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SIMULATION AND LEARNING DYNAMICS IN BUSINESS GAMES

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ABSTRACT

Purpose: This paper studies the influence of simulation dynamics in the learning of business games participants.

Originality/gap/relevance/implications: Although many studies suggest the influence of factors linked simulation dynamics in the learning of participants of business games, it is unusual to investigate partial and simultaneous influence. Within lots of studies, the purpose is to evaluate the influence of one antecedent factor on learning of participants in business games. To explore possible inter-relationships between independent variables and effects of interaction expands the scope of analysis.

Key methodological aspects: It was examined the statements of 90 undergraduate management students of four institutions of higher education in Brazil, by analysis through multiple linear regression model in six variables linked simulation dynamics (professor, manual, team, complexity, debriefing and duration).

Summary of key results: Two variables composed the multiple linear regression model (debriefing and duration). These variables obtained a degree of association of 59% with the quantum of learning perceived by the participants of business games and explained 32% of its variation.

Key considerations/conclusions: The findings of this study may contribute to elaborate lesson plans with business games describing the influence of factors linked simulation dynamics, many of them under the professor control.

KEYWORDS

Business game. Experiential learning. Simulation dynamics. Management education. Multiple linear regression.

1. INTRODUCTION

The use of business games as a learning tool to educate administrators is popular in undergraduate courses. Faria (1998) observed that more than 95% of the universities allied with the Association to Advance Collegiate Schools of Business (AACSB) used business games in their programs. Araújo, Brito, Correia, Paiva, and Santos (2015), in turn, found that the percentage of institutions that had this curricular component in Brazil was around 50%.

The literature review shows that initially the publications about business games were merely explanatory. Then, they began to address teaching-learning relationships provided by the experience, and more recently they started to use the methodology as a business management laboratory. Numerous researches have shown that business games can contribute to the learning of participants, many of which rely on the theory of experiential learning as theoretical support, notably from the taxonomy of Bloom, Engelhar, Frust, Hill, and Krathwohl (1956) and Kolb's experiential learning cycle (1984).

Research suggests a broad set of variables that may affect the perception of participants regarding simulation, performance, and learning. These variables are related, in summary, to two factors: participant (student), such as gender, nationality, cognitive style, previous academic performance, previous contact with another business game (e.g. Dias, Sauaia, & Yoshizaki, 2013a; Apesteguia, Azmat, & Iriberri, 2012; Sauaia, 2006; Peters & Vissers, 2004; Hornaday & Ensley, 2000; Gosen & Washbush, 1999); and dynamics of simulation, such as complexity of the simulation, duration of simulation rounds, professor, debriefing, manual, method to evaluate the performance of businesses game (e.g. Teach & Murff, 2008; Fitó-Bertran, Hernández-Lara, & Serradell-López, 2014; Meij, Leemkuil, & Li, 2013).

Some of these variables were empirically tested, especially those related to the participant. However, it is unusual to investigate the relative and mixed impact of several independent variables on the perceived learning of business games participants; in most of the studies, the purpose was to evaluate the influence of an antecedent factor on the performance or learning of participants, which weakens the evaluation of business games as an educational practice. Thus, the relevance to investigate possible interrelationships between independent variables is understood, since they can interact, entailing the evaluation of the interaction effects.

The research gap motivated in this study explores, in particular, the influence of simulation dynamics on the learning of business games participants, considering the relative impact of a set of independent variables, as

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well as the possible inter-relations between them, from the theoretical lens of experiential learning. Therefore, this study extends the scope of analysis. It is understood that these relations have not yet been examined, so that discussions are progressing on the condition effects of simulation dynamics on business games participants.

It is expected that the conclusions of this study may help in the construction of lesson plans that include business games, by revealing the influence of factors linked to simulation dynamics, many of which are under the professor's control, such as taking or not a passive role in the teaching-learning process, or to include debriefing steps in the simulation dynamics etc.

2. THEORETICAL BACKGROUND

Starting from 1950, with the development of micro computing, there were simulations for didactic support that allowed the development of teaching-learning experiences called business games. The use of such simulations as a teaching tool in Higher Education Institutions (HEI) dates back to 1956 in the United States (Keys & Wolfe, 1990). In Brazil, according to Lopes and Souza (2004), its use in HEI began in 1962 at Fundação Getúlio Vargas. Since then, the use of business games as a teaching-learning tool in business schools has been increasing (Araújo *et al.*, 2015; Motta, Quintella, & Melo, 2012a). Its use as a teaching-learning tool among business students has grown steadily throughout the world, and the main reason for its popularity seems to be associated with the view that business games are instruments that allow students to learn from playful experiences that take participants as central actors in the teaching-learning process (Sauaia, 1995; Gentry, 1990; Lopes, 2001; Peach & Hornyak, 2003).

In this study, which focuses on the educational function of business games, it is defined as an educational technique developed to provide the participant with a playful learning experience based on the representation of a business reality, through simulation techniques and by experiencing the interactivity of teamwork (Naylor, 1971; Goldschmidt, 1977; Lacruz, 2004). In other words, business games are recreated business environments, in which several groups manage different virtual companies competing in the same industry, allowing participants to learn from their own experience.

In this perspective, several studies on business games were based on the experiential learning cycle proposed by Kolb (1984) to support the use of business games as a teaching-learning tool (e.g. Ben-Zvi & Carton, 2008, Crookall & Thorngate, 2009, Meij *et al.*, 2013, Dias *et al.*, 2013a, Araújo *et al.*, 2015). In the words of Kolb (1984, p. 38), "learning is the process whereby knowledge is created through the transformation of experience." At the core of this conceptualization, one may find the tension between dialectical dimensions, concrete/abstract and active/reflective, which is solved by mental operations of grasping experience and its transformation, by considering learning as a spiral quadric cycle where people learn through experience, which support the translation of experiences into concepts, allowing their application in new experiences: concrete experience, abstract conceptualization, reflective observation and active experimentation.

Kolb (1984) explains that in the process of grasping, people grasp (apprehend) and appropriate (understand) knowledge through concrete experience and abstract conceptualization, and the process of transformation leads to the creation of meaning for living through reflective observation and active experimentation. In summary, in the experiential learning cycle, apprehension and transformation are combined by the understanding and transformation of experience, in which people exercise the role of actor (action) and observer (reflection). In this connection, Crookall and Thorngate (2009) and Ben-Zvi and Carton (2008) argue that the simulation can connect action (concrete experience) and knowledge (abstract conceptualization) from the perspective of the experiential learning cycle. They affirm that action leads to knowledge, which in turn leads and perfects action.

In business games, the experiential learning cycle begins with concrete experience, unfolding the effects with which the participants have contact in the simulation that lead to the apprehension of conditions of immediate experience. After considering the example from immediate experience, it is possible to examine and select actions that can be taken in similar circumstances by projecting plausible results of these actions, which leads to general comprehension and understanding of a generalized lived experience, where explanatory hypotheses emerge not only for the particular example of that experience. Finally, when the general principle is understood, the results of learning can be tested, in active experimentation, within the possibilities offered by generalization, from which learning cycle is continually renewed.

Research have shown that business games participants perceive it as a teaching tool that provides a great deal of involvement and participation (e.g. Lopes, 2001; Peach & Hornyak, 2003), which contributes greatly to learning in managerial training (e.g. Sauaia, 1995; Cannon & Burns, 1999; Lacruz & Villela, 2006; Motta, Melo, & Paixão, 2012b; Dias, Moreira, & Stosick, 2013b; Fitó-Bertran, Hernández-Lara, & Serradell-López, 2015). From that, it can be assumed that participation in business games contributes to learning in terms of managerial training. In many researches, the *quan-*

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tum of learning resulting from participation in business games was measured by the self-statement of the participants, according to Gentry's suggestion (1990) that from the perspective of the theory of experiential learning that the assessment of learning is done by the participants themselves as an integrated part of the learning process; from which it is assumed that the *quantum* of learning derived from business games participants can be measured by the self-statement of participants. It is important to note that in spite of assuming such assumptions, the complexity involved in defining and measuring "learning" – which, in business games, has been defined in most studies from the taxonomy of Bloom *et al.* (1956) and Kolb's experiential learning cycle (1984) – is measured by participants' self-statement. On the other hand, there is a sufficient number of studies that allow arguing that business games are a valid method to teach management.

The literature shows that there is a broad set of variables that can affect perceived learning of participants. It can be linked in general to the participant (such as gender, nationality, cognitive style, previous academic performance, previous contact with another simulated environment, etc.) and simulation dynamics (such as simulation complexity, simulation duration, professor, debriefing, manual, method to evaluate the performance of simulated companies, method for selection of teams, etc.). Most of the revised studies focused on the evaluation of the influence of a factor linked to the participant, on their performance or their learning. In this study, the focus centers on the influence of variables linked to the simulation dynamics on the perceived learning of participants. In this respect, the variables investigated in this study are presented in Chart 1, as well as the findings of other revised studies regarding the surveys made:

Chart 1

VARIABLES LINKED TO THE DYNAMICS OF SIMULATION INVESTIGATED IN THE STUDY

Variables	Evidences
Simulation complexity	More complex simulations contribute to learning more than less complex simulations (p-value < 0.01) (Wolfe, 1978).
	Realism, produced through complexity, is a determining factor for learning of business games participants (Hall & Cox, 1994).
	In the main component of factorial model, the most Complex Simulation variable was associated with the factor Complexity (factorial load = 0.723 and commonality = 0.589) (Sauaia, 1995).

(continue)

Chart 1 (continuation)

VARIABLES LINKED TO THE DYNAMICS OF SIMULATION INVESTIGATED IN THE STUDY

Variables	Evidences
Duration of the simulation rounds	The simple linear regression model indicated that the duration can be predicted from the number of decisions (assumed as proxy for complexity) with significant beta weight (β = 0.829, p-value < 0.01), leading to the proposition that the duration of simulation, together with complexity, influences the learning of business games participants (Hall & Cox, 1994).
	In the factorial model of main components, the variable Longest Duration was associated with Learning Climate (factorial load = 0.439), Satisfaction (factorial load = 0.420) and Complexity (factorial load = 0.381) factors. The commonality was 0.601 (Sauaia, 1995).
Professor	There was no identification of statistically significant correlation or beta weight (p-value > 0.05) between student learning and professor (Mayer, Dale, Fraccastoro, & Moss, 2011).
	In the factorial model of main components, the variable Administrator of the simulation (professor) was associated to the factors of Cognitive learning (factorial load = 0.324) and Parameters of the experience (factorial load = 0.397). The commonality was 0.475 (Sauaia, 1995).
Debriefing	The *quantum* of perceived learning of business games participants with debriefing is superior to that of those who participated in simulations without debriefing (p-value < 0,05). The mean effect size (d = 0.45) shows an average improvement of 18% for debriefing (Lacruz, forthcoming).
	In business games, there is a risk that the participants do not complete the experiential learning cycle due to a lack of reflective activities; therefore, it is advisable to include stages that stimulate the analysis of the results of the simulation round so that reflective observations may contribute to the thorough completion of the experiential learning cycle (Dias *et al.*, 2013a).
Manual	There is a significant correlation between learning and the manual for business games (r = 0.32, p-value = 0.001). In addition, the results of the regression analysis indicated that learning can be predicted from the way students learned the simulation with significant beta weight for learning from the manual (β = 0.34, p-value = 0.001) (Mayer *et al.*, 2011).

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Chart 1 (conclusion)

VARIABLES LINKED TO THE DYNAMICS OF SIMULATION INVESTIGATED IN THE STUDY

Variables	Evidences
Team	There is a significant correlation between learning and the peers (r = 0.20, p-value = 0.049). In addition, the results of regression analysis indicated that transfer of learning can be predicted from the way students learned the simulation with significant beta weight for learning from the peers (β = 0.24, p-value = 0.018) (Mayer *et al.*, 2011).
	In the main component factorial model, the variable Teammates was associated with the factors of Cognitive learning (factorial load = 0.305) and Team performance (factorial load = 0.508). The commonality was 0.538 (Sauaia, 1995).

Source: Elaborated by the author.

The literature review, in international and national journals, also revealed that investigating the relative impact of several independent variables on perceived learning of business games participants is uncommon, and more distinctly in the Brazilian case; where in most studies the objective is to evaluate the influence of an antecedent factor on the performance or learning of the participants. It is understood the relevance of investigating the possible interrelationships between the independent variables, and the effects of the interaction. This research gap motivated the continuance of this study, which explores the relative and combined influence of variables linked to the simulation dynamics in the learning of business games participants, based on the theoretical lens of experiential learning. Therefore, the objective question of research is presented: **What is the influence of simulation dynamics in the learning of business games participants?** The following is the selection process and the architecture of the business game used in this study.

3. SELECTION OF THE BUSINESS GAME

The selection of the business game presented a dilemma that should be discussed at this point. If on the one hand the use of a single set of companies would make the results of this study particularly dependent on the

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simulation used, using different simulations would not allow the participants' opinions regarding the simulation (such as its complexity) to be treated as related to the same object. In order to analyze the influence on the learning perception of variables related to the dynamics of simulation, which includes elements related to the simulation, a single set of companies was chosen. It is recognized that such a design leads to a bias in the results, but it is believed that its findings, even if dependent on a particular set of companies, can reveal relations between the independent variables linked to the simulation dynamics, and those (individually and combined) facing the perceived learning of business games participants. In most of the studies, the purpose was to evaluate the influence of an antecedent factor on the performance or learning of the participants – this investigation partially fills this research gap.

In order to select the business game, criteria were initially adopted from the structural aspects of business games (Teach, 1990; Lacruz, 2004): manual, simulation, professor, team, duration, competition, feedback and debriefing. Initially, non-computer simulations were excluded, assuming that the complexity and interactivity of these types of simulations would not satisfy those sought in this study; also those non interactive, meaning the decisions of each team did not influence nor were influenced by the others; applied at a distance, without the direct assistance of the professor; those functional, that focused on only one area of the company; simulations that did not have a student (director) or professor manual; those whose simulated companies were not formed by groups of students, each with a clearly defined role; and those that does not have a system of feedback of the market and the company (managerial reports, newspapers with data of the market etc.).

Thereafter, there were also excluded those that did not have a wide number of applications, since the results of the study will be related to the simulation in particular; and whose necessary investment for its acquisition or use was not impeding. Following, the GI-MICRO business game (version 6 demo – limited to four-round processing) was selected, developed by the Business Games Laboratory, linked to the Federal University of Santa Catarina, because it was a simulation that was used in a number of studies (e.g. Oliveira, 2002; Mecheln, 2003; Gerber, 2006; Gaio, 2008; Souza & Cardoso, 2012) and several higher education institutions as a learning tool (Motta & Quintella, 2012). Finally, the level of complexity used in the simulation was normal, among the minimum, simple, normal and high options.

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4. METHOD

This cross-sectional, descriptive study can be characterized as a survey (Cooper & Schindler, 2003), since its main objective is to describe relations between variables based on the self-perception of business games' participants. The support on which this study is developed is the teaching-learning process in the business administration area, more specifically under the theoretical lens of the experiential learning theory. In similar research where business games were studied as a teaching-learning instrument for business administration courses and under the same theoretical lens, surveys were used as a data collection tool seeking to identify the main dimensions present in business games, and the levels of the participants' learning and satisfaction (e.g. Sauaia, 1995, Lopes, 2001; and Peach & Hornyak, 2003). From these references, and from the application of business games' experience, the instrument of data collection was elaborated comprising the aspects presented in Chart 2.

The survey was elaborated based on data collection instruments used in other studies, confronting the dimensions of the questions with the literature. Initially a matrix was built: survey question versus survey author; then the questions were grouped into dimensions; other dimensions considered not relevant for this study were excluded, such as those related to the participants' satisfaction with the activity. Finally, the relation of each dimension to the findings of other studies was sought.

The perception of learning was measured using a Likert scale, which has been adopted as an interval, under the premise that respondents will treat the differences between adjacent categories as equals (Malhotra, 2008).

As pointed out, the literature shows a broad set of variables that may affect the perception of business games' participants in relation to their learning. In this sense, the GI-MICRO business game was applied to undergraduates from the 8th period of the business administration course[1] (from three private and one federal IES) and without previous experience with business games. In addition, the applications were made by the same professor and included the same number of rounds (4) of the simulation between the first academic semester of 2015 and 2016. A total of 96 students participated in the simulation. Four groups of students were organized (as indicated in the GI-MICRO manual, so that each student could assume the directive: general, marketing, financial and production).

1 According to the academic periods for the Brazilian business administration program.

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Chart 2

DESCRIPTION OF VARIABLES

Theme		Variable	Theoretical Background
Age	Continuous	Complete years	–
Genre	Nominal	Female (0) and Male (1)	*Apesteguia et al. (2012); Florea et al.* (2003)
Learning	Ordinal (Likert)	To acquire new knowledge	Sauaia (1995); Cannon and Burns (1999); Lacruz and Villela (2006); Dias *et al.* (2013a); Fitó-Bertran *et al.* (2015)
		Integrate knowledge from various areas of administration	
		Update knowledge that was already present	
		Identify problems, evaluate alternatives, formulate and deploy solutions and evaluate their results	
		Develop systemic (holistic)	
		Adapt to new situations (flexibility)	
		Stimulate Teamwork	
		Develop / Improve Leadership	
		Troubleshoot conflicts	
Simulation dynamics	Ordinal (Likert)	Duration of the simulation rounds	Wolfe (1978); Hall and Cox (1994); *Sauaia (1995); Mayer et al.* (2011); Dias *et al.* (2013b); Lacruz (forthcoming)
		Complexity of the simulation	
		Professor	
		Team	
		Simulation Manual	
		Debriefing	

Source: Elaborated by the author.

The author of this study was the professor of all simulations, guaranteeing uniformity and consistency both in the preparation and implementation of the business game and also in the procedures for data collection. Added to this, it was assured that the operational parameters indicated by

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Ben-Zvi and Carton (2008) were followed in all simulations, assumed as important for the approximation between business games and the experiential learning cycle to promote its participants' learning: previous guidance, debriefing and adoption of a passive role by the professor.

Initially, the presentation of GI-MICRO business games is performed: participants had previously received the director's manual, emphasizing the rules and scenario of the simulation, and the dynamics of the activity. Then, each group prepared the planning for their simulated company and the decision rounds were started. In each of the four rounds, after the decisions were processed by the simulation software, the groups received feedback from the decision results through reports and market information by the newspaper and a partial ranking and debriefing. Once the fourth round was completed, the final ranking was defined, having as criterion the accumulated profit. At the end, the survey was applied to the participants.

As there is no consensus on the debriefing process (Sims, 2002; Meij *et al.*, 2013), it is important to characterize the assumed setup. Using the experiential learning cycle (Kolb, 1984), a semi-structured debriefing script was made based on a model proposed by Sims (2002). The setup can be characterized as an oral and collaborative self-debriefing, guided by the professor and conducted at the end of each round of the business game and without the participation of external observers.

Thus, it was intended to control the variables that could affect the perception of participants of business games in relation to their learning: applying the same business game and an equal number of rounds (4 rounds of GI-MICRO); engaging participants who followed the same academic level (8th business administration period), with no previous experience with business games, equally distributed in each group (4 students per group); and including the same professor of the simulation, who used the same operational parameters of application (prior orientation, debriefing and passive role assumed by the professor).

The data were collected through a self-administered structured survey, using the online platform Survey Monkey. The survey was applied at the end of the business game, with the presence and supervision of the simulation's professor. Of the 96 participants, 93 answered the survey online. After analyzing the missing data, the final sample consisted of 90 cases, of which 58 were women and 32 were men with a mean age of 23.37 years and a standard deviation of 4.09 (in other words, with 17.5% dispersion around the mean) (Table 1).

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Table 1

SAMPLE DESCRIPTION

HEI	Companies	Students	Respondents	Valid surveys	Answer rate
Private_1	08	32	32	31	97%
Private_2	06	24	24	24	100%
Private_3	06	24	22	21	88%
Federal	04	16	15	14	88%
Total	24	96	93	90	94%

Source: Elaborated by the author.

In relation to the size of the sample, estimated by the software GPower 3.1, considering mean effect size ($f^2 = 0.15$), significance level (α) 0.05, statistical power ($1-\beta$) 0.8, three predictors of a total of seven, the minimum sample size would be 77 observations. Regarding the survey, a pre-test was performed through protocol analysis, in which the respondent "thinks aloud" (Malhotra, 2008), in order to identify misunderstandings in the data collection instrument. Eight students (divided into two groups of four students) participated in the pre-test, from a private HEI that is not included in the sample, after having participated in four rounds of the same business game. It was determined that these participants were exclusively involved in the pre-test. The research basis to carry put the pre-test consisted of a sample that constituted 8.3% of the predicted population (96).

In order to understand the relative and combined influence of the variables related to the dynamics of the simulation on the perceived learning of business games participants, multiple linear regression was used. Out of the data the Perceived Learning Intensity (PLI) variable was created, as a combined mean resulting from the average of the opinion variables about learning (Chart 2). This variable was taken as dependent. In addition, it is reported that the gender variable was used as the control variable.

A hierarchical regression model was used. In the first block, the control variable (gender) was forced in, and in the others, the stepwise method was used to select variables from the regression model; usually chosen for descriptive studies, when the most relevant variables is the focus of interest. In the stepwise method, only variables that significantly contribute to the adjustment of the regression model are incorporated. The contribution of each variable is established by contrasting, from the partial correlations, the hypothesis of independence between that variable and the dependent varia-

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ble. In this study, the rule for the entry and removal of variables to the model was thus established: p-value input < 0.05 and p-value output > 0.10. It should be noted that the assumptions made by the multiple linear regression model were validated and that the size of the multiple regression effect was verified and the reliability of the scale used in the survey was estimated. In the data processing, the software SPSS 20 (multiple linear regression and Cronbach's alpha) and GPower 3.1 (statistical power of the test and Cohen's f^2 index) were used.

5. RESULTS AND DISCUSSION

Before starting the measurement extraction procedures, the reliability of the scale used in the survey was estimated using the Cronbach's alpha coefficient. The result (Cronbach's alpha = 0.7) indicates that the scale used to measure participants' perception was considered adequate, since it is above the threshold (Cronbach's alpha > 0.6) from which the value is considered appropriate for non-causal studies (Hair, Black, Babin, Anderson, & Tatham, 2009). The variables of the study were then characterized in order to broaden the understanding of the results (Table 2).

Table 2

DESCRIPTIVE STATISTICS

Statistics	PLI	Professor	Manual	Team	Complexity	Debriefing	Duration
Mean	4.37	4.43	3.04	2.81	4.54	4.72	4.41
Standard deviation	0.44	0.81	1.02	1.26	0.79	0.45	0.76

Source: Elaborated by the author.

The averages, except for the Manual ($\bar{X} = 3.04$) and Team ($\bar{X} = 2.81$) variables, were high (greater than 4 on a scale of 1 to 5), denoting that the participants' perception on the importance of the team and the manual for their own learning in business games is moderate to low. On the other hand, the dispersion around the mean of the 6 independent variables can be considered low, with the exception of the Manual and Team variables, whose dispersion is moderate, denoting a more heterogeneous profile of the participants in relation to these aspects. Additionally, the perception about learning intensity has a high average ($\bar{X} = 4.37$) and is poorly dispersed ($S = 0.44$), so that the average represents well the participants' perception of the learning benefits that come from participating in the business game.

The correlation test (Table 3) leads to the identification of 3 independent variables as candidates for the regression model: Complexity (r = 0.343, p-value < 0.01), Debriefing (r = 0.479, p-value < 0.01) and Duration (r = 0.424, p-value < 0.01), since the others did not have statistically significant correlations with the dependent variable (PLI). This considerable reduction reinforces the decision to use the stepwise estimation procedure. In addition, it becomes evident that there are few statistically significant correlations between independent variables, reinforcing the choice of this set of variables as predictors. It was observed a moderate correlation ($0.3 < r \leq 0.50$), following the criteria of Miles and Shevlin (2001), between the Complexity and Duration variables (r = 0.368, p-value < 0.01), and low ($0.1 < r \leq 0.30$) between the Professor and Debriefing variables (r = 0.211, p-value < 0.05) and Complexity and Debriefing (r = 0.207, p-value < 0.05). Finally, it was pointed out that no statistically significant correlation was found between the dependent variable and the control variable (gender).

Table 3

PEARSON CORRELATION MATRIX

Variables	PLI	Gender	Professor	Manual	Team	Complexity	Debriefing	Duration
PLI	1		0.155	0.102	0.021	0.343**	0.479**	0.424**
Gender	0.002	1	0.227*	-0.082	0.018	-0.105	0.006	-0.179
Professor			1	0.058	-0.205	-0.109	0.211*	-0.092
Manual				1	0.138	0.109	-0.120	0.092
Team					1	-0.042	-0.034	0.128
Complexity						1	0.207*	0.368**
Debriefing							1	0.205
Duration								1

Note: The * symbol indicates that the correlation is statistically significant at 5% (two-tailed) and ** at 1%.

Source: Elaborated by the author.

For the construction of the best regression model, a hierarchical regression was initially made, forcing in the first block the input of the control variable (*dummy*), and in the second block, using the stepwise method to select the variables (Table 4).

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Table 4

REGRESSION ANALYSIS OF THE DETERMINANTS OF PERCEIVED LEARNING INTENSITY

Variables	Block 1 (Control)			Block 2			Block 3		
	B	β	T	B	β	t	B	β	T
(Constant)	4.374		74.540**	2.141		4.848**	1.597		3.684**
Gender	-0.002	-0.002	-0.023	0.000	0.000	0.003	-0.058	-0.063	-0.709
Debriefing				0.473	0.479	5.090**	0.401	0.406	4.550**
Duration							0.205	0.352	3.873**
F	0.001			12.954**			15.025**		
R	0.002			0.479			0.586		
R2	0.000			0.229			0.344		
R2 Adjusted	-0.011			0.212			0.321		

Note: The * symbol indicates that it is statistically significant at 5% and ** at 1%.

Source: Elaborated by the author.

Note that the control variable (gender) was not related to the dependent variable (perceived learning intensity). The explained variance was null ($R^2 = 0.000$). It is also observed that only the Debriefing and Duration variables composed the regression model, having as a rule to enter and remove variables to the p-value model < 0.05 and p-value > 0.10, respectively, in terms of ratio F (Table 4). Although the variable Complexity has emerged as a candidate for the regression model (Table 3), it did not compose the model, possibly due to the stepwise method, which in the processing of the best set of explanatory variables, by avoiding problems of multicollinearity, usually defines models with few explanatory variables, as noticed by Hair *et al.* (2009).

It is therefore necessary to verify if, with the introduction of the variable Complexity, there is an effect of redundancy (that is, predictors positively correlated with each other in the equation) and whether this possible effect causes loss of an important part of the explanation of the studied phenomenon or the parsimony in the explanation of a criterion. Therefore, regressions were made with the control variable and the combination of the Complexity variable with those that emerged from the stepwise method (Debriefing and Duration). All models with the combination of two variables presented significant regression coefficients (p-value <

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0.05). The combination with the three variables, however, presented a non-significant regression coefficient (p-value ≥ 0.05) for the Complexity variable. It was also seen that the regression coefficients of the Debriefing and Duration variables were reduced with the introduction of the Complexity variable (see Tables 4 and 5), which confirms the redundancy effect in the regression model with the introduction of the Complexity variable.

Table 5

VERIFICATION OF THE REDUNDANCY EFFECT

Statistics	Debriefing and Complexity		Duration and Complexity		Debriefing, Duration and Complexity		
	Debriefing	Complexity	Duration	Complexity	Debriefing	Duration	Complexity
B	0.425**	0.258**	0.359**	0.221*	0.384**	0.298**	0.162
R2 Adjusted	0.268		0.201		0.336		

Note: The * symbol indicates that it is statistically significant at 5% and ** at 1%.

Source: Elaborated by the author.

It was also verified if there was an interaction effect between Debriefing and Duration variables; that is, when the independent-dependent variable relationship of the regression model is affected by the second independent variable. For this, a new hierarchical regression was processed, including in Block 1 the control variable and the variables that emerged from the stepwise method (Debriefing and Duration) and in Block 2 the Mod interaction term (Debriefing X Duration).

$$PLI = \beta_0 + \beta_1(Debriefing) + \beta_2(Duration) \quad (1)$$
$$PLI = \beta_0 + \beta_1(Debriefing) + \beta_2(Duration) + \beta_3(Mod) \quad (2)$$

In equation 1, there were included only the direct relations involving the independent variable that emerged from the stepwise method. In equation 2, besides these relations, the term of interaction appears. To test the moderator effect, it was evaluated whether the regression coefficient of the interactive variable () is significantly different from zero and, in this case, the increase occurred in the adjusted coefficient of determination () (Whisman & McClelland, 2005). See Table 6.

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Table 6
VERIFICATION OF THE INTERACTION EFFECT

Variables	Block 1			Block 2		
	B	β	t	B	β	T
(Constant)	1.597		3.684**	-2.383		0.878
Gender	-0.058	-0.063	-0.709	-0.053	-0.057	-0.647
Debriefing	0.401	0.406	4.550**	1.230	1.247	2.177*
Duration	0.205	0.352	3.873**	1.148	1.971	1.802+
Mod				-0.196	-1.977	-1.486+
F		15.025**			11.979**	
R		0.586			0.600	
R2		0.344			0.360	
R2 Adjusted		0.321			0.330	

Note: Mod is the abbreviation for the interaction term (Debriefing X Duration). The + sign indicates that it is statistically significant at 10%, * at 5% and ** at 1%.

Source: Elaborated by the author.

It was observed that no moderator effect was identified, since the termination coefficient of the interaction term (Mod) was not statistically significant (p-value ≥ 0.05). The results also show that the moderate relation presents an adjusted coefficient of determination (R^2 adjusted = 0.330) only 2.8% higher than the original estimated non-moderate equation (R^2 adjusted = 0.321); which, by the criterion of parsimony, reinforces the option for the equation without the term of interaction – instead of assuming a milder level of significance of 0.10.

For a better evaluation of the regression results (Table 4), the assumptions made by the multiple linear regression model were verified. The variance inflation factor (VIF) denoted the absence of multicollinearity (< 5), according to a criterion suggested by Gujarati (2000). The condition index (< 30) indicated that the variables would not present collinearity problems if they stayed together, as proposed also by Gujarati (2000). Therefore, it is assumed that each variable independent from the model explains different plots of the variation of perceived learning intensity of business games participants. The value was 1.999 for the Durbin-Watson statistic. In the table of critical values d_L and d_U of the Durbin-Watson test, at the significance level of 0.05, there is $d_U \cong 1.801 < 1.999 < 2.19 \cong 4$, being no evidence to

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reject the null hypothesis. Thus, it is assumed that the stochastic perturbation term is independent. The Breusch-Pagan test did not allow rejecting the null hypothesis of stochastic perturbation term (LM = 1.109, p-value = 0.574) and the Shapiro-Wilk test did not allow rejecting the null hypothesis of normal distribution of the stochastic term (SW = 0.974, p-value = 0.072), from which the normality prerequisite can be assumed.

The Debriefing and Duration variables obtained an association degree of 58% with the learning intensity – that is, the multiple correlation between the dependent variable and the predictor score. In turn, the adjusted coefficient of determination (R^2 adjusted) shows that 32% of the variation in perceived learning intensity is explained by the combined variation of the variables emerged in the model. It should be noted that although the adjusted coefficient of determination may seem low (R^2 adjusted = 0.321), it is common to find values of this order in practical applications of multiple regression analysis in the social sciences. For example, the study by Mayer *et al.* (2011), whose regression analysis uses the variables manual, professor, interaction with the team and professor, to analyze how the simulation was learned by the participants of the business game, obtained R^2 = 0.18. In addition, R^2 captures only the relationship between the variables used in the model. As only two variables captured the relation (R^2 adjusted = 0.325) in a situation of inexistence of innumerable other factors (variables not contemplated), the model can be considered satisfactory.

In this study, there were no variables related to the simulation dynamics, such as gender (e.g. Apesteguia *et al.*, 2012, Florea *et al.*, 2003), cognitive style (e.g. Dias *et al.* 2013a), previous academic performance (e.g. Sauaia, 2006), etc.; it can be argued that the study findings are important elements for understanding the research question and remain as a contribution for future studies.

By means of the Anova analysis, which provides the statistical test for the general adjustment of the model in terms of F ratio, evidence was found that allow rejecting the null hypothesis where the coefficient of determination is equal to zero. Moreover, at least one of the independent variables (Debriefing and Duration) influences the intensity of learning. Therefore, the statistical significance of the explanatory variables is demonstrated. In other words, the use of the Debriefing and Duration variables reduces the square error that would occur if only the mean of the dependent variable (PLI) was used to predict it by 34% (as observed by R^2), and such a reduction is considered statistically significant (p-value ≅ 0.000).

The beta weights, expressed on a standardized scale (β), represent a means to evaluate the relative importance of the individual variables (Debriefing and Duration) in the general prediction of the dependent variable (PLI).

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The most relevant variable was Debriefing. It is difficult to classify the variables as high or low; however, observation of the relative magnitude indicates Debriefing = 1.15 (Duration). The beta weights of the variables, although not large, have a substantial impact on the general regression model and are statistically significant, since through the t test we can reject the hypothesis that the coefficients are equal to zero (p-value < 0, 05).

In the setup of the simulation dynamics, considering only the independent variables tested, one part is under greater control of the professor: (Professor) who decides to assume a role more or less passive in relation to the simulation; (Duration) distributes the available time between the simulation steps; (Complexity) parameterizes the simulation (initial configuration and changes throughout the rounds) and determines the partial and final deliveries, besides the calculation form for the winning team; (Debriefing) includes or not a step in the dynamics and more or less encourages the promotion of reflective practices in the results evaluation processes and decision making. In relation to others, the control is reduced: (Team) the size of the team can interfere, the heterogeneity of genders, ages, etc.; (Manual) determines how to present the guidelines (initial presentation) and the time for its reading before the simulation starts. The variables that emerged from the model focus on those in which the professor has greater control, which makes the results particularly interesting.

It is suggested that the participants of business games should not take time to reflect in depth during the simulation about the challenges faced, the decisions made, and the effects resulting from their performance, often due to the pressure related to the established time limits for the delivery of decisions, to the complexity of the activity, and the character of competition between the teams; the completion of the experiential learning cycle is the priority. Furthermore, debriefing marks the proper moment for reflection on the actions taken and feelings experienced, contributing to the insights and generalizations derived from the simulation, according to Dias *et al*. (2013a), allowing the professor to perceive these circumstances and change the activity setup in order to achieve an effective learning of the participants.

In summary, the results lead one to believe that the debriefing stage; the duration between the simulation rounds, is responsible for the most relevant explanation of expected variations in the perceived learning intensity of business games participants. Consequently, in this empirical verification (dependent on inferences induced to statistical errors), the findings of other studies (Chart 1) are complemented (Chart 3), contributing with the theory in the understanding of possible interrelations between the simulation dynamics and the perceived learning of business games participants.

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Chart 3
SUMMARY OF EVIDENCE

Variables	Evidences from other studies	Evidences from this study
Simulation complexity	More complex simulations contribute to more learning than less complex simulations (p-value < 0.01) (Wolfe, 1978). Realism, produced through complexity, is a determining factor for learning of business games participants (Hall & Cox, 1994). In the factorial model of main components, the most Complex Simulation variable was associated with the Complexity factor (factorial load = 0.723 and commonality = 0.589) (Sauaia, 1995).	The complexity, despite having a moderate statistical correlation with the perceived learning intensity of business games participants (r = 0.343, p-value < 0.01), did not compose the regression model. Redundancy was identified with the Debriefing and Duration variables.
Duration of the simulation rounds	The simple linear regression model indicated that the duration can be predicted from the number of decisions (assumed as *proxy* for complexity) with significant beta weight (β = 0.829, p-value < 0.01), leading to the proposition that the duration of the simulation, together with the complexity, influences the learning of business game participants (Hall & Cox, 1994). In the factorial model of main components, the longest Duration variable was associated with the factors Learning Climate (factorial load = 0.439), Satisfaction (factorial load = 0.420) and Complexity (factorial load = 0.381). The commonality was 0.601 (Sauaia, 1995).	The duration of the simulation rounds presented a moderate statistically significant correlation with the perceived learning intensity of business games participants (r = 0.424, p-value < 0.01) and composed the regression model (β = 0.352, p-value ≅ 0.000). In addition, it presented a statistically significant correlation with the complexity of the simulation (r = 0.368, p-value < 0.01).
Professor	No statistically significant correlation or beta weight (p-value > 0.05) was found between student learning and professor (Mayer *et al.*, 2011). In the factorial model of main components, the variable professor was associated to the Cognitive learning (factorial load = 0.324) and Parameters of the experience (factorial load = 0.397) factors. The commonality was 0.475 (Sauaia, 1995).	No statistically significant correlation or beta weight was identified between the perceived learning intensity of business games participants and the professor of the simulation. The professor presented a statistically significant correlation with the debriefing stage (r = 0.211, p-value < 0.05).

(continue)

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Chart 3 (conclusion)

SUMMARY OF EVIDENCE

Variables	Evidences from other studies	Evidences from this study
Debriefing	The quantum of perceived learning of business games participants with debriefing is superior to that of those who participated in simulations without debriefing (p-value < 0.05). The mean effect size (d = 0.45) shows an average improvement of 18% because of the debriefing (Lacruz, forthcoming).	The debriefing stage presented a moderate statistically significant correlation with the perceived learning intensity of business games participants (r = 0.479, p-value < 0.01) and composed the regression model (β = 0.406, p-value ≅ 0.000). In addition, it presented a statistically significant correlation with the complexity (r = 0.207, p-value < 0.05) and professor (r = 0.211, p-value < 0.05) variables.
	In business games, there is a risk that the participants do not complete the experiential learning cycle due to a lack of reflective activities, suggesting the need to add new stages to the process that could stimulate the analysis of the results of the simulation rounds so that reflective observations may contribute to the completion of the experiential learning cycle (Dias *et al.*, 2013a).	
Manual	There is a significant correlation between learning and the business game manual (r = 0.32, p-value = 0.001). In addition, the results of the regression analysis indicated that learning can be predicted from the way students learned the simulation with significant beta weight for learning from the manual (β = 0.34, p-value = 0.001) (Mayer *et al.*, 2011).	No statistically significant correlation or beta weight was identified between the perceived learning intensity of business games participants and the simulation manual, nor with any of the other variables considered to evaluate the simulation dynamics.
Team	There is a significant correlation between learning and the team (r = 0.20, p-value = 0.049). In addition, the results of regression analysis indicated that the transfer of learning can be predicted from the way students learned the simulation with significant beta weight for learning from the team (β = 0.24, p-value = 0.018) (Mayer *et al.*, 2011).	No statistically significant correlation or beta weight was identified between the perceived learning intensity of business games participants and the team, nor with any of the other variables considered to evaluate the simulation dynamics.
	In the main component factorial model, the variable Teammates was associated with the Cognitive learning (factorial load = 0.305) and Team performance (factorial load = 0.508) factors. The commonality was 0.538 (Sauaia, 1995).	

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In order to verify the statistical power of multiple regression, the effect size was calculated. By the criterion classification proposed by Cohen (1988) for regression, the effect size is considered large ($f^2 = 0.52 > 0.35$). Cautiousness is necessary for interpreting the size of effect classification. Cohen's classification (1998) was adopted, since particularly new results were explored in this study, and could not be compared with previous findings in the literature. On the other hand, its results, with the presentation of effect size, allow other studies to compare the average effectiveness of the model developed in this study, in the light of its research area, giving practical meaning to the effect size. Assuming the significance level of 0.05, the statistical power was approximately 0.99. According to Hair *et al*. (2009), in multiple regression, statistical power refers to the probability of detecting a statistically significant a specific coefficient level of determination or regression for a given sample size and significance level. For example, considering the statistical significance level of 0.05, power of 0.8 and 5 independent variables, a sample of 100 observations would detect R^2 values greater than or equal to 12%.

Regarding the scope of the results, examination of the R^2 adjusted reveals small loss in predictive power when compared to the value of R^2 (0.321 and 0.344, respectively – see Table 4), which suggests a lack of over-adjustment. In addition, the minimum sample size before the parameters reached in the study ($f^2 = 0.52$, $\alpha = 0.05$, $1\text{-}\beta = 0.99$, 2 predictors and a total of 7) that were estimated by using GPower 3.1 software, would be 45 observations; therefore, half of the sample size of this study. In addition, an estimation of the parameters was done by the bootstrapping resampling technique, which is a non-parametric procedure that generates subsamples from the original sample, estimating the parameters for each sub-sample (Mooney & Duval, 1993). In this study, the number of five thousand subsamples was defined in order to obtain more accurate estimates of significance levels. The regression model with bootstrapping presented convergent coefficients in terms of statistical significance; only the confidence interval of the Duration variable of the regression with bootstrapping presented a variation of ≥ 10%. It is then assumed that the results are not specific to the sample used in the estimation equation; although it was not possible, due to limitation of the data set, to perform direct validation by evaluating the matching of results from another sample of the population, since partitioning the samples into analysis and tests samples would not allow for the minimum proportions of number of observations per independent variable. On the other hand, the same cannot be considered assuming the generalization of the results to other business games, because the

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results are particularly dependent on the used business game, given the research design.

Nevertheless, in educational processes that can count on the participation of the same participants in successive events – which is common in undergraduate courses of business administration in Brazil (Motta *et al.*, 2012a), it would be possible to take advantage of management development efforts conducted in subsequent business game rounds from a similar study to this one, that could be done after the initial rounds, helping to calibrate the complexity of the simulation (in the majority of business games one can choose the level of complexity and/or change some general parameters, such as economic conjuncture, strike, supply shock in the market of inputs, etc.), duration of activities, as well as the processes of interaction with the other contributors of the experience, such as the debriefing stage, the group discussion for decision making, the initial presentation of the simulated environment by the professor, among others.

6. FINAL CONSIDERATIONS

The results of this study bring important advances to the field of knowledge. Although the variables linked to the simulation dynamics had already been empirically tested, investigating the relative impact and set of several independent variables on the perceived learning of business games participants is unusual. In most of the studies, the objective is to evaluate the influence of an antecedent factor on the performance or learning of the participants. This research has demonstrated that some of these variables can share their predictive power so they could not stay together in the estimated regression model, from which two variables emerged with direct effects (Debriefing and Duration) that obtained an association degree of 59% with the perceived learning intensity of participants, and 32% of their variation was explained.

In addition, it emerged from the study the redundancy effect of Complexity in the context of the Debriefing and Duration variables, pondering that Complexity explains part of the variance of perceived learning intensity that is explained by the other predictors. The proposed analytical framework suggests that the duration of the simulation rounds, that is, the time taken by participants to evaluate decisions, was related to the perception of learning, from which it can be suggested that the students who dedicated to the development of strategy and the evaluation of the results were able to achieve a deeper learning experience from the simulation. The results also indi-

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cate that the debriefing stage was related to the perception of learning, which suggests that the debriefing implies reflections that lead to learning how to learn, in the abstract level of the experiential learning cycle, where the dynamics of debriefing contribute to the participants' questioning on why and how decisions were made, as well as the reasons for the results obtained, allowing them to identify weaknesses and strengths in a sort of "autophagy" of the processes that allow them to go through the experiential learning cycle.

In business games, according to the experiential learning cycle, the participants promote *ex ante* reflections in the decision-making process, monitor the implementation of the suggested solutions *ex cursum*, and evaluate the results *ex post* in a virtuous learning cycle. In the perspective of experiential learning, reflective observation, and abstract conceptualization, stages are planned, which in relation to business games can be reinforced by an adequate duration for the evaluation of the problem-situation and by debriefing activities subsequent to the simulation rounds, in order to enhance continuous processes of action and reflection of the participants, according to the spiral experiential learning cycle. The bivariate correlation implies that the more complex the business game, the greater the importance of debriefing.

This study present certain limitations. While the reliability of the scale used in the survey seems to be acceptable for non-causal studies (Cronbach's alpha = 0.7) and its content validity can be assumed (or nominal validity); the construct validity must be determined. No validations were made of the dimensions (constructs) Learning and Dynamics of the simulation regarding the convergent validity (that is, the relationship between indicators of the same construct) and the discriminant validity (that is, the degree to which a construct is different from the others). In addition, perceived learning of the participants, and not effective learning, was measured.

The perception of learning may be associated with the emotional aspect triggered by the activity, taking participants as central and active elements of the learning process (Lacruz & Vilella, 2006), causing a "good feeling", which can lead to a halo effect in terms of the measurement of perceived learning (Gentry, Commuri, Burns, & Dickinson, 1998). On the other hand, attribution theory conclusions suggest that behavioral perceptions can result in actual behaviors (Kelly, 1971; Martinko, 1995). In addition, the model of this study is limited to the range of the PLI variable, whose amplitude was small (minimum = 3.2 to maximum = 5).

Therefore, it is suitable for activities such as business games in which the participants perceive their learning from the simulation in average bet-

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ween 3.2 and 5 in a scale of 1 to 5 points. Finally, the results correspond to the observations of students from four higher education institutions and only one business game in particular, as in other studies (e.g. Dias *et al.*, 2013a, Meij *et al.*, 2013, Mayer *et al.*, 2011). Similar analyzes with different business games need to be done before generalized assertions can be made, nonetheless the results of this study provide some evidence that business games learning may be associated with the dynamics of simulation.

DINÂMICA DA SIMULAÇÃO E APRENDIZAGEM EM JOGOS DE EMPRESAS

RESUMO

Objetivo: Explorar o impacto relativo e conjunto de variáveis vinculadas à dinâmica da simulação sobre a aprendizagem percebida pelos participantes de jogos de empresas.

Originalidade/lacuna/relevância/implicações: Embora estudos indicaram que variáveis vinculadas à dinâmica da simulação podem afetar a percepção dos participantes quanto a sua aprendizagem, é incomum investigar o impacto relativo e conjunto dessas variáveis sobre a aprendizagem. Na maioria dos estudos, o objetivo é avaliar a influência de um fator antecedente sobre aprendizagem. Ao investigar as possíveis inter-relações existentes entre as variáveis independentes e os efeitos da interação, amplia-se o escopo de análise.

Principais aspectos metodológicos: A mostra foi composta por 90 alunos que cursavam o último ano da graduação em Administração de quatro instituições de ensino superior no Brasil. Foram analisadas, por meio de regressão linear múltipla, seis variáveis vinculadas à dinâmica da simulação (animador, manual, equipe, complexidade, *debriefing* e duração).

Síntese dos principais resultados: Duas variáveis compuseram o modelo de regressão (*debriefing* e duração). Essas variáveis obtiveram grau de associação de 59% com a intensidade do aprendizado percebido pelos participantes e explicaram 32% da sua variação.

Principais considerações/conclusões: Os achados deste estudo podem auxiliar na construção de planos de aula com jogos de empresas, ao se revelar a influência de fatores vinculados à dinâmica da simulação, muitos dos quais sob o controle do animador da simulação.

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PALAVRAS-CHAVE

Jogos de empresas. Aprendizagem vivencial. Dinâmica da simulação. Ensino de administração. Regressão linear múltipla.

DINÁMICA DE LA SIMULACIÓN Y DE APRENDIZAJE EN EL JUEGOS DE NEGOCIO

RESUMEN

Objetivo: Investigar el influencia de la dinámica de la simulación en la aprendizaje en el juegos de negocio.

Originalidad/laguna/relevancia/implicaciones: Aunque muchos estudios sugieren que las variables relacionadas con la dinámica de la simulación puede influir en la aprendizaje de los participantes, es inusual investigar el influencia relativa y en conjunto. En la mayoría de los estudios, el objetivo es evaluar la influencia de un factor antecedente en el aprendizaje. Investigar las posibles interrelaciones entre las variables independientes y los efectos de la interacción, se expande el alcance del análisis.

Principales aspectos metodológicos: El espectáculo consistió en 90 estudiantes que asistieron al último año de la carrera de cuatro instituciones de gestión de la educación superior en Brasil. Se analizaron através de regresión lineal múltiple seis variables vinculadas con la dinámica de la simulación (animador, manual, equipo, complejidad, *debriefing* y duración).

Síntesis de los principales resultados: Dos variables han compuesto el modelo de regresión (*debriefing* y duración). Estas variables obtienen un grado de asociación del 59% con la intensidad del aprendizaje percibido por los participantes y explicó el 32% de la variación.

Principales consideraciones/conclusiones: Los resultados de este estudio pueden ayudar a crear planes de lecciones con los juegos de negocio para demostrar la influencia de factores relacionados con la dinámica de la simulación y de aprendizaje, muchos de ellos bajo el control animador de simulación.

PALABRAS CLAVE:

Juegos de negocio. Aprendizaje experiencial. Dinámica de la simulación. Enseñanza de administración de empresas. Regresión lineal múltiple.

REFERENCES

Apesteguia, J., Azmat, G., & Iriberri, N. (2012). The impact of gender composition on team performance and decision-making: evidence from the field. *Management Science, 58*(1), 78-93.

Araújo, U. P., Brito, M. J. de, Correia, L. F., Paiva, F. D., & Santos, A. de O. (2015). Simulação de negócios no ensino da administração em centro de educação brasileiro. *Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 13*(2), 99-130.

Ben-Zvi, T., & Carton, T. C. (2008). Applying Bloom's revised taxonomy in business games. *Developments in Business Simulation and Experiential Exercises, 35*, 265-272.

Bloom, B. S., Engelhart, M. D., Frust, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives*. New York: David McKay.

Cannon, H. M., & Burns, A. C. (1999). A framework for assessing the competencies reflected in simulation performance. *Developments in Business Simulation and Experiential Learning, 26*, 40-44.

Cohen, J. A. (1998). Power primer. In A. E. Kazdin. *Methodological issues and strategies in clinical research*. Washington: APA.

Cooper, D. R., & Schindler, P. S. (2003). *Métodos de pesquisa em administração*. Porto Alegre: Bookman.

Crookall, T., & Thorngate, W. (2009). Acting, knowing, learning, simulating, gaming. *Simulation & Gaming, 40*(1), 8-26.

Dias, G. P. P., Sauaia, A. C. A., & Yoshizaki, H. T. Y. (2013a). Estilos de aprendizagem Felder-Silverman e o aprendizado com jogos de empresas. *Revista de Administração de Empresas, 53*(5), 469-484.

Dias, C. M., Jr., Moreira, B., & Stosick, E. (2013b). Um estudo sobre o desenvolvimento de competências em ambiente simulado. *Novas Tecnologias na Educação, 11*(1), 10-23.

Faria, A. J. (1998). Business simulation games: current usage levels-an update. *Simulation & Gaming, 29*(2), 295-308.

Fitó-Bertran, A., Hernández-Lara, A. B., & Serradell-López, E. (2014). Comparing student competences in a face-to-face and online business game. *Computers in Human Behavior, 30*, 452-459.

Fitó-Bertran, A., Hernández-Lara, A. B., & Serradell-López, E. (2015). The effect of competences on learning results and educational experience with a business simulator. *Computers in Human Behavior, 51*(B), 910-914.

Florea, N. B., Boyer, M. A., Brown, S. W., Butler, M. J., Hernandez, M., Weir, K., Meng, L., Johnson, P. R., Lima, C., & Mayall, H. J. (2003). Negotiating from Mars to Venus: gender in simulated international negotiations. *Simulation & Gaming*, *34*(2), 226-248.

Gaio, B. E. (2008). Competências empreendedoras e habilidades cognitivas em um curso superior na modalidade à distância, utilizando jogos de empresas: um estudo de caso. *Anais do Congresso Internacional ABED de Educação à Distância*, São Paulo, SP, Brasil, 14.

Gentry, J. W. (1990). What is experiential learning?. In J. W. Gentry (Coord.). *Guide to business gaming and experiential learning*. London: Nichols.

Gentry, J. W., Commuri, S. R., Burns, A. C., & Dickinson, J. R. (1998). The second component to experiential learning: a look back at how ABSEL has handled the conceptual and operational definitions of learning. *Developments in Business Simulation and Experiential Exercises, 25*, 62-68.

Gerber, J. Z. (2006). *Jogo de empresas e a formação de líderes empresariais*. Tese de doutorado, Universidade Federal de Santa Catarina, Florianópolis, SC, Brasil.

Goldschmidt, P. C. (1977). Simulação e jogo de empresas. *Revista de Administração de Empresas*, *17*(3), 43-46.

Gosen, J., & Washbush, J. (1999). Perceptions of learning in TE simulations. *Developments in business simulation and experiential exercises*, *26*, 170-175.

Gujarati, D. N. (2000). *Econometria básica. São Paulo*: Makron Books.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2009). *Análise multivariada de dados*. Porto Alegre: Bookman.

Hall, J., & Cox, B. (1994). Complexity: it is really that simple. *Developments in Business Simulations and Experiential Exercises*, *21*, 30-34.

Hornaday, R. W., & Ensley, M. (2000). Teamwork attributes in a classroom simulation. *Developments in Business Simulation and Experiential Learning*, *27*, 195-200.

Kelly, H. H. (1971). *Attribution in social interaction*. New Jersey: Learning Press.

Keys, J. B., & Wolfe, J. (1990). The role of management games and simulations for education and research. *Journal of Management*, *16*(2), 307-336.

Kolb, D. (1984). *Experiential learning: experience as source of learning and development*. New Jersey: Prentice Hall.

Lacruz, A. J. (2004). Jogos de empresas: considerações teóricas. *Caderno de Pesquisas em Administração*, *11*(4), 93-109.

Lacruz, A. J. (forthcoming). *Influência do debriefing no aprendizado em jogos de empresas: um delineamento experimental*.

Mackenzie Management Review (Rev. de Adm. Mackenzie – RAM), *18*(2), 49-79 • SÃO PAULO, SP • MAR./APR. 2017
ISSN 1678-6971 (electronic version) • http://dx.doi.org/10.1590/1678-69712017/administracao.v18n2p49-79

Lacruz, A. J., & Villela, L. E. (2006). Percepção dos participantes de jogos de empresas quanto às condições facilitadoras para o aprendizado em programas de simulação empresarial: um estudo exploratório. *Anais dos Seminários em Administração*, São Paulo, SP, Brasil, 9.

Lopes, P. da C. (2001). *Formação de administradores*: uma abordagem estrutural e técnico-didática. Tese de doutorado, Universidade Federal de Santa Catarina, Florianópolis, SC, Brasil.

Lopes, P. da C., & Souza, P. R. B. de. (2004). Jogos de negócios como ferramenta para construção de competências essenciais às organizações. *Anais dos Seminários em Administração*, São Paulo, SP, Brasil, 7.

Malhotra, N. K. (2008). *Pesquisa de marketing*. Porto Alegre: Bookman.

Martinko, M. (1995). *Attribution theory: an organizational perspective*. Florida: St. Lucie Press.

Mayer, B. W., Dale, K. M., Fraccastoro, K. A., & Moss, G. (2011). Improving transfer of learning: relationship to methods of using business simulation. *Simulation and Gaming*, *42*(1), 64-84.

Mecheln, P. J. von (2003). *Jogo de empresas, ambiente interativo e agentes computacionais mediadores*. Tese de doutorado, Universidade Federal de Santa Catarina, Florianópolis, SC, Brasil.

Meij, H. van der, Leemkuil, H., & Li, J. (2013). Does individual or collaborative self-debriefing better enhance learning from game?. *Computers in Human Behavior*, *29*(6), 2471-2479.

Miles, J., & Shevlin, M. (2001). *Applying regression and correlation*: *a guide for students and researches*. London: Sage.

Mooney, C. Z., & Duval, R. D. (1993). *Bootstrapping: a nonparametric approach to statistical inference*. New Park: Sage.

Motta, G. da S., & Quintella, R. H. (2012). A utilização de jogos e simulações de empresas nos cursos de graduação em administração no estado da Bahia. *Revista Eletrônica de Administração*, *18*(2), 317-338.

Motta, G. da S., Quintella, R. H., & Melo, D. R. A. de. (2012a). Jogos de empresas como componente curricular: análise de sua aplicação por meio de planos de ensino. *Organizações & Sociedade*, *19*(62), 437-452.

Motta, G. da S., Melo, D. R. A. de., & Paixão, R. B. (2012b). O jogo de empresas no processo de aprendizagem em administração: o discurso coletivo de alunos. *Revista de Administração Contemporânea*, *16*(3), 342-359.

Naylor, T. H. (1971). *Computer simulation experiments with models of economic systems*. New York: John Wiley & Sons.

Mackenzie Management Review (Rev. de Adm. Mackenzie – RAM), *18*(2), 49-79 • SÃO PAULO, SP • MAR./APR. 2017
ISSN 1678-6971 (electronic version) • http://dx.doi.org/10.1590/1678-69712017/administracao.v18n2p49-79

Oliveira, C. J. (2002). *Implementação da simulação de abertura do capital no jogo de empresa as GI-MICRO.* Dissertação de mestrado, Universidade Federal de Santa Catarina, Florianópolis, SC, Brasil.

Peach, B. E., & Hornyak, M. (2003). What are simulations for? Learning objectives as a simulation device. *Developments in Business Simulation and Experiential Learning*, *30*, 220-224.

Peters, V., & Vissers, G. (2004). A simple classification model for debriefing simulation games. *Simulation & Gaming*, *35*(1), 70-84.

Sauaia, A. C. A. (1995). *Satisfação e aprendizagem em jogos de empresas*: contribuições para a educação gerencial. Tese de doutorado, Universidade de São Paulo, São Paulo, SP, Brasil.

Sauaia, A. C. A. (2006). Conhecimento versus desempenho das organizações: um estudo empírico com jogos de empresas. *Revista Eletrônica de Administração*, *12*(1), 1-17.

Sims, R. R. (2002). Debriefing experiential learning exercises in ethics education. *Teaching Business Ethics*, *6*(2), 179-197.

Souza, T. M. P. de, & Cardoso, A. M. P. (2012). Diretrizes de interface para jogos de empresas. *Revista de Informação*, *13*(6), 1671-1675.

Teach, R. D. (1990). Designing business simulations. In J. W. Gentry (Org.). *Guide to business gaming and experiential learning*. Nichols: GP Publishing.

Teach, R., & Murff, E. (2008). Are the business simulations we play too complex?. *Developments in Business Simulation and Experiential Learning*, *35*, 205-211.

Whisman, M. A., & McClelland, G. H. (2005). Designing, testing, and interpreting interactions and moderator effects in family research. *Journal of Family Psychology*, *19*(1), 111-120.

Wolfe, J. (1978). The effects of game complexity on the acquisition of business policy knowledge. *Decision Sciences*, *9*(1), 143-155.

Mackenzie Management Review (Rev. de Adm. Mackenzie – RAM), *18*(2), 49-79 • SÃO PAULO, SP • MAR./APR. 2017
ISSN 1678-6971 (electronic version) • http://dx.doi.org/10.1590/1678-69712017/administracao.v18n2p49-79