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# INDIVIDUAL ACHIEVEMENT VERSUS TEAM PERFORMANCE: AN EMPIRICAL STUDY WITH BUSINESS GAMES

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## ABSTRACT

*Undergraduate students (160) were ranked according to their performance in three objective tests (two multiple-choice quizzes and one objective exam) and then grouped in teams of 5 to 6. During seven weeks the teams managed companies in a medium complexity business game (MMG). One would expect that better performance in the objective tests (individual knowledge acquisition) would produce better performance in the business game (knowledge deployment in teamwork). The results however did not indicate any consistent and significant correlation between level of individual knowledge and company performance. This shows that theoretical knowledge is not sufficient to explain teamwork successful performance.*

## INTRODUCTION

*Le faire savoir ne suffit pas. Il faut le faire savoir et le savoir faire.*

It has been since long being recognized that three are the main pillars of the learning process: a balance of Knowledge, Skills and Attitudes should be attained via formal education. However, academia has historically concentrated its effort on knowledge, probably due to the form that learning has developed in the course of time. Initially mimetic at the time of human language acquisition, learning took afterwards a more practical lean, in the beginning of civilization. As writing evolved so did abstraction, and from ancient Greece onwards rationality became more focused in theory. However, such theoretical emphasis may have been exaggerated in the education for some professions, whose activities require an emphasis on attitudes and decision-making.

Although we distinguish — again, in theory — these three dimensions, Knowledge, Skills and Attitudes, they are always present, "mingled" one would say, in any learning situation, whatever the teaching process may be (Marques *apud* Abreu and Masetto, 1990:32).

Notwithstanding, Business Schools always gave much more attention to knowledge acquisition. This is a consequence of their teacher-centered expositive classes whereby knowledge is disseminated and, hopefully, memorized. It is also the result of the evaluation process itself, usually made via objective written tests.

At the University of São Paulo, Brazil - Business School, only 300 hours out of the total 3600 hours of the undergraduates' course correspond to a supervised on-the-job training, which will be the subject of their final dissertation. Besides that, 60 hours are further allocated to Business Games. Thus, only 10% of the total course is dedicated to training as opposed to 90% of ordinary theory oriented classes.

## TEACHING AND LEARNING: TWO DIFFERENT PERSPECTIVES

*The more he teaches, the more he learns. The teacher that is...*

It seems logic that teaching be given more importance in an educational process oriented toward the fulfillment of the students expectations: getting to know about the ideas of the "great masters", experts in various issues, and hearing from teachers some brilliant speeches on their specific professional experiences. On the other hand, however, activities, which are student-centered, should rather focus on learning. Abreu and Masetto (1999:5) recommend that academic environment should privilege learning over teaching, even though both concepts cannot be dissociated from one another.

Nevertheless it is not possible to affirm that either one, student or teacher-centered approach is better than the other. Both are needed for what Postman (2002:17) calls the building of meaning. To privilege any of them would be to oversimplify such a complex process, almost as if it were something that could be mechanically acquired.

## PREVIOUS STUDIES

In the attempt of obtaining correlates of performance for simulated companies in Business Games, some important studies have been produced (Faria, 2000:90). Among them, the specific question to be answered in Nielsen's study (1975:111-5) was "whether there is a difference of any significance in the performance of team players as compared with individual players? Based on the data shown (…), although the teams outperformed the individuals in absolute amount, the lack of significance to the difference indicates that the difference probably occurred due to chance. Since there is no significance to the difference, the question of whether the game should be played by individuals or teams will have to be found by methods other than rate of return."

Badgett's study (1978:32) did not produce significant findings about the factors, which influence the performance of participants in a simulation exercise. However, the findings reported suggest that some of the factors, which are ordinarily considered important determinants of success in a simulation game, really have very little influence at all. None of the variables studied could be reliably used to predict performance in a simulation game.

Wolfe's study (1978) produced evidence that a student's performance as individual player in a business game conforms to past academic achievement. This is also true to a lesser degree for certain ACT test scores. It also found that all academic majors responded equally to the simulation as a learning device. Withdrawal rates, enrollment profiles, performance results, and perceived learning values were the same for all students regardless to their own discipline's presumed biases and predilections.

According to Gosenpud (1987), the difficulty with using participant characteristics to predict team simulation performance was due to the mixture of characteristics that is to be found on teams of three to six or more members. As such, team characteristics (e.g., degree of planning, formal decision-making organization, cohesion) have proven to be slightly better predictors of performance than individual characteristics (e.g., GPA, major, personality type).

Gosenpud, and Washbush (1991:44-8) explored different antecedents and their relationship to simulation performance when the game was played in teams versus played by individuals. "The method was for two sections of undergraduates to play a simulation in teams and two others in the same course in the same university play much of the game as individuals. The results showed that university GPA and academic major predicted performance for individual players but not for teams while carefully choosing teammates varied with performance for teams but not for individuals."

Ultimately, research in this area has culminated in a series of papers by Gosen and Washbush presented at ABSEL conferences from 1993 to 1998. These papers are based on five years of classroom experimentation involving 401 student simulation game participants. From a review of the ABSEL literature, Gosen and Washbush (1998) concluded that eight participant characteristics are most likely to be related to simulation game performance. These are academic ability, participant motivation, team cohesion, degree of team organization, team goal setting, degree of team competitiveness, perceptions toward the particular simulation, and perceptions about simulation games as a learning tool. (Faria, 2000:86)

Given the above results from North-American studies, the aim of the present paper is to verify whether in an academic environment from a different country, in this case Brazil, any consistent and significant correlation exists between individual academic achievement and team performance as reflected in a business game.

## RESEARCH PROBLEM

On Exhibit 1 learning objectives are listed together with their usual evaluation techniques. In **bold** are shown the evaluation techniques adopted in the present study.

Theoretical knowledge evaluation: Objective test – besides permitting a wide coverage of the subject, it is objective in the sense that different competent examiners will give identical evaluations.

Skills evaluation: Practical test – Requires specific equipment, laboratories, and field activities where students take actions that show their capabilities such as knowledge, motor, intellectual, and social skills that enable them to carry out the tasks and activities proposed.

**Exhibit 1: Learning objectives, evaluation techniques (Adapted from Abreu and Masetto, 1990:98)**

| Evaluation | Main Objective | Evaluation Techniques |
|---|---|---|
| Student Performance<br><br>X%+Y%+Z% = 100% | Knowledge: X% | Written test, dissertation.<br>Oral test, interview.<br>Objective test:<br>- Fill-in-the-blanks<br>- True or false<br>- Multiple choice |
| | Skills: Y% | Record critical incidents<br>Check list<br>**Practical test** |
| | Attitudes: Z% | Oral test, interview.<br>Written test, dissertation.<br>Record critical incidents |

Academy measures learning progress mainly through objective tests where a minimum score (in Brazil, 5 of a maximum 10) and attendance to classes of at least 70% are required. These requirements, as far as we know, have no scientific basis whatsoever. Anyhow, if these evaluation criteria are correct, knowledge thus measured should be providing the needed competences and managerial skills required for a successful career.

If this is indeed the case, one should expect that in a business game groups whose members are higher academic achievers should perform better than groups formed only with lower academic achievers. In the present study we thus test the following hypothesis:

$H_0$: Groups in a business game that include the higher academic achievers will perform better.

## DESCRIPTION OF THE EXPERIMENT

This study included 163 undergraduate students in their last year of both Business Administration and Accounting courses, at

FEA/USP, São Paulo, Brazil. No previous grades were used for any evaluation in this study. Students were evaluated via three individual tests in order to measure their academic achievement:

Objective Tests (two quizzes, ten questions each) covering the knowledge acquired during the traditional classes of the previous six or eight semesters (day or night courses). Questions ranged over the various themes involving business management: planning, marketing, operations, finance, and human recourses.

Objective Exam on the MMG simulation rules. In this exam students also had their previous knowledge evaluated. They were presented a business strategy previously set by a Board of Directors and were asked to objectively fill in a decision form and a Cash Flow statement.

They were subsequently evaluated via one practical exam in order to measure their team performance:

Practical Exam - Students in each class were ranked in descending order according to the average of their marks. In the same descending order they were grouped in teams of 5 to 6 that played during the seven weeks. This was the practical test (Business Game – MMG) whereby groups performance was measured according to seven sectorial multiples: market share, return on sales, return on asset, return on equity, asset turnover, inventory turnover, and debt to total assets.

To make this study more rigorous the 32 teams were combined into 4 industries with 8 groups each, according to the quartile ranked by individual grades (Exhibit 2).

**Exhibit 2: Team distribution by classes, industries and knowledge (quartiles).**

| Class hours | Students | Industry 1 (1°quartile) | Industry 2 (2°quartile) | Industry 3 (3°quartile) | Industry 4 (4°quartile) |
|---|---|---|---|---|---|
| 7:30h AM | 41 | 2 teams | 2 teams | 2 teams | 2 teams |
| 9:20h AM | 56 | 3 teams | 3 teams | 3 teams | 2 teams |
| 9:20h PM | 66 | 3 teams | 3 teams | 3 teams | 4 teams |
| Total | **163** | 8 teams | 8 teams | 8 teams | 8 teams |

## RESULTS

To assure a high involvement of students in the discipline the final grade was weighted to reinforce the importance of time allocation for decision-making in the business game. Individual knowledge measured in the experiment represented 25% of the final grade. Team performance in the business game represented 35% of the final grade. There was a 15% grade for presence in classes (attendees). Besides, absent students graded zero in every class they didn't attend. Other evaluation techniques produced 25% extra grades that were not used in this study. See Exhibit 3.

The raw data matrix included ten variables (3 objective test grade – test 1, test 2, and exam) and seven grades from the business game (MMG1 ... MMG7). Absentees scored zero. Based on that, Pearson correlate analysis was applied to the whole data resulting in Exhibit 4 hereunder.

As a second step of this study, and to get a more accurate view of the various industries in the competition (industry = achievers of equivalent level), the raw data was then split into four matrixes for separate analysis per knowledge quartile. The results are shown in Exhibit 5.

**Exhibit 3: Discipline activities and weighted final grade criteria.**

| Learning Objectives | Evaluation Techniques | Partial Weight | Total Weight | Time Allocated | Classes schedule |
|---|---|---|---|---|---|
| Briefing on the Discipline | ---------- | ---------- | --------- | 4 hours class | 1st and 2nd classes |
| Individual knowledge X=25% Allocated time = 4 hours | Individual quiz # 1 | 7,5% | 7,5% | 1 hour class | 3rd class |
| | Individual quiz # 2 | 7,5% | 15% | 1 hour class | 4th class |
| | Individual exam # 1 | 10% | 25% | 2 hours class | 5th class |
| Team arrangement | ---------- | ---------- | --------- | 2 hours class | 6th class |
| Practical exam Team performance in the business game Y=35% Allocated time= 14 hours | MMG round 1 | 5% | 30% | 2 hours class | 7th class |
| | MMG round 2 | 5% | 35% | 2 hours class | 8th class |
| | MMG round 3 | 5% | 40% | 2 hours class | 9th class |
| | MMG round 4 | 5% | 45% | 2 hours class | 10th class |
| | MMG round 5 | 5% | 50% | 2 hours class | 11th class |
| | MMG round 6 | 5% | 55% | 2 hours class | 12th class |
| | MMG round 7 | 5% | 60% | 2 hours class | 13th class |
| Involvement control | Presence in classes | 15% | 75% | ---------- | All class |
| *Intermediate Exam | Individual exam # 2 | *10% | 85% | 1 hour class | 7th to 11th classes |
| *Final Paper | Individual Dissertation | *15% | 100% | Outside | Final class |

Obs: *Grades not considered for the present experiment.

**Exhibit 4: Individual achievement vs. Team performance (Pearson correlations, 2-tailed test)**

| Performance Evaluation | QUIZZ 1 Individual | QUIZZ 2 Individual | EXAM Individual | QUIZZES' Average | Knowledge Average | MMG1 Team | MMG2 Team | MMG3 Team | MMG4 Team | MMG5 Team | MMG6 Team | MMG7 Team |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QUIZZ 1-Individual | 1,000 | 0,356** | (0,035) | 0,857** | 0,769** | (0,070) | (0,046) | 0,042 | (0,021) | (0,008) | 0,094 | 0,105 |
| QUIZZ 2 - Individual | 0,356 | 1,000 | 0,023 | 0,787** | 0,729** | (0,053) | (0,022) | (0,078) | (0,091) | (0,134) | (0,152) | (0,025) |
| EXAM – Individual | (0,035) | 0,023 | 1,000 | (0,010) | 0,404** | 0,056 | 0,168 | 0,007 | (0,085) | (0,122) | 0,130 | 0,099 |
| QUIZZES' Average | 0,857 | 0,787 | (0,010) | 1,000 | 0,910** | (0,076) | (0,043) | (0,014) | (0,064) | (0,080) | (0,019) | 0,056 |
| Knowledge Average | 0,769 | 0,729 | 0,404 | 0,910 | 1,000 | (0,045) | 0,032 | (0,010) | (0,094) | (0,122) | 0,036 | 0,091 |
| MMG1 Team | (0,070) | (0,053) | 0,056 | (0,076) | (0,045) | 1,000 | 0,773** | 0,218* | 0,106 | 0,067 | 0,000 | (0,205)* |
| MMG2 Team | (0,046) | (0,022) | 0,168 | (0,043) | 0,032 | 0,773 | 1,000 | 0,386** | 0,281** | 0,274** | 0,216* | 0,003 |
| MMG3 Team | 0,042 | (0,078) | 0,007 | (0,014) | (0,010) | 0,218 | 0,386 | 1,000 | 0,764** | 0,637** | 0,582** | 0,431** |
| MMG4 Team | (0,021) | (0,091) | (0,085) | (0,064) | (0,094) | 0,106 | 0,281 | 0,764 | 1,000 | 0,835** | 0,621** | 0,466** |
| MMG5 Team | (0,008) | (0,134) | (0,122) | (0,080) | (0,122) | 0,067 | 0,274 | 0,637 | 0,835 | 1,000 | 0,730** | 0,486** |
| MMG6 Team | 0,094 | (0,152) | 0,130 | (0,019) | 0,036 | 0,000 | 0,216 | 0,582 | 0,621 | 0,730 | 1,000 | 0,693 |
| MMG7 Team | 0,105 | (0,025) | 0,099 | 0,056 | 0,091 | (0,205) | 0,003 | 0,431 | 0,466 | 0,486 | 0,693 | 1,000 |

** Correlation is significant a the 0.01 level (2-tailed); * Correlation is significant a the 0.05 level (2-tailed)

**Exhibit 5: Individual achievement vs. Team performance by industry (Pearson correlations, 2-tailed test)**

| Performance by Industry | MMG1 Team | MMG2 Team | MMG3 Team | MMG4 Team | MMG5 Team | MMG6 Team | MMG7 Team |
|---|---|---|---|---|---|---|---|
| Knowledge Average: Industry 1<br>40 observations – 1st quartile | 0,160<br>39 | 0,098<br>38 | 0,500**<br>39 | 0,284<br>38 | 0,159<br>40 | 0,337*<br>38 | 0,107<br>40 |
| Knowledge Average: Industry 2<br>37 observations – 2nd quartile | -0,067<br>35 | 0,286<br>36 | -0,078<br>37 | -0,107<br>36 | -0,200<br>36 | 0,024<br>37 | 0,030<br>35 |
| Knowledge Average: Industry 3<br>35 observations – 3rd quartile | -0,300<br>31 | -0,442**<br>34 | -0,279<br>33 | -0,354*<br>34 | -0,254<br>35 | 0,238<br>34 | 0,382*<br>34 |
| Knowledge Average: Industry 4<br>22 observations – 4th quartile | 0,264<br>21 | 0,094<br>20 | -0,005<br>20 | 0,305<br>21 | -0,032<br>21 | -0,071<br>20 | -0,057<br>18 |

** Correlation is significant a the 0.01 level (2-tailed); * Correlation is significant a the 0.05 level (2-tailed)

## DISCUSSION

A significant (better than 1%) low correlation (36%) was obtained between the grades of the two quizzes, what suggests that some overlap (in form or content) exists between them. On the other hand, the objective test based in the MMG case showed a non-significant, slightly negative, correlation with the average of the tests. This is probably due to the different nature of the objective exam when compared to the quizzes (Exhibit 4).

The objective exam seems to have accessed distinct contents that demand different competences in the use of the knowledge acquired. Whether due to its different format (the filling in of a form) or to the distinct content (a case study) it seems to be a legitimate evaluation tool since it measures competences that the objective tests do not reach.

When individual averages are compared to group performance (Exhibit 4), very low, non-significant, correlation values are observed. $H_0$ hypothesis is thus rejected. Such a result may seem unexpected especially in what concerns the exam, since its content is the same as the play's content.

However one should bear in mind that the objective exam measured the performance of specific individuals in their capability for understanding and transcribing a preset business strategy. The teamwork in the business game evaluates a process - the formulation and deployment by a group of a management strategy (Gentry *et alli*, 1992:211).

When one examines the results of the game in the seven periods, a high significant positive correlation between consecutive years is obtained. This indicates that results obtained in one period were maintained in the following periods. This may be due to different competences in what respects attitudes and skills of the members in each group, which are reflected in the groups' collective actions. On the other hand, the fact that $H_0$ was rejected, strongly suggests that individual knowledge level is not sufficient for successful collective action.

A competitive advantage based on aspects other than knowledge was created and sustained throughout simulation runs demonstrating that low achievers can reach higher performance

and show competences never measured by traditional exams. This reinforces the need for tools as business games that allow one to measure competences arising from team action that cannot be evaluated by more traditional methods.

It is to be noted that, if built from the onset of the experiential activity, this kind of advantage may be very difficult to imitate. This however may be due to a memory effect in the simulator already pointed out by several studies (see ABSEL literature). This effect if it indeed exists in MMG has been countered by the author via schedule of class activities and use of several critical incidents. Besides that, in the last two years correlation though still exists, is no longer significant, suggesting the presence of an "end-of-game-strategy effect".

It can be seen in Exhibit 5 that different results were obtained in the case that the analysis was carried out for each industry (industry = achievers of equivalent level). In the industry formed by students in the 1st quartile, individual knowledge seems to explain team performance:

There is a consistent positive correlation between individual knowledge and team performance in the 7 runs;

The correlation becomes significant in the 3rd run (1%) and explains only 50% of the variance, and in the 6th run (5%) explaining 34% of the variance in this case;

In the industry formed by students in the 3rd quartile, to the contrary individual knowledge seems to jeopardize team performance:

There is a consistent negative correlation between individual knowledge and team performance.

The correlation become significant in the 2nd run (1%) and explains only 42% of the variance, in the 4th run (5%) it explains 35% of the variance, and in the 7th run (5%) it explains 38% of the variance.

In the industries formed by students in the 2nd and 4th quartiles, individual knowledge is not sufficient to explain team performance. Low non-significant correlations alternate from positive to negative.

Anyhow, when considered by industry, the results do not show a stable pattern that could allow one to consider it as a trend.

The results obtained in this study indicate that learning by memorizing the meaning of the "great authors" - and taking this to be all that knowledge is about - does not actually build meaning that lasts for long, since those who acquired this kind of knowledge were not able to duly apply it. This kind of knowledge may have trapped high achievers students within the limits of conceptual models, while low achievers showed to better adapt to situations and sustain team performance.

Learning by doing stimulates curiosity and the search for a not yet memorized knowledge, something that acquires a meaning of its own for the student and which the student feels he owns it himself. Business game players usually point out that a great similarity exists between the game environment and the real companies environment, which is for sure much bigger than the similarity they see with traditional classes.

If we indeed agree with Faria (2002) that business games are more similar to the business environment, why do we still adopt the traditional classes model for more than 90% of the undergraduate programs? The balance should be reconsidered so that inefficiencies brought by the rework presently being done are avoided in a developing economy that cannot afford to waste resources and time.

## CONCLUSIONS

Academy considers knowledge to be of great importance, a variable it always adopt to measure individual performance. However, it does not explain consistently team performance, the ever-prevailing operating model in organizations. Undergraduate Schools in general, and Business Administration and Accounting courses in particular, may be failing in some aspects such as:

They supply mostly theoretical knowledge evaluated through objective exams;

They provide uncompleted certified based only on grades and assiduity.

We are preparing scientists that probably learn how to think and how to demonstrate individual knowledge but we should rather prepare managers who are able to work in teams and produce better results. Knowledge in the Academy is considered as key to professional success but companies do not recruit based only on academic records. They do observe the behavior candidates show during role playing games – that as a matter of fact could be advantageously substituted by Business Games – and interview them so that they may show their aptitudes and other interpersonal competences.

It is to welcome the growing recognition that team performance is not related to individual performance. This is evidence that teamwork adds value, positive or negative, and thus it should be more thoroughly investigated.

Since the results of this study indicate that knowledge does not explains consistently the performance of the simulated companies, one can conclude that Business Administration and Accountancy are not only Sciences that develop through knowledge of their theories, but also Arts, something never to be contained in written books alone, that can't be simply memorized, but must be experienced, in rational and emotional ways.

In this picture the main role Business Games are to play is to supply students, the newcomers in the professional world, with this combined, rational and emotional, unique experience.

## CONTRIBUTIONS

There are some studies closely related to this experiment. Badgett (1978) and Gosenpud & Washbush (1991) arrived at similar conclusions showing that individual knowledge was not able to explain team performance. Differently from previous studies however, we formed here teams with 5 to 6 members ranked by their individual grades. Besides that, it was adopted the simulation MMG for the first time in this kind of study. Instead of using only one performance measure (rate of return) what was considered a limitation by Nielsen (1975), seven sectorial multiples were used to measure team performance.

## PROPOSITIONS

This kind of "gap" here discussed reinforces the need for tools as business games that allow one to observe performances arising from team action, which cannot be evaluated by more traditional methods. Academy may be delivering incomplete diplomas for undergraduate students instead of helping them to form an idea of his/her own practical potential. We demonstrate in this study that we should take into account that performance is produced by elements other than knowledge. New studies are needed that take into consideration dimensions related to skills and aptitudes. We may learn much more as we observe individuals operating as teams in Business Games, trying to reproduce results that reveal the transformation of these groups into teams (with positive synergy). This is an important consequence of the rejection of hypothesis $H_0$.

Besides, the results reported in the literature reinforce the importance of studying this issue in a multiple player approach instead of single-player that could be considered too big a simplification of the reality. In the single players approach we would lose the richness of the synergic interactions among members and oversimplify the simulated reality, repeating a rank based on knowledge. Multiple-player teams help us to study which variables are related to human skills, that add value to companies. Single-player teams are too far from the way companies operate in the real world. External validity was not the aim in this study. For generalization of the conclusions presented above this study should be replicated in similar conditions, with different populations, and other simulations over time.

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