synthetic variables called linear discriminant functions, which facilitate differentiation of the groups as linear combinations of the predictor variables with certain weights (indicators of the variables that discriminate best).

4. Analysis of Results

To determine if the academic results of the scores in the final student grades were affected by the balanced or random group configurations according to the student's role, the results of the partial tests, the exam, and final score were compared through the comparison of Student's *t*-test means.

The contrast of means of independent samples of Student's *t*-test shows significant differences (p-value = 0.04) between the two groups. The average final exam score was higher for the group with balanced roles ($\mu_{\text{balanced roles}}$ = 5.54 and standard deviation 1.99) than for the unbalanced group ($\mu_{\text{unbalanced roles}}$ = 4.68 and standard deviation 2.89).

Furthermore, the percentage of students classified as failed (final grade < 5), passing (final grade 5–7), notable (final grade 7–9), and outstanding (final grade $\geq$ 9) differed between the two groups (Table 3). The chi-square homogeneity test shows significant differences (p-value = 0.019), with the percentage of students with passing and notable qualifications higher in the group with a balanced role, and the percentage with outstanding and failed qualifications higher in the group with an unbalanced role.

Table 3. Frequency and percentage of final grades by categories according to group.

Qualification	Balanced Group % (Frequency/Total)	Unbalanced Group % (Frequency/Total)
Failed	30.4% (21/69)	47.5% (38/80)
Passing	47.8% (33/69)	28.7% (23/80)
Notable	21.7% (15/69)	18.8% (15/80)
Outstanding	0% (0/69)	5% (4/80)

Source: authors.

Regarding the work grade (20%), the contrast of means of independent samples of Student's *t*-test shows no significant differences (p-value = 0.907) between the two groups, with the average final exam score for the group with balanced roles being $\mu_{\text{practice20\%\_balanced group}}$ = 1.265 and standard deviation 0.56, and the unbalanced group being $\mu_{\text{practice20\%\_unbalanced group}}$ = 1.188 and standard deviation 0.44. Groups 21, 22, and 23 were omitted because they had different weighting of the final qualifications.

It is worth highlighting the differences in variability of the grades of the balance practice between the two student groups. Figure 1 shows a strong dispersion of scores of the group with unbalanced student roles relative to the balanced-role group, even though the contrast of Levene assumes an equality of variances (p-value = 0.412) in the scores of the two group practices. This is because of the small range of variation of possible scores in the assessment of this practice.

Regarding the exam grade (work grade 30% + work grade 50%), the contrast of means of independent samples of Student's t shows significant differences (p-value = 0.002) between the two groups, with the average final test score for the balanced-role group greater ($\mu_{\text{exam\_balanced group}}$ = 4.27 and standard deviation 1.94) than that of the unbalanced group ($\mu_{\text{Exam\_unbalanced\_Group}}$ = 3.14 and standard deviation 2.36). Groups 21, 22, and 23 were omitted because they had a different weighting of the final grades.

It is worth emphasizing again the differences in variability of the grades between the two student group practices. Figure 2 shows the strong dispersion of scores of the group with an unbalanced role with respect to the group with a balanced role. The Levene test rejects the hypothesis of equality of variances (p-value = 0.001) in the scores of both groups because the range of possible scores in the qualification of this test is larger.

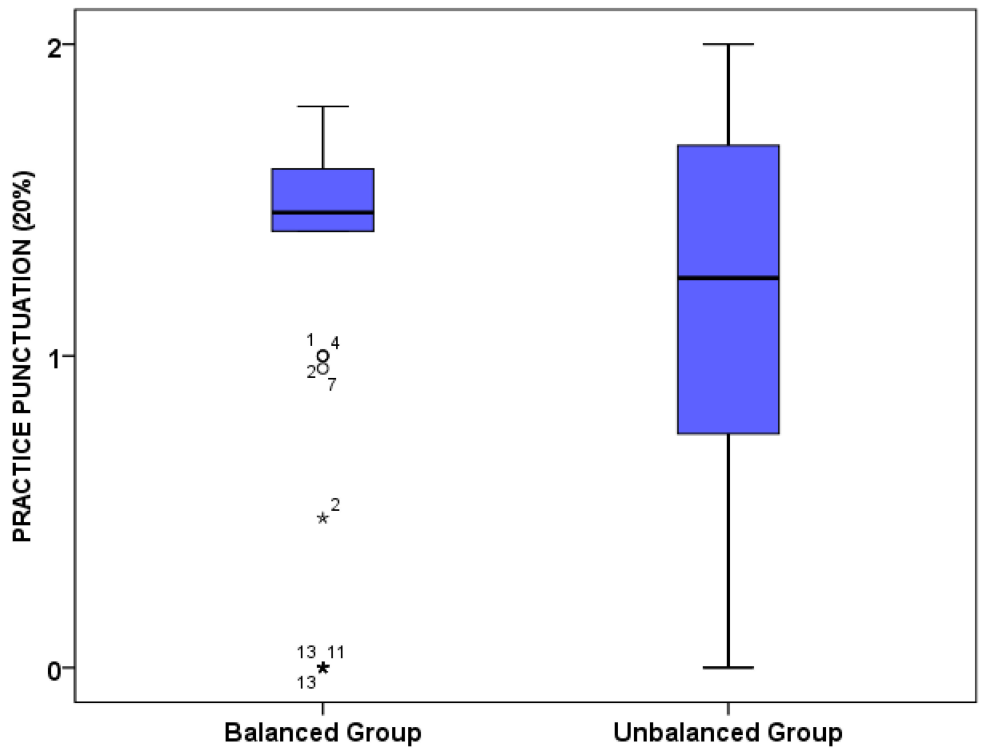

Figure 1. Box plot of scores obtained from the practice of 20% weighting according to student groups.

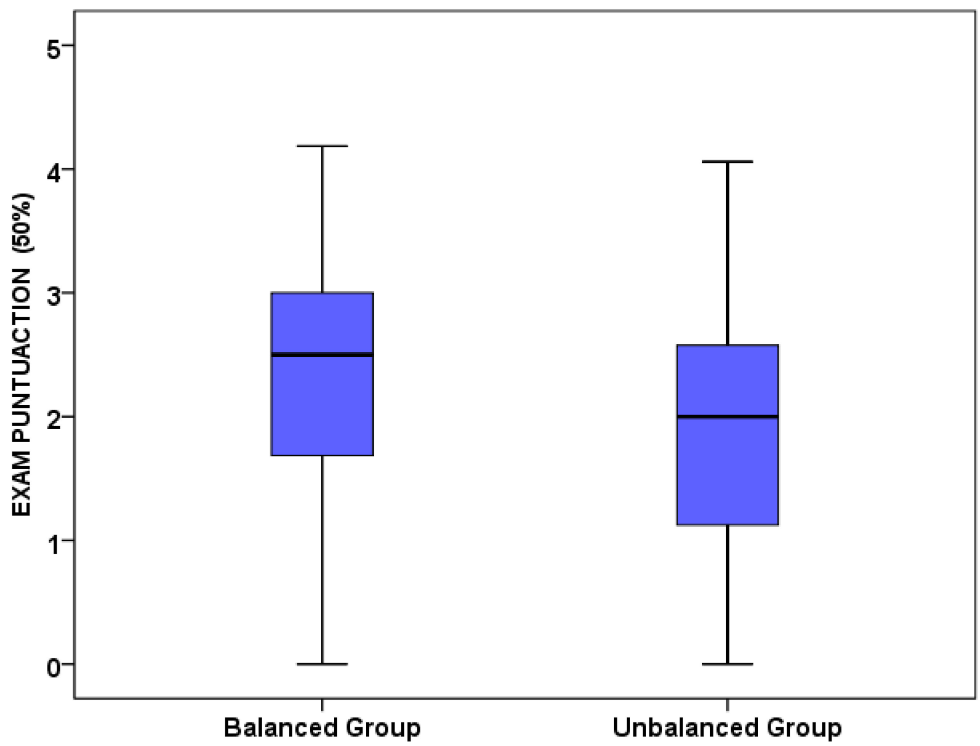

Figure 2. Box plot of scores obtained in the exam according to student groups.

To explain the final exam scores according to the scores of the different group roles, we performed linear regression. For the group with balanced roles, selecting a model of introduction by successive steps, we obtained a linear fit with the ability to explain the total variability $R^2 = 0.947$ and corrected $R^2 = 0.891$ expressed in Equation (2). Bartlett's sphericity test (p-value ≈ 0) rejects the hypothesis of collinearity between the variables selected in the analysis. The Kolmogorov–Smirnov test (p-value = 0.36) assumes the hypothesis of normality of the residuals.

$$\text{Final grade} = 0.211\ \text{Investigator} + 0.131\ \text{Coordinator} + 0.092\ \text{Implementer} + 0.101\ \text{Team worker}; \quad (2)$$

For the group of students with unbalanced roles, selecting a model of introduction by successive steps, we obtained a linear fit with the capacity to explain R^2 = 0.876 and corrected R^2 = 0.761 expressed in Equation (3). The Bartlett sphericity test (p-value $\approx$ 0) rejects the hypothesis of collinearity between the selected variables. The Kolmogorov–Smirnov test (p-value = 0.627) assumes the hypothesis of normality of the residuals.

$$\text{Final grade} = 0.333\ \text{Finisher} + 0.178\ \text{Shaper}; \quad (3)$$

Regarding the score of the work grade (20%), for the balanced roles group, selecting an introduction model by successive steps, we obtained a linear fit with the ability to explain R^2 = 0.917 and R^2 corrected = 0.832 expressed in Equation (4). Bartlett's sphericity test (p-value $\approx$ 0) rejects the hypothesis of collinearity between the selected variables. The Kolmogorov–Smirnov test (p-value = 0.005) rejects the hypothesis of normality of the residuals, so there is structure to explain in this model.

$$\text{Final grade} = 0.031\ \text{Investigator} + 0.026\ \text{Coordinator} + 0.022\ \text{Team worker} + 0.035\ \text{Implementer} \quad (4)$$

For the student group with unbalanced roles, selecting an introduction model by successive steps, we obtained a linear fit with the capacity to explain R^2 = 0.938 and corrected R^2 = 0.875 expressed in Equation (5). Bartlett's sphericity test (p-value $\approx$ 0) rejects the hypothesis of collinearity between the variables selected. The Kolmogorov–Smirnov test (p-value = 0.160) assumes the hypothesis of normality of the residuals. Groups 21, 22, and 23 were omitted because of having a different weighting of the final grades.

$$\text{Final grade} = 0.048\ \text{Coordinator} + 0.043\ \text{Implementer} + 0.046\ \text{Plant}; \quad (5)$$

Regarding the score of the exam grade, for the group with a balanced role, selecting an introduction model by successive steps, we obtained a linear fit with the ability to explain R^2 = 0.915 and R^2 corrected = 0.829 expressed in Equation (6). Bartlett's sphericity test (p-value $\approx$ 0) rejects the hypothesis of collinearity between the variables selected. The Kolmogorov–Smirnov test (p-value = 0.178) assumes the hypothesis of normality of the residuals.

$$\text{Final grade} = 0.219\ \text{Investigator} + 0.135\ \text{Coordinator} + 0.088\ \text{Team Worker}; \quad (6)$$

For the group with unbalanced roles, selecting a model of introduction by successive steps, we obtained a linear fit with the capacity to explain the total variability R^2 = 0.836 and corrected R^2 = 0.694 expressed in Equation (7). Bartlett's sphericity test (p-value $\approx$ 0) rejects the hypothesis of collinearity between the variables selected. The Kolmogorov–Smirnov test (p-value = 0.430) assumes the hypothesis of normality of the residuals. Groups 21, 22, and 23 were omitted due to them having a different weighting of the final grades.

$$\text{Final grade} = 0.339\ \text{Finisher}; \quad (7)$$

Thus, in the unbalanced model, not all roles can explain the students' scores in the final qualification. The roles of the balanced group are maintained in the explanatory models of the score of the final grade, 20% weighting practice, and final exam (except for the role of implementer). However, for the unbalanced group, the different student roles alternate in the explanatory model, with the coordinator, implementer, and plant profiles predominant in the practice score weighted at 20% in a directly proportional way and the role of finisher in the final exam qualification.

We highlight the substantial variability of the different profiles in the balanced group relative to the unbalanced group. Significant differences were found between the two groups in the scores of the roles of implementer, coordinator, shaper, plant, and finisher. The scores of implementer and coordinator were larger in the balanced group than in the unbalanced group (Table 4).

Table 4. Descriptive statistics and *p*-value from a comparison of means between the different roles of students in the two groups.

	Balanced Group		**Unbalanced Group**		***p*-Value**
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**($\mu_{G1}-\mu_{G2}$)**
Implementer	13.98	6.10	9.22	1.73	<0.0001
Coordinator	10.05	4.75	8.37	2.08	0.005
Shaper	7.87	4.58	9.47	2.73	0.01
Plant	5.83	4.32	8.05	1.87	<0.0001
Finisher	5.5	4.06	9.15	2.73	<0.0001
Monitor-Eval	7.26	4.6	8.03	2.18	0.183
Team worker	11	6.13	9.76	2.58	0.103
Investigator	8.48	4.24	7.89	1.8	0.253

Source: authors.

In order to identify the variables that best segregated the groups, we did a discriminant analysis. The selection criterion for the best model based on the associated Wilks lambda value and a method of inclusion of variables by successive steps was used if the associated Snedecor F value exceeded the threshold of 3.84 (associated with the probability of the right tail of 0.05) and the exit criterion was less than 2.71. The results show that the best model considers a single discriminant function including the variables shaper, plant, finisher, and Monitor-Eval, with a significant Wilks lambda = 0.596 with an associated *p*-value < 0.0001. The associated eigenvalue = 0.679 and Equations (8) and (9) show the Fisher classification functions obtained for each group.

$$\text{Balanced Group} = -34.52 + 1.479\ \text{Implementer} + 1.804\ \text{Coordinator} + 1.186\ \text{Team Worker} + 1.859\ \text{Investigator}; \quad (8)$$

$$\text{Unbalanced Group} = -23.216 + 1.106\ \text{Implementer} + 1.489\ \text{Coordinator} + 0.991\ \text{Team Worker} + 1.609\ \text{Investigator}; \quad (9)$$

Table 5 shows the confusion matrix associated with the model, with an ability to correctly classify 81% of the observations.

Table 5. Classification matrix for the study groups from discriminant analysis, being 1 = Balanced Group and 2 = Unbalanced Group.

		ROLE	**Predicted Membership Group**		**Total**
			1	**2**	
Original	Count	1	47	22	69
		2	6	74	80
	%	1	68.1	31.9	100.0
		2	7.5	92.5	100.0

Source: authors.

5. Conclusions and Implications

In this work, we analyzed the academic performance of 149 students in the course Introduction to Business II. The students were placed into 21 groups. The roles of each group were identified by the students themselves at the end of the course. From the results, there were 14 groups whose members had naturally different role profiles, so we called these the control group. The other seven we considered the experimental group because they did not have a balanced formation, as the student roles were repeated.

The performance of each student was measured through two grades: one for the group, obtained by the work they had to develop within the group throughout the semester; one for the individual, i.e., the final exam was measured in two parts, one theoretical and one practical, whose contents were treated in the work developed by the students during the semester.

The study indicates that the students who were part of the control group had a final grade between passing and outstanding, and no student had a failing grade. In the experimental group, grade variability was greater, with the number of failures representing 47.5% of the sample and the number of outstanding at 5%.

Regarding the performance of the various tests, collaborative work developed by students in the control group resulted in grades centered around 1.5, with the grades of the unbalanced group between 1.5 and 0.75. There was a similar situation regarding the final exam, for which the grades were more concentrated, and the average was higher for the balanced group than the unbalanced one.

The results reject the hypothesis to be tested as indicated by authors such as Alberola et al. [1], Jeffries et al. [41], and Senior [7], establishing a positive relationship between the balance of roles and performance. Therefore, there were statistically significant differences between the final scores of the students and the configuration of their groups, according to student roles. Such performance is reflected by greater homogeneity in group grades and improvement in the results of the team as a whole [38], ensuring that the grades are not very different and there is no significant difference between students.

Regarding the roles, it is noteworthy that within the group, students who identified with the role of implementer or coordinator attained significantly higher scores than the rest of the students.

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