

Triple Helix Model (of Knowledge Based Economy) in Open Architecture Business Games

Subtheme: TH educational decision-making in the Academia

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Abstract

One emerging question in the university of XXI century is the development of an entrepreneurial attitude in students of social applied sciences, raising their abilities for leadership and creation of new knowledge and ventures. Recently it was published in Brazil a methodology for education and research called Management Laboratory (Sauaia, 2010) that guides students of applied social sciences beyond the curriculum content. It's based on an organizational simulation that supports a business game where each participant grouped in teams develops an individual research in scientific format, while managing his/her company. As recommended by the Triple Helix model (Etzkowitz, 2008), it has been possible to stimulate the emergence of innovative ventures in this controlled environment, similar to incubators. Then, the university determines a new method, tested and replicated, to lead the relationship between industry and government in the process of knowledge creation that unfold in innovation and economic development to the local society.

1- Introduction

Lectures are one of the most traditional educational methods adopted in Academia particularly in the area of Applied Social Sciences. This approach is oriented to knowledge achievement, and has been facing changes as technology evolves. As greater experience with new methods of knowledge delivery is obtained, Whiteley (2006, p.65) alerts there is a realization that the teaching approaches used in a traditional classroom cannot effectively serve as mirror-image templates for the participant centered classroom setting; changes are required. Besides, some educational institutions have embraced the new technology of the Internet to deliver online courses in a format that more often serves as a substitute, rather than a supplement, to the traditional "chalk and talk" in-class lecture format. In his study Whiteley (2006, p.66) revisited Bloom's taxonomy of educational objectives (cognitive domain) since this approach has guided the pedagogical process for almost half a century. The taxonomy identifies six levels of learning through which a student can progress.

"The six levels are: knowledge, comprehension, application, analysis, synthesis, and evaluation.

1. The knowledge level focuses on whether the learner can recall, recognize, or identify specific information (e.g., identify the four components of a SWOT analysis).
2. The comprehension level focuses on whether the learner understands the meaning of a content area (e.g., explain the meaning of each component of the SWOT analysis).

3. Application focuses on whether the learner can apply a content area (e.g., determine the breakeven point in units).
4. Analysis focuses on whether the learner can see patterns in the material presented and can separate the material into its constituent parts (e.g., from a conceptual and theoretical perspective, explain the nature of the marketing mix reflected in the case study; identify the marketing problem in the case study).
5. Synthesis focuses on whether the learner can establish new relationships (e.g., suggest alternative solutions to solve the identified problem in a case study).
6. Evaluation focuses on whether the learner can evaluate (access) alternatives or suggested relationships and arrive at an appropriate solution (decision) based on a reasoned assessment of the situation (i.e., recommend the best solution to the problem in the case study).

Knowledge, comprehension, and application are considered to reflect lower-order learning and analysis, synthesis, and evaluation are considered to reflect higher-order learning. Higher-order learning is much more difficult to achieve than lower-order learning, since the former reflects critical thinking, which requires one to go beyond just the basic facts, understanding an application, and to use reasoned thinking to gain the insight required to deal with the situation at hand. Because of this greater difficulty, the role of the teacher, or learning facilitator, is more important. The learning facilitator can use his or her knowledge and insight to help the student, in a step-by-step fashion, to acquire a higher level of understanding.

One emerging question in the university of the XXI century is the development of an entrepreneurial attitude in students of social applied sciences, stimulating their abilities of leadership and creation of new knowledge and ventures, and leading students beyond the usual content achievement. Adapting the definition proposed by Carland et al. (1984, p. 358), Guerry et al. (2008, p.45) define potential entrepreneur as “an individual [student] who accepts the possibility that he/she might establish and manage a business for the principal purposes of profit and growth”. While at a macro-level, entrepreneurship is seen as being responsible for job-creation, innovation and the creation of wealth, at a more individual level, the development of enterprising behavior has been characterized as one of the primary stimuli to the widening of career options, particularly among first time labor market entrants. There is an understanding of the authors about the existence of a number of schools of thought regarding the explanation of the entrepreneurial function and/or entrepreneurial behavior. They mentioned the model proposed by Cunningham and Lischeron (1991) as presented in the Exhibit 1.

Exhibit 1. The nature of the entrepreneur: main schools of thought

School of thought	Characterization of the entrepreneur
'Great People'	'Innate capacity': the entrepreneur born with the potential to act intuitively, energetically, with confidence and determination.
Classical	'Entrepreneurial function': the entrepreneur is anyone showing evidence of functioning in an inventive, innovative and creative way.
Psychological/behavioral characteristics	'Psychological profile': the entrepreneur has values and behavioral patterns that set them apart from the rest of society.
Management schools	'The organizer': the entrepreneur is able to identify opportunities, assess risks, plan the process, and manage the resources necessary for its successful conclusion.
	'The leader': the entrepreneur directs and motivates a team established to achieve specific aims.
	'The intrapreneur': the motivations and mind-set of managers working in complex organizations allows them to act in an enterprising manner

Source: Adapted from Cunningham and Lischeron (1991), in Guerry et al. (2008, p.46).

As already known, great people are rare in the general population and particularly among students at universities. Therefore, there is a need to prepare new entrepreneurs considering the approaches proposed by management schools.

Recently, it was published in Brazil a methodology for management education and empirical research named Management Laboratory (Sauaia, 2010) that guides students through an entrepreneurial learning experience in the applied social sciences course far beyond the curriculum content. It is based on an organizational simulator that supports a business game where each participant assumes a role, makes decisions in a competitive environment, and develops a scientific research. This approach makes possible for students to go through the six levels of Bloom's taxonomy, experiencing knowledge achievement, comprehension, application, analysis, synthesis, and evaluation, as will be explained in details in the next sections.

Besides, as recommended by the Triple Helix model (Etzkowitz, 2008), it has been also possible to stimulate the emergence of innovative ventures in this controlled environment, similar to incubators. The development of this approach started at the university with academic studies in the Business Administration department at USP – Brazil, in 1986, and was formally published in 2008 to offer a new method, which was tested and replicated in 2009, and to lead the relationship between industry and government in the process of knowledge creation that unfold in innovation and economic development to the local society. Under this educational environment, theories have been practiced in low risk and low cost conditions that allow decision makers and researchers to learn about many issues that would never be possible in the organizational real life environment.

In the topic two of this study there is a brief theoretical review of the conceptual framework established in the Management Laboratory (Sauaia, 2010). In the topic three it is presented the undergraduate Management courses at USP and UFF-VR and how Triple Helix perspective was included in the business game environment. In the topic four, it was presented the methodology adopted in this study. In the topic five it was described the findings that emerge as a result of the combined approaches and, in the last part, contributions, implications, final considerations and future applications of this approach for education, research, and MBA courses. The references here adopted are presented in the final topic.

2- State of the art about the Management Laboratory (Sauaia, 2010)

Business Game is a technique originally developed to train executives (Bellman, CLARK, MALCOLM, CRAFT, & RICCIARDI, 1957, p. 469). This method uses simulations to replicate organizational environments and enterprise groups that enable participants to interact as managers of firms encompassed within a single institutional setting. In the Management Science, business games were consolidated as a management training technique all around the world since 1957 (Keys and Wolfe, 1990, p.309). The educational principles of business game have been supported by the theory of experiential learning (Kolb *et al.*, 1984) which assumes that in addition to cognitive learning, students develop decision making skills as they take social and politic responsibility, setting a new attitude for future professional problems. For these authors, business games are an exercise to create experimental environments where changes in learning process and behavior can be observed. The simulated environment, even simplified, is able to induce innovative questions and appropriate answers from situations similar to those found in the real world.

In their studies describing the future trends in business games, Chiesl and Patz (GENTRY, 1990, p.139) prospected an evolution of the traditional business games to an interactive real time simulation and an open System Simulation. "Advances in technology have presented the opportunity to move away from relatively static batch simulation games toward truly dynamic games. For example, most current simulation games do not use a continuous clock, but rather involve a lock-step approach where all decisions are made by each firm simultaneously. The advances in computer networking now allow multiple students to access the game at once, and they are able to monitor the game environment simultaneously and continuously. Students can make decisions whenever they wish. Newell E. Chiesl discussed the process in general and

then discussed the play of one of his games in detail. Another new approach to simulation gaming is open system simulation, discussed by Alan L. Patz. Open system simulation allows the algorithms that determine the simulation outcomes to emerge as a result of decision making rather than having to be programmed in advance.”

Subsequently, researchers became sensitive to the possibility of using Business Games as research laboratories, as suggested by Keys and Wolfe (1990). Since 2002 Business Games in Brazil have been used in undergraduate, postgraduate (Suaia, 1995) and post-doctoral research (Suaia, 2006) at the University of Sao Paulo.

The studies on business games progressed in Brazil to produce an educational methodology that integrates management education and empirical research named Management Laboratory (Suaia, 2010). Business Games were integrated in the process of experiential learning and applied research called Management Laboratory, which encompasses the two uses of games and promote greater gains in learning and research. The method uses a simulator to create a political and economic environment where simulated companies, controlled by students, compete with each other. There are three main elements in the conceptual framework for structuring this experiential environment, as showed in the Exhibit 2:

Exhibit 2: Conceptual design of the Management Laboratory

Three Conceptual pillars	Learning process	Products
Organizational simulator	Students achieve the economic rules	An integrated mental model
Business game	Teams make decision	A dynamic and systemic vision
Theoretical-Empirical research	Students select a research problem	An abstract; a research paper; a thesis

Source: Suaia, 2010, p. X.

- a) The organizational simulator (a tangible element: an artifact) represented by a set of economic rules described as a company case. Qualitative and quantitative data describe the initial situation of the company that has to be studied and understood under the perspectives of the market, the operations and the finance. Participants learn the economic rules to use them in the business game and to practice the creation of an integrated mental model.
- b) The business game (the intangible element) constitutes a decision making process where teams are intentionally formed to compete in the quest of objective goals. Despite the fact that all competing teams start in an identical situation the asymmetry of understanding the initial data and the cognitive biases make them reach different performance as a result of their asymmetric competencies present in the competing teams. The decision making cycle repeats over and over to build a dynamic and systemic view of the company.
- c) The applied research, theoretical or empiric is conducted by the participant in his managerial role, from the project to the final report (abstract, research paper or thesis). A research problem to be studied is selected for creating value for the simulated company. In the literature review (secondary data) the management tools are examined. Primary data are collected in the business game, quantitative (quarter reports) e qualitative (managerial behavior observed, questioned or interviewed). The results of the analysis are discussed based on the theoretical framework. In the conclusion. the positive and negative externalities are highlighted as evidences of the experiential learning that alert and prepare for the real life management.

Organizational, political and economic problems have been examined in this environment by integrating theoretical models with the simulated practice and experiencing several scientific possibilities. In the management games organizational entities are recreated through written materials (balance sheets, statements of cash flow, income statements, balance sheets, professional correspondence, annual reports and management plans). These games are often supported by software. Described in the model of the simulation, and also present in the activities performed by the participants during the business game, most of organizational functions are included, such as marketing, production, finance, human resources, R&D, operations and accounting. The experience begins with a presentation of a business case to the

participants grouped in teams and describes the economic environment where decisions will be made.

The structure of applied research produced at the Management Laboratory was recast in 2009. In each study a literature review on a selected management tool was integrated. The tool was then illustrated by the manager-researcher with two cases, one of success and one of failure, of real organizations that have adopted such tool in their organization. The final innovation was made in the environment of the business game by introducing cross-cutting themes of present reality: sustainability (economic, social and environmental), politics (the individual votes, participates and influences the collective) and citizenship (individual and collective codes for social relationship).

Considering that most of the conceptual courses adopt the lecture method, theories and models are easily forgotten during the semesters. Therefore, at the beginning of the Management Laboratory course some of the key management models are revisited in the six functional perspectives present in the total enterprise business simulator:

- Planning: BSC, SWOT, Porter's Diamond, Value Chain; five competitive forces; Matrix Attractiveness; Almeida and Fischmann, generic strategies, Prisoner's Dilemma
- Marketing: Demand Forecasting; 4P's; BCG Matrix; CRM; YES; Segmentation, Positioning; Customization; product life cycle; Consumer behavior; New products.
- Production: Theory of Constraints; economic Lot; Breakeven; Theory of Queues, TQM, KANBAN, 6 Sigma, Kaizen, Operational Research, JIT, outsourcing, production cells, productive arrangements; Clusters.
- Human Resources (HR): Maslow's Hierarchy; Management w / competencies; Remuneration (f / v) stimulation / motivation / leadership; Meritocracy; QVT; Assessment 360, performance management, Organizational Structure, Mentoring & Coaching
- Finance: Cost of Capital; TIR CAPM, EVA, WACC, Derivatives, DUPONT, Project Analysis, 5 C's of Credit; Funding, investing and distributing; Working Capital, Budget, Business Valuation, Financial Planning and Control.
- President: Innovation, Politics & Citizenship, Governance, Sustainability, models of leadership; Internationalization; Liability business, New Business Development.

The six studies in Part 2 of the text book 2nd edition were selected among the 150 papers produced between February and July/2009 co-authored with undergraduate students of Business Administration and Accounting from FEA/USP/SP. These studies illustrate the topics of interest to managers in the Management Laboratory. It is a prior mandatory reading to be held by each director, and a summary or review may be requested in order to verify the understanding of studies' results and a possible replication.

SIMULAB's areas of study (www.simulab.com.br) are threefold and have been enhanced in the last 10 years since the formal establishment of the research group in 2002:

- a) Organizational simulators – studies of conceptual modeling in the management field have been conducted for development of mathematical and computational models that support simulations. These artifacts may have low or high complexity, depending on the educational objectives and the students' profiles.
- b) Experiential learning – Based on active and participant centered approaches, studies on this issue have been conducted focusing the benefits of adopting as learning methods approaches like case studies, business games, and role playing games.
- c) Compared economy and compared strategy – Studies related to institutional and economic analysis comparing the governmental rules adopted by states and countries, and the behavior of economic agents affecting industries performance indicators. Also

case studies analyzing the influence of the industry structure, the strategy that emerge in this particular structure and the performance of the companies competing and cooperating in this environment.

3- Research focus

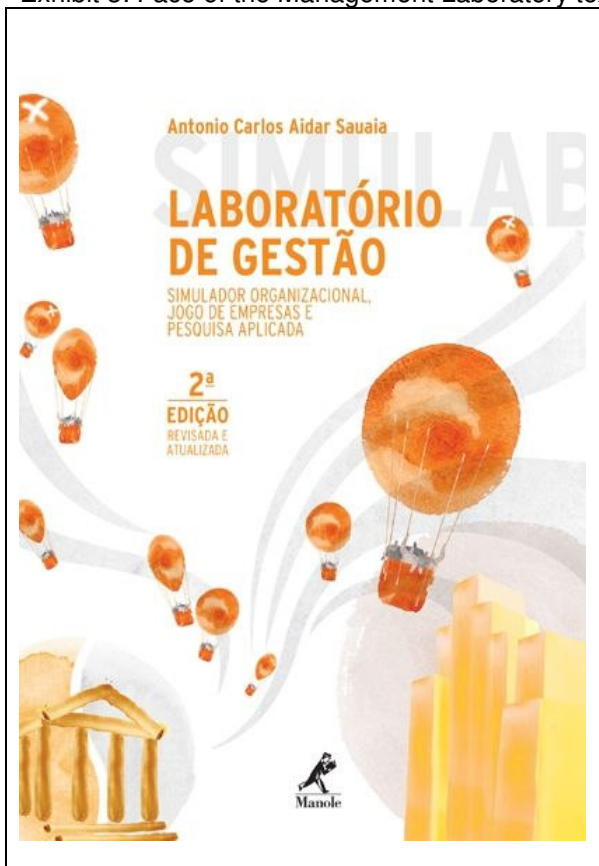
Participants in the Management Laboratory are encouraged to examine the simulated macro environment and compete with other firms formulating and implementing competitive strategies. At the end of the process of experiential learning, as participants prepare the strategy control report, they also write an applied research as a scientific paper, describing their personal experience and referring to the knowledge acquired. The data produced by the simulation, in the business game reports and in the observations and surveys conducted by the manager-researchers, are used as primary data for behavioral and quantitative studies in a variety of fields in the Applied Social Sciences.

The positive externalities of the method are even clearer when the teacher, responsible for leading the business game, orient the inclusion of topics like sustainability, government and citizenship. Because of this Education Institutions which use Management Laboratory are encouraged to include these topics in the simulations, helping to create a broader business vision and go beyond the profit, the usual economic performance indicator.

The connection between academia, organizations and the government is clear in the Management Laboratory, because:

- 1) Besides undergraduate courses conducted with this methodology, MBA courses are also offered to create a process of extension to the community of the academic development, supplying training to senior managers and future managers.
- 2) This methodology creates scientific knowledge from the experiences of managers or future managers, participants in the game;
- 3) It helps create a sustainable vision in the participants, and reinforce, in an experiential basis, their political and citizenship consciousness responsibility.

Exhibit 3: Face of the Management Laboratory textbook

	<ol style="list-style-type: none"> 1. In the bottom, at left, there is a symbol representing the Academy. 2. In the bottom, at right, there is a symbol of organizations. 3. There is no physical bridge to easily connect both of the sides in the image. 4. Students have to prove their competences to be accepted by organizations 5. Professional are stimulated to go back to Academy for recycling their knowledge in graduate courses like MBA studies. 6. In the center, the economic winds create opportunities and threats for the teams. 7. The competitors manage their organizations represented by balloons, some succeeding and some others failing.
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The SIMULAB research group have been studying a variety of social sciences issues and trying to bring them into the Management Laboratory. In 2006 a new doctorate study was started for replicating the educational environment in another educational institution.

Simulab has been offering courses in universities, companies, and to professionals who want to learn more about the theories and methods used in this group. As it can be seen in the front page of our last published book (Exhibit 3)), we tend to think in a similar way to the Triple Helix methodology. We believe that the integration of companies, universities, and governments is crucial to the sustainable development of the world, and to the creation of knowledge. While universities investigate theories, companies apply these theories on a daily basis, which reinforces the importance of alliances between these two organizations. However, the government also has an important role affecting both universities and companies. While it may provide money for universities to research, it also regulates the environment in which companies play their games.

Based on the importance of these three helix presented in the Triple Helix methodology, we can see that Simulab and the Triple Helix methodology have this important assumption in common, that the integration of Companies, Universities, and Governments is, as mentioned above, essential to the development of the world.

Therefore, we have been trying to present our theory to all the organizations involved, i.e. companies, government, and universities. We offer short courses to professors, representing universities, who want to learn more about business games theories and practices. We have also courses for companies, who want to apply simulation games to their employees.

We are trying not to center all the attentions in São Paulo, so by creating multiple branches around the country, we believe that we can spread our experiences and theories faster. Therefore, a group was created in UFF, which has been implementing the same values and has the same goals that we have in São Paulo.

When we offer our courses to professors from different universities, we are also trying widespread our theories throughout the country, as we believe that the more people who know about Simulab, the better the results we may offer to the society.

4- Methodology

Two case studies were conducted to examine the consequences of the replication of the USP Management Laboratory approach at UFF-VR. The report describes the implementation conducted from 2007 to 2009 and examines the difficulties confronted. The innovations resulting from the peculiarities of UFF-VR and the progress indicators reveal opportunities for developing a learning culture to replace the traditional teaching culture.

Since 2002 in the Department of Management at USP, there is an initiative led by the research group SIMULAB, who created and adopted the Management Laboratory approach for education and research (Suaia, 2010). The methodology operation is based on an organizational simulator where simulated organizations compete for results. It describes the problem situation of a company that produces and sells a commodity in a domestic market. Groups of students manage simulated companies that are similar at the very beginning. The teams compete to for results. The first challenge is the regency of economic rules of the simulator. The second challenge is to formulate, implement and control a competitive strategy over time. The third challenge is to identify opportunities for innovation, differentiating itself from competitors and reporting the experiential process in a scientific study.

The approach here presented was first adopted in the Business Administration undergraduate course at the University of São Paulo and replicated in the University Federal Fluminense, Campus of Volta Redonda, both (USP and UFF-VR) in Management courses.

The game based activity evolves from an economic rationality, passing through the exercise of a strategic thinking and culminates in encouraging the practice of an entrepreneurial and innovative management (Suaia, 2006). The research produced in this environment describes the innovation projects, the business opportunities created by a better understanding of the economic actor's interaction process.

The innovation discussion requires the economic environment as an area of continuous interaction between the actors (universities, industries and government), as recommended by the Triple Helix approach. In knowledge based economies the Triple Helix can be understood as an interpretation or a model of how economic actors organize themselves to create, adapt and disseminate new knowledge

5- Findings

A PhD thesis was written describing the implementation of a methodology that integrates management education and applied research using business games. The theoretical framework and conceptual study was based on Education in Management, Business Games and Simulations and Education in Laboratories and the propositions on the Management Lab (SAUAIA, 2010) directed by a conceptual tripod: Simulators Organizational, Business Games and Applied Research.

The methodology of the Management Lab in Course of Business Administration was replicated in a university in the state of Rio de Janeiro, Brazil. The research, exploratory and descriptive, combined qualitative and quantitative approach, adopting the methods of case study and action research. About 27 teachers were invited in the department of Education and 119 students regularly enrolled in the Administration during the years of 2007 and 2008. The results indicated some benefit of the methodology of Management Laboratory: it was observed a more efficient use of institutional resources, reported by the three groups involved: engagement of the dean and the coordinators; proactive involvement of the faculty members; a positive response from students. The study enabled the deployment of an innovative process that allows the generation of continued improvements that integrate research and education, capable of bringing the theory of organizational practice, emphasizing educational actions focused more on learning than teaching doctrine and low attractiveness.

A rising culture of training and the expert guidance of the research group SIMULAB studying this issue at FEA / USP since 2002 led the foundation for the development of the program at UFF/VR. The challenge taken up by coordination produced the opportunity to lead the review process of the education program and include the program based on the methodology of Management Laboratory with all the innovations devised under SIMULAB. The strategic actions for implementation of the Management Laboratory, along with the pedagogical project of the course were:

1. Awareness through acculturation on teaching business games;
2. Establishment of program of education and research within the department;
3. Approval of the laboratory as an extension program with the Pro-rector of Extension;
4. Establishment of compulsory courses along the educational program;
5. Approval of a monitoring program linked to the lab next to the Academic Pro-Rector;
6. Linking the program to the Group's Research Department;
7. Basic scientific research project;
8. Evaluation of program results.

To reach an integration of all actions it was created the Laboratory of Organizational Management Mock (LAGOS), an incorporated program of teaching, research and extension methodology whose application is based on business games, in order to be an environment for knowledge practice and skills development at the undergraduate level.

This methodology was first replicated in 2007 in the undergraduate Management course at UFF-VR (Oliveira, 2009). The methodology complements the learning process of a variety of

issues including the fundamentals of business management and the modern techniques of project and innovation management, with the objective to instill in the students an entrepreneurial attitude and a scientific approach. After that and because of the workshops offered to professors and researchers in an annual basis, we have been bringing more and more partners to this educational and research Brazilian community.

6- Contributions

The aim of this study was to initiate the discussion about spreading the use of frameworks like Triple Helix conceptual model (Etzkowitz, 2008) in an experiential approach through the Management Laboratory experimental environment for education and research (Suaia, 2010).

The Management Laboratory provides an answer already tested at USP since 2002 and already replicated at UFF/VR in 2009. Supported by business games, ways to "incubate" simulated ventures and monitor their performance can be created. In a later stage such simulated industries may be "transferred" to the real world at physical incubators or scientific and technological parks.

Since 2002 the Business School at USP has been adopting this methodology for education and research that is being replicated in the last three years at the UFF-VR. To achieve progress in this area it's appropriate to spread these ideas, focusing on direct relationship with the Triple Helix model and multiplying research groups that could adopt this approach, where under the university leadership, it's feasible to reunite industry and governments to accelerate the economic development.

7- Implications

With the challenge of spreading the management experiential learning, and as a consequence of the applied research created in this environment, the building of a scientific community is advancing. Since 2010 we are operating the website that represents an important support for the community. The site www.simulab.com.br/portal is the link for SIMULAB research group with others researchers in Brazil and with others kind of organizations (not only academics). Actually, this site provides an important support for the activities of the courses and workshops.

Management Laboratory is an adaptive educational environment based on the Moodle technology. There are many possibilities to work in the site with this technology. One of these possibilities will work soon; it is an electronic journal to publish studies developed in one of the three lines of research. The idea is to invite researches interested in the group SIMULAB, from the academia and from organizations to share efforts to develop a Periodic Publication and help to advance the studies in the areas of experiential learning, design of simulations and the other studies about compared economy and compared strategic. The electronic platform for this e-Journal is ready to start (www.simulab.com.br/revista) and the next step is to constitute a group of doctors to evaluate the papers.

This e-Journal will help with the knowledge distribution for the community, playing an important role to get people together, because the ideas that were born in the "Management Laboratory" about sustainability and politics can be shared with everyone registered at the website. Another opportunity with the site is the possibility to build a multi-language page, connecting us with others researchers in others parts of the world, and to teach the disciplines and workshops of Management Laboratory in other languages enables the spread of the idea "learning experimental". The SIMULAB web tool can be the link with others institutions, exist a great opportunity to the "Management Laboratory" and the companies, because we can see the abilities of the members in a "Management Laboratory", so it became an important way to evaluate candidates in a admission process. With the SIMULAB's mission of experiential learning, it was also possible to connect the group with the third sector. All the management practices present at Simulab is being offered to overcome the difficulty of management in the

third sector (Nucleo Espiral – www.nucleoespiral.org.br), so it became a great opportunity to develop simulators for non governmental organizations also. This is the beginning of a "multi-institution" scientific community (SIMULAB), spreading inside Brazilian frontiers.

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