

INDIVIDUAL ACHIEVEMENT DOES NOT GUARANTEE TEAM PERFORMANCE: AN EVIDENCE OF ORGANIZATIONAL LEARNING WITH BUSINESS GAMES

Antonio Carlos Aida Saia
Universidade de São Paulo
asaia@usp.br

Guilherme Mirage Umeda
Universidade de São Paulo

ABSTRACT

The premise here adopted was that students who obtained higher academic marks in business courses would perform better managing simulated companies. Two groups of Brazilian graduate students were ranked in descending order according to the average of their individual grades and arranged in teams to compete in a Total Enterprise business game. The results after running 8 quarters showed that teams formed by high achievers did not necessarily produce the best performance during the first 4 quarters, being possibly surpassed by low achiever teams that seem to learn faster the game rules. Surprisingly in the first replication there is significant evidence of individual knowledge producing superior performance in the second half of the experiment, as the trivial problems become more complex and demand long-term orientation instead of short-term focus. Results indicate that it is too naive for both, companies and business schools, to assess competencies based only on individual achievement. Organizational learning skills should be seriously taken into account as well.

INTRODUCTION

The collective organization is an ancient institution of Business studies. By proposing the job division as a means to increase individual efforts efficiency, Adam Smith fundamentals a company basis as a reunion of people that produce more together than separated. This idea gained new contours until flowing towards the organizational learning modern theories. At a time when Smith's influence had already been assimilated by the majority organizations, Peter Senge (1990:73) affirmed that specialization could efficiently solve daily problems but would fail to deal with more complex issues. He proposed that teamwork synergistic gains could overcome scale economy, by affirming that: "a team that learns in group is more capable to deal with corporate systemic complexities".

Nowadays, teamwork emerges as a productive, competitive, and efficient organizational configuration. At the employee selection, it has been emphasized the need for professionals with social skills for team integration, as long as more integrated corporate models are coming out and being consolidated (Casado, 2002: 237). Under a company's view based on resources (Fleury e Oliveira, 2002: 134) knowledge intangible assets are complemented with skills to be applied in collective contexts. By this way, purely cognitive knowledge does not guarantee excellence to the organization. Senge (1990:19) poses a question: "how is it possible that a group of managers with an individual IQ over 120 has a collective IQ of 63?" The author believes that coordinated actions development, dialogue-based, constitutes a key factor to the modern organization. Group learning skills can overcome the limits of the local team knowledge, deposited by each one of its individual participants.

Identifying good managers is not a trivial task: plenty of methods and criteria show that there is not a completely safe way of carrying out a head hunting process. In general, companies have put constant and significant effort on recruiting and selecting talents recently graduated at good business schools. If higher academic achievers were a certain assurance for also higher results, it could be sufficient to examine the academic records and select talents based on purely academic performance. The academic institution has its own criteria to assess the students' cognitive level and based on that, to approve and certify its students.

Why do not companies use only the same traditionally adopted average marks as objective and universal ranking criteria, and base on that its selection? If, objective grades do not say all about an applicant, on the other hand there is some hope that the academic education aggregates differential value to form apt professionals by means of either knowledge, or skills, or attitudes. Because of that employees are stimulated to continue studying and sometimes negotiating at their job contracts some additional benefits, such as partial or full sponsorship for specialization

Developments in Business Simulations and Experiential Learning, Volume 32, 2005

courses, graduate programs that offer continuing education and, in many cases conditioning the career advancement.

PREVIOUS STUDIES

Large financial resources have been invested in talent formation and in professional updating via continuing education – MBA programs, corporate university, courses abroad, and so on. Are these funds being properly directed to the most efficient purposes? Does the essentially cognitive content of undergraduate and graduate education provide organizations with expected financial return, by means of activity results? Questions like these motivated the present study as a reflex of a growing concern about creating and sustaining competitive advantages based on intellectual capital, one of the major intangible resources of corporations.

In addition to its potential as a systemic learning tool, Total Enterprise business games have also been used as a “laboratory” for developing academic-purpose researches. Some examined the relation between academic performance measures and corporate simulation play. Results, as showed hereunder by Wolfe (1978) were inconclusive (Exhibit 1):

Business concepts, and one exam over a brochure about the business game.

Students were ranked in descending order according to their exams marks and then arranged in groups of five or six components. Individual tests were considered here as predominantly cognitive evaluations. The findings demonstrated low and statistically non-significant correlations between achievement exams average marks and respective business game performances.

The main conclusion of the study was that individual achievement and performance measures in simulated companies assess – and thus require – distinct competencies. These methods would be complementary to a proper evaluation of future managers. The business game, despite being a simplified reality model, is based on knowledge, skills, and attitudes necessary to succeed in the real world. It demonstrates that static knowledge contained in an excellent strategic plan depends on dynamic ability, skills and attitudes to be properly executed.

Another recent article (Thavikulvat and Pillutla, 2004) reports on two studies that were conducted to determine whether (a) total enterprise simulations (CEO) are suitable for assessing business skills and (b) the tournament concept

Exhibit 1

Correlation between achievement and performance studies

Author	Year	Study Measures	Findings
Dill	1961	Average at ATGSB exam and accumulated profits.	No correlation was found.
		ATGSB exam and academic average mark	Correlation between 0.4 and 0.5
Potter	1965	ATGSB and ROI of simulated company	Weak correlations (0.07 to –0.07)
		GPA and ROI of simulated company	Correlation –0.4
McKenney and Dill	1966	Students teams “upon average”, “average” or “under average” and profits.	Correlation was found. None correlation with sales volume.
Wolfe	1978	Academic evaluations, aptitudes and performance in simulation (individual companies).	Correlation was found. All students considered the simulation as a learning tool.

Source: Adapted from Wolfe, 1978.

Similar conclusions were reached by Badgett, Brenenstuhl and Marshall (1978) affirming that the factors, which influence and condition the corporate simulation performance, are diverse and complementary to those that ensure success in other academic activities. Gosenpud and Washbush (1991) compared different antecedents and their relationship to simulation performance when a game was played in teams versus played by individuals. The results showed that university GPA and academic major predicted performance for individual players but not for teams.

In a study presented by Sauaia (2004), using a Total Enterprise business game application as research universe, it is quite clear the gap between what is taught in Business schools – focus on achievement – and the performance resulting from managerial practice. Participated in the experiment 163 undergraduate students in Business and Accounting courses at University of São Paulo, Brazil. Results from 7 runs of 32 simulated companies (MMG – *The Multinational Management Game*) were compared to individual marks obtained at two instruments: one test about

can be effectively applied to such simulations. The first study involved 141 senior business students; the second, 74. The results are consistently favorable on both questions for the particular simulation adopted. The studies also show that the free-rider problem that may have previously undermined the validity of simulation performance scores can be overcome by incorporating a system of individual performance scores, and that a progressively difficult simulation experience can keep participants challenged for 30 decision periods.

RESEARCH PROBLEM

The following question proposed in this study is in part a replication and an advance of previous studies (Dill, 1961; Potter, 1965; McKenney & Dill, 1966; Nielsen, 1975; Badgett, 1978; Wolfe, 1978; Gosenpud, 1987, 1991; Gosenpud & Washbush, 1993-8; Sauaia, 2004). Even studying similar research problems, replications have been conducted with different business games at different schools

Developments in Business Simulations and Experiential Learning, Volume 32, 2005

and populations. Besides, researchers have adopted different individual measures to evaluate participants' achievement. Each study has been designed differently in search of external validity – similar results in different experiments testing analogous hypothesis.

- Is that true that, besides the necessary knowledge to planning process, also the organizational learning skills and attitudes are essential to the new group of managers in order to guarantee superior performance to a company?

It has been adopted, as null hypothesis, the premise that higher individual achievement (average marks) produces better team performance (simulation results).

group performance ratios were collected, comprising profitability, indebtedness and turnover. In each one, the score allocation is ordinal (in an industry of 8 participants, the company with the best ratio receives 80 points, the second 70, and so on, no matter the difference between the intervals). After that, ratio scores are added resulting in a performance measure. This number is no longer an ordinal but an interval, once the score modular distance is relevant. To convert scores into a scale from 0 to 10, comparable to the grades, the company that achieved the highest score was attributed a 10 and each company score was divided by the leader's, so obtaining proportional and competitive grades.

When game scores are correlated with average marks obtained in individual exams, part of the interval scale

Exhibit 2
Different approaches of replications here studied

Database	Previous study: 2002	This study: 2003
Population	163 undergraduate students	70 (Finance); 40 (Accounting) graduate students
Business School	One public school; SP – Brazil (Southeast)	Two private schools; Bahia – Brazil (Northeast)
Business Game	Multinational Management Game, 1992	Executive Game, 1972
Teams per industry	8 firms; 6 members firms in each team	7 firms; 5 members in each team
Duration	One semester	One week
Number of runs	7 rounds (years)	8 rounds (quarters)
Individual achievement	Grades from one quiz and one exam	Grades gathered from all previous courses
Team performance	Accumulated points: 7 performance indicators	Single performance indicator: ROE

METHOD

Despite the different treatment given to the students ranking process, now based on compound averages of all the remaining program disciplines, the research problem proposed hereby is directly related to the experiment carried out by Sauaia (2004). Exhibit 2 shows the differences between this study and the previous one. In this way, to examine the problem it was carried out a reprocessing of data used by the author, in addition to two replications of the same experiment, with different device and population.

DATA REPROCESSING

To reprocess a database created in a pedagogical context demands several actions that can affect the scientific strictness in the case of more rigorous analyses. However, it is possible to make some adaptations in order to reduce the risk, so that obtaining safer results from the study. A first review of Sauaia (2004) experiment is the one where accumulated score – performance measure employed in evaluating the companies' results – works within a discrete and comparative scale in MMG business simulation. Seven

precision is lost. Other problem resulting from this score method is the unlikelihood of making comparisons among industries, since they are comparable within their own group only. With the purpose to refine the study the same database was reprocessed. Instead of accumulated score (discrete), it was adopted ROI (return on investments) measure, a continuing and interval variable. Doing so, the marks correlated with simulation performance could be carried out without the previous statistic restrictions.

The new variable brought up the possibility to compare the companies' performance in different industries. ROI is a standardized measure; it is not relevant to know in which specific industry it is being invested, but what is the related return (under the investor's view). At the same way, knowledge evaluation criterion has a standardizing character, once marks from 0 to 10 are generally accepted for academic pedagogical assessment. In the search of validating the obtained findings of previous experiment, it was calculated the correlation between companies score and correspondent ROI. The use of ordinal ratios, in an interval scale could jeopardize measurement process. Nevertheless, Exhibit 3 results demonstrate that a strong correlation exists between both criteria, indicating that the produced error margin is smaller that one could suppose.

Exhibit 3

Correlation between ROI and accumulated scores (database 2002)

	ROI	PONT ACU
ROI	1,000	0,779**
Accumulated Scores (PONT ACU)	0,779**	1,000
** Correlation is significant at 0,01 level (2-tailed)		

A second review was obtained as concerning to data analysis. Instead of using the student as a study unit, the whole group was used in this reprocessing. That happened because of two reasons. First, because the simulation performance grades for each student suffers from the interferences of his or her own presence in the classroom. When the student was absent, the part related to the points produced by his/her absence was discounted from the mark. However, it cannot be affirmed that one absence had prevented from contributing to the result, because each decision received the corporate history effects, in which the absentee did participate. Second, because the simulation did not evaluate each student individually as happened with knowledge marks. One can only conclude that participation of each member was proportional (Exhibit 4).

The results shown in Exhibit 5 used as knowledge factor the average exams marks of all group participants. Team performance the simulated company was measured at the end of the game. One can observe from the correlation and significance ratio that there is no duplicity between achievement and performance measures. The strategy implementation in organizations, process in which the teacher-centered dominant education has little efficiency to deal with, has proven to be a distinct ability from acquired knowledge and demonstrated via exams. Sauaia's (2004) conclusions can be supported by these results.

FIRST REPLICATION

The first replica was carried out in post-graduate program in Finance with a time schedule of 24 hours,

concentrated on one-week period (evening classes, 4 hours each). A list with all general average marks of each student in all previous disciplines of the program (one year long) was used to arrange the groups. The purpose of applying this criterion was to eliminate result distortions of using a single exam, subject to many circumstantial variations. The experiment comprised 69 students of two different classes, gathered at an oral presentation and general directions at the beginning of the course. Seven groups were formed in one out of two industries with an average of 5 participants. The software used in this experiment, a version of the Executive Game (EG), presents lower difficulty level comparing to MMG, which is more adequate in case of short duration courses (one week). Its single performance measure is the Return on Equity (ROE) ratio.

Seven or eight decision rounds were performed (in quarterly basis, run up to 2 years of the simulated time). At the end of year one the best performing firm got a grant in money credited as extra gains. From the fifth round on, it was adopted a new decision form, a decision support instrument formatted as a cash flow forecast. Besides, critical incidents that altered the companies' scenario were adopted every quarter demanding extra attention of teams and better planning (for example: at the fifth quarter, the raw material supplier faced problems and had to sale (in auction) the few loads it had in stock, provoking additional charges and asymmetry of production factors). No incident was completely unanticipated; all of them were preceded by signs, in articles inserted into the quarterly bulletin available to the groups through purchase.

Exhibit 4

Changes in the original processing

Element	Sauaia (2004)	Reprocessing
Sample unit	Individual student	Group
Performance Measure	Score (interval-scale marks in industries)	ROI (interval-scale comparable among industries)
Knowledge Measure	Individual students marks	Average of each participant mark of each group

Exhibit 5

Reprocessing of correlations (database 2002)

	MED CONH	ROI
Average (MED) Knowledge (CONH)	1,000	0,124
ROI	0,124	1,000
Significance	0,499	

Exhibit 6
First replicate correlations (Pearson) - database 2003

Correlations (2 Classes)	MED CONH	ROE1	ROE2	ROE3	ROE4	ROE5	ROE6	ROE7	ROE8
Average knowledge (MED_CONH)	1	0,383	0,407	0,260	0,291	0,696**	0,700**	0,629*	0,728
ROE1	0,383	1	0,500	0,006	0,111	0,388	0,333	0,329	0,428
ROE2	0,407	0,500	1	0,678* *	0,691**	0,174	0,175	0,173	-0,074
ROE3	0,260	0,006	0,678**	1	0,937**	0,328	0,338	0,356	-0,178
ROE4	0,291	0,111	0,691**	0,937* *	1	0,393	0,385	0,435	-0,202
ROE5	0,696**	0,388	0,174	0,328	0,393	1	0,984**	0,969**	0,806*
ROE6	0,700**	0,333	0,175	0,338	0,385	0,984**	1	0,967**	0,824*
ROE7	0,629*	0,329	0,173	0,356	0,435	0,969**	0,967**	1	0,696
ROE8	0,728	0,428	-0,074	-0,178	-0,202	0,806*	0,824*	0,696	1
Major changes during the two years in the business game	First simulated Year: "daily problems" Learning the rules of the game; Decision form as data entry					Second simulated year: "complex problems" Dealing with critical incidents; Decision form as a Cash Flow forecast			

** Significance > 0.01 (2-tailed).

* Significance > 0.05 (2-tailed).

DATA ANALYSIS OF THE FIRST REPLICATION

The results of Exhibit 6 indicate low significance levels and low correlations between individual achievement and team performance in the first four simulation cycles (Year 1). Low achievers seem to have reached better performance than high achievers. At this point of the game (periods 1 to 4), the challenges were team integration (cohesion), rules control and understanding of the relations among the competitive environment variables. Considering these as "daily problems", results show that low achievers were more effective than high achievers to produce superior results in the short run, demonstrating to learn faster.

In periods 5 to 8, second year of simulation, the seasonality of demand observed in the first year could be predicted, increasing the predictive ability of the managers. To reduce the predictability effect, critical incidents were brought in during Year 2 at each quarter, making the companies' environment more turbulent. In spite of this, achievement and performance showed a significant correlation in the fifth (0,696**) and sixth (0,700**) quarters. The significance level declined in the seventh (0,629*) and disappeared in the eighth quarter (0,728). This event suggests that in Year 2, once all teams overcame learning of the rules, short term orientation fail to produce superior results. Problems became more complex demanding from successful teams orientation to the long term. Initial performance based on memorized knowledge and rapid responses were able to add value to companies until a new set of complex critical incidents make prevail team-learning skills.

The same memory effect observed in the previous experiment (Saaia, 2004) could be noticed in correlations between return rates of some consecutive quarters (2 and 3; 3 and 4; 5 and 6; 6 and 7). Correlations are highly

significant and demonstrate that the reached performance in one period affects the subsequent period performance. The last year is an exception to this rule, indicating the possible presence of "end-of-the-game" strategies, despite the teacher's efforts to inhibit such practice.

DATA ANALYSIS OF THE SECOND REPLICATION

The second experiment followed the same design of the first replica and was carried out at the same week with double time scheduled (40 hours, morning and afternoon classes). The 7 groups with 5 members each operated the EG for 8 quarters in an Accounting MsC. program. The same activities were adopted at each quarter of year 1. At the end of year 1 the best performance firm was granted a prize in cash. At this moment it was also announced a comprehensive job rotation exchanging managers among firms. This additional incident has distributed among teams the cognitive learning occurred during year 1 and promoted sharing of best practices in the business games. Besides, critical incidents were the same adopted on first replica during year 2, including the adoption of a new decision form in a forecast cash flow format.

Exhibit 7 shows that correlations between individual achievement and team performance are not statistically significant in all 8 quarters (years 1 and 2). There was no distinction between correlations in Year 1, learning rules phase, and Year 2, with a plenty of more complex problems. Perhaps the negative correlations at the first quarter could reinforce that low achievers were once more faster learners than high achievers considering "daily problems". It can be noted that the memory effect is observed many times in correlations between consecutive quarterly results (2 and 3; 3 and 4; 4 and 5; 6 and 7; 7 and 8).

Exhibit 7

Correlations (Pearson) in the second replicate - database 2003

Correlations (2 Classes)	MED CONH	ROE1	ROE2	ROE3	ROE4	ROE5	ROE6	ROE7	ROE8
Average knowledge (MED, CONH)	1	-0,657	0,175	0,282	0,439	0,472	0,506	0,513	0,484
ROE1	-0,657	1	-0,042	-0,172	-0,299	-0,277	-0,635	-0,573	-0,542
ROE2	0,175	-0,042	1	0,896*	0,521	0,519	-0,121	-0,082	-0,097
ROE3	0,282	-0,172	0,896**	1	0,746*	0,729*	-0,009	0,021	0,014
ROE4	0,439	-0,299	0,521	0,746*	1	0,990**	0,435	0,267	0,254
ROE5	0,472	-0,277	0,519	0,729*	0,990**	1	0,426	0,249	0,233
ROE6	0,506	-0,635	-0,121	-0,009	0,435	0,426	1	0,911**	0,898**
ROE7	0,513	-0,573	-0,082	0,021	0,267	0,249	0,911**	1	0,999**
ROE8	0,484	-0,542	-0,097	0,014	0,254	0,233	0,898**	0,999**	1

Major changes during the two years
in the business game

First simulated Year: "daily problems"
Learning the rules of the game;
Decision form as data entry

Second simulated year: "complex problems"
Dealing with critical incidents; Job rotation;
Decision form as a Cash Flow forecast

** Significance > 0.01 (2-tailed).

* Significance > 0.05 (2-tailed).

CONCLUSIONS

The analysis of results give support to the idea that business games evaluated learning aspects not measured by individual assessment tools. Therefore, in all three studied samples there is a consistent gap between individual achievement and team performance, no matter what the business game is being used, what is the external environment designed in the simulation, or what is the criteria to allocate students in teams. Such gap is a consistent evidence of the organizational learning process observed differently in all groups derived from teamwork short term oriented and not correlated with the objective knowledge, existing a priori in individuals. In all three experiments, low or statistically non-significant correlations between individual students and team performances can be observed. Teamwork results did not represent the simple addition of individual results, as anticipated by Senge's studies (1990), not only in real companies but also in simulated firms.

This is evidence that the problems brought in by business simulations can be designed to study organizational learning for low and high achievers. Challenges may focus daily problems in a short term perspective or more complex problems, long term oriented. High or low achievers, depending on the project's life cycle, could administer new projects demanding for managers. Low achievers considering their competencies seem to respond faster and could supervise short life cycle. As the problems become more complex and the project's life cycle grows to be longer, high achievers were supposed to take over the management since they are expected to be more successful on this perspective.

It reinforces the importance of Business Games, a proven experiential learning method that permits to develop and evaluate managerial competencies not achieved in traditional teacher-centered classes. The idea proposed by

Gentry et al. (1992:21) is confirmed: while objective exams evaluate the "memorized content" Business Games evaluate the development of a strategy – "process".

This study confirms the findings of Sauaia (2004). Participants of distinct profiles (undergraduates and graduates) managing different Business Games (MMG and EG) were observed. High achievers teams were not able to guarantee the best performance when playing as managers. Besides, there is strong evidence that organizational learning occurred during simulation and produced tangible value (ROE) not correlated to previous knowledge.

Besides reinforcing the previous findings, an additional contribution of this study is that in the first replica occurred high and significant correlations during the year 2. Since the adaptation phase of the participants at the new work group is overcome, long-term orientation becomes more important and high achievers produce superior performance as a consequence of organizational learning in a more complex environment. The general believe that teamwork is always more productive than individual work is here rejected. As a recommendation to Business Games administrators, different characteristics of each program should be tested and replicated to exploit learning opportunities, making the experience more challenging and promote a non-repetitive learning to participants and to the teacher himself.

LIMITATIONS

These replications of Sauaia's experiment (2004) reinforced the previous findings and produced external validity for different populations and diverse business games. One can notice a significant correlation between individual achievement and team performance starting in quarters 5, 6, and 7, in data collected from the first replica, which suggests that in future studies it could be isolated initial data from the period game rules are being learned.

Besides, in attempting to produce abundant and better quality data, the number of rounds should be increased to better characterize the organizational learning process in a long-term perspective.

Campbell and Stanley (1979:6) recommend that experiments, even if successful, should have a replication and cross validation in different periods, under other conditions, before they could be incorporated to science and theoretically interpreted with confidence.

REFERENCES

- Badgett, Tom F., Brenenstuhl, Daniel C., and Marshall, William J. An Analysis of Performance in Simulation Games compared to Performance on Structured Course Criteria: a Case Study. *Exploring Experiential Learning: Simulations and Experiential Exercises*, Vol. 5, 1978, 32-8.
- Campbell, D. T. e Stanley, J. C. *Delineamentos experimentais e quase-experimentais de pesquisa*. São Paulo: EPU, 1979.
- Casado, T. The individual and the Team: the key for Development. In.: Fleury, M. T. L. (org.). *People in the organization*. São Paulo: Gente, 2002.
- Fleury, M. T. L. e Oliveira, M. O. J. Learning and Knowledge Management. In.: Fleury, M. T. L. (org.). *People in the organization*. São Paulo: Gente, 2002.
- Gentry, James W., Stoltman, Jeffrey J., and Curtis, William W. (1992) "What is it that we want students to learn: Process or Content?" *Developments In Business Simulation & Experiential Exercises*, Volume Nineteen, 211, 1992.
- Gosenpud, Jerry J. and Washbush, John B. Predicting Simulation Performance: Differences Between Groups and Individuals. *Development In Business Simulation & Experiential Exercises*, Volume 18, 1991
- Henshaw, R.C., and Jackson, JR. (1972) *The Executive Game*. rev.ed. Homewood: Richard Irwin.
- Keys, J. B.; Edge, A. G.; Wells, R. A. (1992) *The Multinational Management Game – A Game of Global Strategy*. 3. ed. Dallas: Business Publications Inc, 1992.
- Sauaia, A. C. A. Individual Achievement Versus Team Performance: An Empirical Study With Business Games. *Developments in Business Simulation and Experiential Learning*, V. 31, p. 154-9, 2004
- Senge, P. *The Fifth Discipline: art, theory and practice of learning organization*. São Paulo: Best Seller, 1990.
- Thavikulwat, P. and Pillutla, Sharma. The tournament concept in assessment. *Simulation & Gaming*, Vol. 35 N.1, March 2004, 5-28.
- Wolfe, Joseph. Correlations Between Academic Achievement, Aptitude, and Business Game Performance. *Exploring Experiential Learning: Simulations and Experiential Exercises*, Vol. 5, 1978, 316-24.