TEACHING THE BALANCED SCORECARD THROUGH SIMULATION

Carlos Capelo, Ana Isabel Lopes and Ana Mata
Universidade Lusófona
Campo Grande, 376, 1749-024 Lisboa – Portugal

ABSTRACT

Kaplan and Norton introduced the Balanced Scorecard (BSC) which is based on a systems perspective of the business strategy and performance measurement. Many organizations around the world are using the BSC to define, implement and manage strategy. Nevertheless there exist studies that identify problems and limitations associated with the implementation and use of the BSC. Those studies show in general terms that managers do not understand the BSC as the measures and perspectives in use are fairly independent, and do not always mirror the recommended cause-and-effect logic included in the systems perspective of the BSC approach. This article addresses the effectiveness of teaching the Balanced Scorecard by means of business simulation. An experiment that uses a business simulator is performed for testing a set of hypotheses about the influence of simulation on the students' understanding of the BSC. The simulation experience was specifically designed by the authors to promote understanding of the BSC concepts. Student feedback and assessment showed that the simulation significantly enhanced the understanding of the BSC concepts related to the strategic management and double-loop learning processes and the systems perspective. Results also suggested that understanding of those BSC concepts positively influences simulation performance.

KEYWORDS

Balanced Scorecard, Business Simulation, Training, Business Education, Teaching Methods.

1. INTRODUCTION

Kaplan and Norton (1992) introduced the Balanced Scorecard (BSC) with the aim of overcoming strategic management limitations of the traditional performance measurement systems. The BSC approach features a mix of lead (performance drivers) and lag (outcome measures) indicators, financial and non-financial measures. These are categorized as follows: (i) financial, (ii) customer, (iii) process and (iv) learning and growth. The BSC tool helps managers monitor actual financial and market performance, evaluate the results of short-term processing actions, monitor the intangible development of competencies that will drive future financial performance and assess the progress of implementing corporate strategy. To support managers in developing a cause-and-effect perspective and to better understand the business system in which they participate, Kaplan and Norton (2001) developed the strategy map concept as a complementary tool to the BSC approach. The strategy map links the performance indicators in a causal chain (causal diagram) that helps managers to translate, test and communicate their understanding of the business system.

Managers make decisions and learn in the context of feedback loops (Forrester, 1961). In single-loop learning, managers compare information about the state of a real system to pre-established goals, perceive deviations between desired and actual states, and make the decisions they believe will move the system towards the desired state. Single-loop learning does not change the managers' mental models. A mental model is a conceptual representation of the structure of an external system used by people to describe, explain and predict a system's behavior (Craik, 1943, Johnson-Laird, 1983). In double-loop learning, information about the business system is not only used to make decisions within the context of existing frames, but also feeds back to modify the managers' mental models (Argyris, 1976). As their mental models change, managers define new strategies and policies.

It is clear that the BSC approach is consistent with the systems and feedback learning perspective of business management and performance measurement. Kaplan and Norton (2001) argue that the BSC approach supports double-loop learning that facilitates managerial strategic learning, leading to better performance. In a continual process, managers use the balanced scorecard and the strategy map to re-evaluate the assumptions used in the previous strategy. They review the assumed cause-and-effect relationships and identify new ones. Then they improve their understanding of the business system and they determine a new strategy (Kaplan and Norton, 2001). In other words, BSC triggers a process by which managers can make explicit improvements to their mental models of the business system. They adapt the company strategy and define the new short and middle term objectives by simulating their mental models to infer the future behavior of the business system.

Many organizations around the world are using the BSC approach to define, implement and manage strategy. However, according to empirical research into the performance implications of the BSC, the positive contributions of the BSC have not been unambiguously confirmed. There exist studies in the field of management accounting research that identify problems and limitations associated with the BSC approach. The inadequate definition and utilization of the performance indicators has been highlighted as a main drawback of the BSC system (Lingle and Schiemann, 1996; Stivers et al., 1998; Ittner and Larcker, 1998, 2003; Lipe and Salterio, 2000; Malmi, 2001; Speckbacher et al, 2003). Those studies show in general terms that the measures and perspectives in use are fairly independent, and do not always mirror the recommended cause-and-effect logic of the BSC approach.

1.1 The use of Simulation for teaching the BSC

Business simulators, business games, management simulators, microworlds, learning laboratory, interactive learning environments are some examples of terms used to describe computer-based simulations that have been proposed by researchers from many fields, e.g., management and decision science, psychology, education and computer science, as important tools to support management learning processes (Maier and Grobler, 2000). In a broad definition, business simulators for learning purposes comprise virtually everything connected with the learning process. An interactive learning environment contains more than a computer simulation model. A simulation model is embedded into a learning environment, which may also include case descriptions, presentations by a facilitator, modelling tools, background information, source material and working instructions (Davidsen and Spector 1997).

Simulators are promising tools for teaching in business management domain as they expected to help students acquire knowledge. Students' learning processes center around the exploration of the simulation model. They gather knowledge through an inquiry learning process as they make a broad analysis of the domain, generate hypothesis, experiment, interpret the outcomes, conclude about the validity of the hypothesis or form new ideas, and finally reflect on the domain (de Jong and van Joolingen, 2008). Additionally, by performing simulated tasks, learners understand through experiential processes how concepts are applied and why they are useful, thus enabling new learning to be more easily (Cannon-Bowers and Bowers, 2008). Other specific advantages have been pointed out. An often named advantage of computer simulations is the "compression of time" as they instantly show the results of decisions a user has made. Simulators help subjects leverage their domain-rich knowledge by allowing them to play through simulated years, reflect on their actions, modify their mental models, then repeat the process. By compressing time, business simulators can accelerate learning by enabling them to conduct many such cycles of action and reflection (Bakken et al, 1994). Providing a safe environment is at the same time an important advantage of simulators (Sterman 1994), which allows for experiential learning without that stress-related obstacles that are met in reality. However, subjects may tend to take more risks than in real-life decisions. Also, computer simulations of business systems address objectively certain special management issues and try to abstract from details and isolating from confounding factors (Isaacs and Senge, 1994). This abstraction allows a focus on the learning of important and specific business themes.

As mentioned in previous section, several studies show in general terms that managers do not understand the fundamental concepts of the BSC approach, in particular those connected with the systems and feedback learning perspective. Thus, appropriate teaching and training methodologies must be designed in order to improve subjects learning and comprehension of those concepts. The present study addresses the effectiveness of teaching the Balanced Scorecard by means of business simulation. An experiment that uses a business simulator is performed for testing a set of hypotheses about the influence of simulation on the subjects' understanding of the BSC. The effectiveness and relevance of simulators for learning is intuitively acknowledged by many researchers. However, there exists scarce research about the effectiveness of computer-based simulations to support learning. Thus, this study also aims to be a contribution to the research issue of “effectiveness of computer-based simulations to support learning’’ not been solved so far.

2. RESEARCH HYPOTHESES

This research focuses on how business simulation facilitates the teaching of the Balanced Scorecard approach, leading to enhanced students’ understanding of its main concepts. The analysis of the subjects’ understanding of the BSC concepts considers two components: the performance measurement system and the systems and strategic learning perspective. The performance measurement system associated with the BSC approach is viewed as a comprehensive structure of performance indicators that combine both financial and non-financial measures. By using a BSC performance measurement system, managers access more relevant information to interact with the business environment, and they acquire a sharper understanding of the impact of their decisions. The systems and strategic learning perspective - The BSC approach is consistent with the systems and strategic learning perspective. By using the BSC strategy map tool, managers will benefit from more effective double-loop learning as they review the critical cause-and-effect relations through a process that externalizes and improves their mental models of the business system.

It is assumed that by teaching the BSC through business simulation, students will benefit from more effective understanding of the BSC performance measurement system concepts. Hypothesis 1: The use of simulation improves the level of understanding of the BSC performance measurement system.

It is assumed that by teaching the BSC through business simulation, students will benefit from more effective understanding of the systems and strategic learning perspective of the BSC approach. Hypothesis 2: The use of simulation improves the level of understanding of the BSC as a strategic learning system. Hypothesis 3: The use of simulation improves the level of perceived relevance of the strategic learning system concepts.

This study also assumes that students perform better the business simulation task if they reach both higher level of understanding of the BSC performance measurement system and higher level of understanding of the systems and strategic learning perspective of the BSC approach. Hypothesis 4: The level of understanding of the BSC performance measurement system is positively correlated with Performance. Hypothesis 5: The level of understanding of the BSC as a strategic learning system is positively correlated with Performance. Hypothesis 6: The level of perceived relevance of the strategic learning system concepts is positively correlated with Performance.

3. METHOD

The hypotheses defined in this research and presented in the previous section were tested with a simulation-based experiment. This section presents an overview of the simulator, describes the subjects and the experiment conditions, and overviews the research variables.

The business simulator was built by incorporating the same system dynamics model that had been used in previous research (Capelo and Dias, 2009). The participants run a realistic simulator of a wireless telecommunications firm by making critical decisions every six months for a simulation period of seven years. The participant objective was to develop critical and interrelated resources at appropriate rates and levels in order to gain and retain customers, operate efficiently, and maximize value creation. To succeed in this simulation task, participants had to identify and understand the cause-and-effect relationships among critical variables. The simulator provides an interface that represents a balanced scorecard that includes a set of leading and lagging, financial and non-financial indicators that are graphically separated into four sections related to the four perspectives associated with the BSC approach. The simulation task also involves drawing and reviewing a strategy map. The participants produced and reviewed a strategy map linking the critical concepts as were found in the simulation model. This strategy map represents the participants’ understanding of the structure of the simulated business system.

The subjects consisted of 74 undergraduate students. All the participants were familiar with basic BSC concepts as they attended previous classes on the BSC approach. The participants had no experience with the simulator and they also had no prior specific knowledge about wireless telecommunications businesses.

All participants were given a full experimental guide including: description and objective of the simulation task; case text; instructions for accessing and starting the simulator on the computer network; instructions for running the simulator; sheets for strategy map review. The decisions made on the simulation and its results were automatically stored in a protected spreadsheet on the participant's computer.

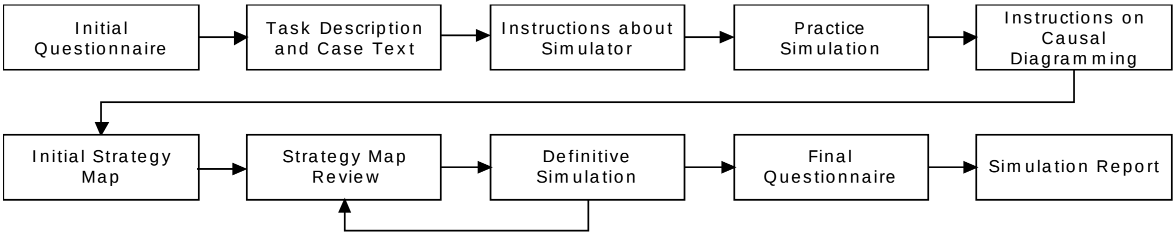

Figure 1. Experimental procedure

The firm was run by using the balanced scorecard and the strategy map. They analyzed business status using the simulator interface, used this information to review the strategy and objectives and decision making, and then repeated the process. The experiment procedure involved four sessions and had the following steps (Figure 1). Session 1: a) The participants answered a questionnaire on BSC approach. This questionnaire, comprising twenty five multiple choice questions about the BSC, and a ten-point scale to evaluate the relative relevance of ten critical concepts (five regarding the performance measurement system, and other five regarding the systems and strategic learning perspective), captured their initial level of comprehension of the BSC approach. Session 2: b) The participants read the introduction with the overall description and the objectives of the simulation and the business case and were instructed to raise any questions they had as they proceeded with the case. c) The participants read the instructions for accessing, starting and running the simulator and they were given oral instructions with examples to show simulator operation. d) A first simulation was conducted to familiarize participants with the game interfaces and commands, and at this point they were instructed to ask for help at any time. Session 3: e) The participants received instruction in how to draw the strategy map, and how to review it by cutting or inserting links between the indicators and defining the arrows that indicated the cause-and-effect relationships. f) The participants drew the initial strategy map. g) The participants performed the definitive simulation. They were also asked to review the causal diagram (strategy map). They cut or inserted links so that the causal diagram accurately expressed their latest understanding of the simulated business system. The participants were also encouraged to use the strategy map to reflect on strategy, objectives, and decisions. Session 4: h) The participants filled out the same questionnaire that was used on the session 1 in order to capture their ultimate understanding of the certain critical concepts of BSC approach. Finally, the participants described their simulation experience in a written report which was part of the evaluation process.

3.1 Research Variables

Level of understanding of the BSC performance measurement system (LUPMS-BS and LUPMS-AS). These variables were measured in terms of the evaluation score of participants in answering a questionnaire, before the simulation experiment (LUPMS-BS) and after the simulation experiment (LUPMS-AS).

Level of understanding of the BSC as a strategic learning system (LUSLS-BS and LUSLS-AS). These variables were measured in terms of the evaluation score of participants in answering a questionnaire before the simulation experiment (LUSLS-BS) and after the simulation experiment (LUSLS-AS).

Level of relevance of the performance measurement system concepts (LRPMS-BS, LRPMS-AS and LRPMS-CA). These variables represent the students' perception on the relative importance of the performance measurement system of the BSC approach. LRPMS-BS and LRPMS-AS were obtained from the questionnaire answered by participants, before and after the simulation experiment. The variable LRPMS-CA results from a quantitative content analysis of the final report.

Level of relevance of the strategic learning system concepts (LRSLS-BS, LRSLS-AS and LRSLS-CA). These variables represent the students' perception on the relative importance of the systems and strategic learning perspective of the BSC approach. They also result from the questionnaire answered by participants, before and after the simulation experiment. The variable LRSLS-CA was also obtained from quantitative content analysis of the final report.

Performance - Task performance was measured by total financial value creation.

4. RESULTS AND DISCUSSION

Table 1 shows the results of statistical testing to identify differences in means between stages. Unexpectedly, after simulation the participants showed on average a lower level of understanding of the BSC performance measurement system (LUPMS). However, the mean values of LUPMS for after simulation stage were not significantly different from the equivalent values for before simulation stage (mean difference=-0.32, p=315). On average, after simulation, the participants showed a better level of understanding of the BSC as a strategic learning system (LUSLS), a lower level of relevance of the performance measurement system concepts (LRPMS), and a better level of relevance of the strategic learning system concepts (LRSLS). Table 1 shows that those differences are significant at $p<0.01$ (mean difference LUSLS=0.188, $p<0.001$; mean difference LRPMS=-3.39, $p<0.001$; LRSLS=3.63, $p=0.001$).

Table 1. Tests of significance for differences in means between the stages

	After Simulation – Before Simulation		
Variable	Mean Difference	Standard Deviation	Significance p
LUPMS	-0.32	2.44	0.315
LUSLS	1.88*	2.85	0.000
LRPMS	-3.39*	6.96	0.000
LRSLS	3.63*	7.65	0.001

*p<0.01

Table 2. Tests of significance for differences in means for BSC concepts between stages

	After Simulation – Before Simulation		
BSC Concept	Mean Difference	Standard Deviation	Significance p
Concepts included in LRPMS			
C 1 – BSC perspectives	-2.20**	3.49	0.000
C 2 - Financial measures	-0.85*	2.96	0.032
C 3 - Non-financial measures	-0.03	3.30	0.937
C 4 - Objectives and targets	-0.25	3.42	0.571
C 5 – Key initiatives	-0.05	2.96	0.895
Concepts included in LRSLS			
C 6 – Systems and dynamical view	0.49	4.20	0.372
C 7 – BSC strategy map	1.00*	3.77	0.046
C 8 - Understanding and validation of the cause-and-effect relationships	1.47**	2.87	0.000
C 9 – Inference about future performance	0.22	3.62	0.642
C 10 - Double-loop learning process	0.44	3.80	0.376

*p<0.05; **p<0.01

Table 2 shows the results of statistical testing to identify differences in means between the stage before simulation and the stage after simulation for each BSC concept. The lower mean value of LRPMS revealed by participants after simulation was mainly due to C1 - BSC perspectives (mean difference =-2.20, $p<0.001$) and C2 - Financial measures (mean difference =-0.85, $p<0.05$) concepts. These results suggest that after simulation the participants changed their perception about the importance of those concepts as they rated on average a lower level. Results in table 2 also suggest that the better mean value of LRSLS after simulation was mainly due to C7 - BSC strategy map (mean difference =1.00, $p<0.05$) and C8 - Understanding and validation of the cause-and-effect relationships (mean difference =1.47, $p<0.001$) concepts. Thus, on opposite, it seems that the simulation experience made the participants changing their view on the relevance of these concepts as they rated on average a higher level. The relevance of those BSC concepts was also evaluated by means of a quantitative content analysis of the final report (table 3). According to that analysis, the participants perceive on average that C7 (BSC strategy map), C8 (understanding and validation of the cause-and-effect relationships) and C10 (Double-loop learning process) are the most relevant BSC concepts.

In order to evaluate the relationship between Performance and each variable, a bivariate correlation analysis was conducted. As it can be seen in table 4, there is some correlation between Performance and LUPMS–AS (Corr=0.245, p=0.053). However, that correlation is not significant (at $p<0.05$). Performance is significant correlated (at $p<0.05$) with LUSLS–AS, and with LRSLS–CA.

Table 3. Results of quantitative content analysis of the simulation reports

BSC Concept	Quantitative Content Analysis of Simulation Reports: Number of Mentions	%
Concepts included in LRPMS	63	36.0%
C 1 – BSC perspectives	16	9.1%
C 2 - Financial measures	7	4.0%
C 3 - Non-financial measures	18	10.3%
C 4 - Objectives and targets	7	4.0%
C 5 – Key initiatives	15	8.6%
Concepts included in LRSLS	112	64.0%
C 6 – Systems and dynamical view	6	3.4%
C 7 – BSC strategy map	31	17.7%
C 8 - Understanding and validation of the cause-and-effect relationships	32	18.3%
C 9 – Inference about future performance	19	10.9%
C 10 - Double-loop learning process	24	13.7%

Table 4. Analysis of correlation (Pearson)

Variables	Correlation Analysis – Performance: Pearson Correlation	Significance
LUPMS–AS	0.245	0.053
LUSLS–AS	0.298*	0.018
LRPMS–AS	0.019	0.882
LRSLS–AS	-0.030	0.817
LRPMS–CA	0.186	0.144
LRSLS–CA	0.299*	0.017

*p<0.05

Table 5 shows the results of multivariate regression analyses of Performance on the independent variables (model 1). The regression model was then refined (model 5) by performing a stepwise regression in order to exclude the variables that did not seem to significantly explain the dependent variable and to preserve the most significant explanatory variables. Regression analysis of Performance on the most significant independent variables shows significant effects for LUPMS-AS and LRSLS-CA.

These results confirm five of the six hypotheses (table 6). The present study does not support Hypothesis H1 as from table 1 the mean values of LUPMS for before and after simulation stages were not significantly different. On average, the participants in after simulation stage showed better LUSLS and LRSLS, with significant differences evident in Table 1, supporting Hypothesis H2 and Hypothesis H3. The correlation analysis (table 4) showed no significant relationship between LUPMS-AS and Performance. However, the results of multivariate regression analysis of Performance on the independent variables (model 5 - table 5) indicates a significant effect for LUPMS-AS. Consequently, the results provide support of Hypothesis H4. The results from correlation analysis (table 4) provide support of Hypothesis H5 as it was found a significant correlation between LUSLS-AS and Performance. LRSLS was measured through two processes: data obtained from the questionnaires answered by participants after simulation (variable LRSLS-AS) and data extracted from quantitative content analysis of participants' simulation report (variable LRSLS-CA). Correlation between LRSLS-AS and Performance is not significant. However, results reveal a significant correlation between LRSLS-CA and Performance. Thus, the results provide support of Hypothesis H6.

Table 5. Model 1: regression results for all independent variables; Model 5: regression results obtained through a stepwise procedure

Independent Variables	Dependent Variable	
	Performance	
	Standardized Beta	Significance
Model 1		
LUPMS – AS	0.226	0.088
LUSLS – AS	0.144	0.273
LRPMS – AS	0.111	0.783
LRSLS – AS	0.053	0.894
LRPMS – CA	0.176	0.151
LRSLS – CA	0.336**	0.009
Model 5		
LUPMS – AS	0.292*	0.016
LRSLS – CA	0.340**	0.006

*p<0.05; **p<0.01

Table 6. Summary of Hypothesis Testing

Hypotheses	Description	Results
H1	The use of simulation improves the level of understanding of the BSC performance measurement system	Not supported
H2	The use of simulation improves the level of understanding of the BSC as a strategic learning system	Supported
H3	The use of simulation improves the level of perceived relevance of the strategic learning system concepts	Supported
H4	The level of understanding of the BSC performance measurement system is positively correlated with Performance	Supported
H5	The level of understanding of the BSC as a strategic learning system is positively correlated with Performance	Supported
H6	The level of perceived relevance of the strategic learning system concepts is positively correlated with Performance	Supported

4. CONCLUSION

Kaplan and Norton introduced the Balanced Scorecard (BSC) which is based on a systems perspective of the business strategy and performance measurement. Many organizations around the world are using the BSC to define, implement and manage strategy. Nevertheless there exist studies that show in general terms that managers do not understand the BSC as the measures and perspectives in use are fairly independent, and do not always mirror the recommended cause-and-effect logic included in the systems perspective of the BSC approach. Thus, appropriate teaching and training methodologies must be designed in order to improve subjects learning and comprehension of those concepts. The present study addresses the effectiveness of teaching the Balanced Scorecard by means of business simulation. An experiment that uses a business simulator is performed for testing a set of hypotheses about the influence of simulation on the subjects' understanding of the BSC. The simulation methodology significantly enhanced the understanding of the BSC concepts related to the strategic management and double-loop learning processes and the systems perspective. Results also suggested that understanding of those BSC concepts positively influences simulation performance.

The findings confirm our assumptions on the effectiveness of using simulation for teaching the BSC approach as a strategic management system (involving balanced scorecards and strategy maps as suggested by Kaplan and Norton). The simulator operates by participants developing and combining critical resources in appropriate levels in order to attract and retain customers, while running an efficient company. To reach this goal, the participants must understand the interdependence among critical resources and variables of the business case and they must combine these effectively. As students create a causal model (the BSC strategy map) representing the critical cause-and-effect relations of the business case, and use that causal model and the feedback information from the BSC performance system for running the firm, they develop an effective understanding about the meaningless and usefulness of the BSC concepts related to the strategic management and double-loop learning processes.

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